Joint Review Panel Request for Additional Information Response Package
Addendum 10

Package 4: Indigenous Rights, Land Use and Culture and Human Health

Benga Mining Limited
Grassy Mountain Coal Project

August 2019

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INDIGENOUS RIGHTS, LAND USE AND CULTURE

4.1 Information Request 4.1

Canadian Environmental Assessment Agency "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012*". (December 2015).

Final Environmental Impact Statement Guidelines. (CEAR #11).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H – Aboriginal Consultation. (CEAR #42).

Eighth Addendum to the Environmental Impact Assessment. (CEAR #89).

From the Canadian Environmental Assessment Agency to the Joint Review Panel re: Indigenous Groups Participation. (CEAR #147).

Comments from JFK Law Corporation on behalf of Káinai First Nation. (CEAR #184).

The Environmental Impact Statement Guidelines (CEAR #11) require the proponent to assess effects of changes to the environment on Indigenous peoples, including current use of lands for traditional purposes, and provide information to support the assessment of impacts to asserted or established Aboriginal or Treaty rights. The Canadian Environmental Assessment Agency's "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012*"[1] was provided to Benga in 2016 to guide the gathering of information and assessment related to the effects of any changes to the environment on Indigenous peoples.

The Technical Guidance specifically notes that there may be a relationship between the effects on the biophysical components of the environment and the effects on the current use of lands and resources for traditional purposes. Such relationships will exist when the use is related to a particular component (e.g. fish). The Technical Guidance further notes that the assessment of a biophysical Valued Component (VC) may inform the assessment of a current use VC however, effects to current use cannot always be entirely captured solely on an independent assessment of biophysical components.

Benga's assessment of current use relies entirely on the assessment of effects on biophysical VCs, as described by Benga in Table H.2.2-1 (CEAR #42). There are no identified VCs specific to current use in the updated EIA that are assessed in accordance with Technical Guidance.

For example, for Káinai First Nation, the characterization of residual effects is titled 'hunting' but the assessment presents only data for wildlife VCs, Benga states "the

[1] Available online: Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012*. https://www.canada.ca/en/environmental-assessment-agency/services/policy-guidance/technical-guidance-assessing-current-use-lands-resources- traditional-purposes-under-ceaa-2012.html

Project is not expected to have measureable effects on the long term abundance, distribution, and sustainability of species hunted by Káinai Nation" (Section H - CEAR #42, CEAR #184). It is unclear what criteria are used for characterization of residual effects and significance, only criteria for wildlife VCs have been defined. No discipline-specific assessment criteria has been provided for current use of lands and resources in Appendix 2 of Addendum 8 (CEAR #89).

In Section 15.2.5.1.3 of the Cumulative Effects Assessment, provided in Appendix A-1 of Addendum 8 (CEAR #89), Benga states: "Aboriginal groups' experience of land use within the range of visual and noise changes from the Project may be altered due to Project noise and visual disturbance. As a result, the value and importance of physical and cultural heritage sites to Aboriginal groups in the area may be affected." Although Benga considers "experience of land use" with respect to cumulative effects, experience of land use is not considered for project-effects to current use or physical and cultural heritage, nor is it a component of any of the Aboriginal valued components. Sensory disturbance from the Project could reasonably affect Indigenous groups' experience in the context of current use activities such as hunting, trapping, fishing and plant gathering, as well as cultural and physical heritage.

In addition to the above, the EIS Guidelines (CEAR #11) note that the list of Indigenous groups may change as more is understood about the environmental effects and components of the Project. The EIS Guidelines indicate that the Agency reserves the right to alter the list of Indigenous groups and that the proponent must engage as additional information is gathered during the assessment. The proponent is expected to provide information on any additional groups to the Agency or review panel at the earliest opportunity.

Recent correspondence from the Agency (CEAR #147) indicated that three additional Indigenous groups have been included on the list of groups to be consulted for this Project:

- Louis Bull Tribe
- Montana First Nation
- Ermineskin Cree Nation

Provide an updated assessment of potential effects of the Project on Indigenous people using all

traditional land use and related studies completed to date for the Project including any updated information contained in Addenda 1-9, traditional land use studies, cumulative effects assessments, consultation tables, and submissions to the Joint Review Panel (the Panel) directly from Indigenous groups. For each Indigenous group specified in the EIS Guidelines as well as those specified in CEAR #147 include:

a) an updated assessment of the potential adverse effects to the environment for all biophysical valued components that have been directly or indirectly identified by Indigenous groups in Traditional Land Use and related studies. Include a description of any necessary changes to the ecological and social context, residual effects,

conclusions and proposed mitigation measures as a result of the consideration of such studies.

b) a completed assessment of the effects of the Project on current use of lands and resources for traditional purposes following the Agency's "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act*, 2012". At a minimum, this assessment should focus on resources, access, use and experience and include the following:

   i. a description of the presence and distribution of traditional resources and traditional land and resource use areas within the LSA and RSA, including historic, current, and intended future uses;

   ii. explanation of the relative importance of identified resources, importance of access to these resources and preference for use of these traditional land and resource use areas;

   iii. specific consideration of the effects of the Project on location, means and timing of uses of lands and resources for traditional purposes within the LSA and RSA based on traditional land uses identified by Indigenous groups;

   iv. identification of where Project activities may affect the traditional use for land-based activities such as hunting, fishing, medicine gathering, plant harvesting, trailways, and waterbodies identified by Indigenous groups;

   v. a description of pathways of effects to traditional resources and land use identified by Indigenous groups in the LSA and RSA. Pathways of effects may include Project interactions with, or effects on, resources, access, and experience and should illustrate the interconnectedness between the biophysical environment, ceremonial practices, and community well-being;

   vi. a description of whether or how evaluation criteria and thresholds for significance were defined in collaboration with Indigenous groups;

   vii. a consolidated list of mitigation measures related to current use of lands and resources for traditional purposes that Benga commits to implement, should the Project be approved. Include mitigation measures within the LSA and RSA as well as mitigation measures for specific uses, practices or activities that occur outside of the boundaries of the RSA where a potential effect of the Project may occur;

   viii. proposed monitoring and follow-up measures;

   ix. the residual effects, significance conclusions and rationale for such conclusions using evaluation criteria and definition of significance, specific to current use VCs and considering mitigation measures listed above;

   x. an assessment of the potential to return affected areas to pre-disturbance conditions to support traditional practices; and

xi. identification of where the views of Indigenous groups have been taken into account in the conclusions or the views of Indigenous groups on the conclusions separately where they differ.

Response:

Appendix 4.1-1 to this Addendum is a document entitled "An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups". This updated assessment provides the requested analysis. Also attached is Appendix 4.1-2 which is a consolidated list of mitigation measures related to current use of lands and resources for traditional purposes.

4.2 Information Request 4.2

Canadian Environmental Assessment Agency "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012*". (December 2015).

Canadian Environmental Assessment Agency "Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act, 2012*". (March 2015)

Final Environmental Impact Statement Guidelines. (CEAR #11).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H – Aboriginal Consultation. (CEAR #42).

Ninth Addendum to the Environmental Impact Assessment. (CEAR #185).

Ktunaxa Nation Rights and Interests Study in relation to the Grassy Mountain Coal Project. (CEAR #189).

In Table H.2.2-1 of the updated EIA (CEAR #42), Benga identified potential effects of the Project on Aboriginal physical and culture heritage as disturbance to physical and cultural heritage, change in access to physical and cultural heritage and change to cultural value or importance associated with physical and cultural heritage. However, the described "associated valued components" which are used to complete the assessment are limited to historical resources land and resource use.

Section 5(1)(c) of the CEAA 2012 states that with respect to Aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on…physical and cultural heritage…and any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance are to be taken into account in the assessment. Furthermore, the "Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental*

Assessment Act, 2012"[2] states that, the heritage value of a resource is embodied in tangible and/or intangible character-defining elements. These elements include the materials, forms, location, spatial configurations, uses and cultural associations or meanings that embody the heritage value of a cultural resource, which must be retained to preserve that value.

Correspondingly, Section 6.3.4 of the EIS Guideline (CEAR #11) requires Benga to describe and analyze changes to the environment caused by the Project. It also requires consideration of how changes to the environment caused by the Project will affect the cultural value or importance associated with physical and cultural heritage, and the current uses of land and resources for traditional purposes (e.g., inter- generational teaching of language or traditional practices, communal gatherings) and indirect effects such as avoidance of the area due to increased disturbance (e.g., noise, presence of workers).

No discipline specific assessment criteria has been provided for current use of lands and resources in Appendix 2 in Addendum 8 (CEAR #89).

Submissions from Indigenous groups refer to the importance of spiritual legends and oral stories regarding the Project area that depict individual, Indigenous group's history and travel routes (CEAR #185, #189). Benga has not considered the intangible aspects of culture including the experience related to physical and cultural heritage, and the importance of an interconnected landscape. Physical and cultural heritage is not only associated with an individual physical site, but also with the experience lived by Indigenous groups in those areas, and the importance of the landscape as a whole. It is not sufficient to mention how many sacred sites will be disturbed by the Project, rather a description and analysis of the importance of the connections to the landscape and the experience embodied in physical and cultural heritage is necessary. The following are examples of spiritual activities and sites that should be considered: vision quests, meditation sites, sun dances, pipe ceremonies and harvesting. Other examples within the Project development area include locations where the following items were detected: fire broken rocks, pottery, medicine wheels, stone effigies, artifact scatters or deposits, arrowheads, pipes, carvings, bone piles, human remains, water and a healing sulphur spring.

In addition, the "Technical Guidance for assessing the Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012"*, indicates that uses that may have ceased due to external factors should also be considered if they can reasonably be expected to resume once conditions change. The Modern Buffalo Treaty as mentioned by the Ktunaxa Nation Council (CEAR #189) includes as an objective to restore and steward the return of bison within the animal's historic range. This could have implications for the Project area and should be

[2] Available online: Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act, 2012*. https://www.canada.ca/en/environmental-assessment-agency/services/policy-guidance/technical-guidance-assessing-physical-cultural-heritage-or-structure-site-or-thing.html

incorporated into the analysis as this may impact Indigenous physical and cultural heritage.

Provide, an updated assessment of potential effects of the Project on Indigenous people using all traditional land use and related studies completed to date for the Project including any updated information contained in Addenda 1-9, traditional land use studies, cumulative effects assessments, consultation tables, and submissions to the Panel directly from Indigenous groups. For each Indigenous group specified in the EIS Guidelines, as well as those specified in CEAR #147, provide a description and analysis of how Benga has assessed the connections to the land and the experience embodied in physical and cultural heritage, and how changes to the environment caused by the Project will directly and indirectly affect the tangible and intangible value of the physical and cultural heritage of Indigenous peoples. This should include:

a) a completed assessment of the effects of the Project on current use of lands and resources for traditional purposes following the Agency's "Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act, 2012*". At a minimum, this assessment should focus on resources, access, use, and experience and include the following:

   i. a description of the presence and distribution of lands and resources within the LSA and RSA that have been identified by Indigenous groups as having cultural importance;

   ii. a description of the cultural importance of identified structures, sites or things to Aboriginal heritage including tangible and intangible context and consideration of undisturbed or contiguous cultural landscape features;

   iii. specific consideration of the effects of the Project on location, means and timing of uses of cultural heritage lands, structures, sites, etc. within the LSA and RSA based on current and traditional land uses identified by Indigenous groups;

   iv. identification of where Project activities may affect the access and use of the Project area for cultural or spiritual activities and the intergenerational transmission of knowledge.

   v. an analysis of how the Project is expected to impact the intactness of the cultural landscape from the perspective of oral or ceremonial legends and Indigenous stories;

   vi. a description of pathways of effects to physical and cultural heritage resources identified by Indigenous groups in the LSA and RSA. Pathways of effects may include Project interactions with, or effects on, tangible and intangible cultural heritage resources, access, and experience;

   vii. a description of whether or how evaluation criteria and thresholds for significance were defined in collaboration with Indigenous groups;

viii. a consolidated list of mitigation measures related to cultural and physical heritage that Benga commits to implement, should the Project be approved. Include mitigation measures within the LSA and RSA as well as mitigation measures for specific uses, practices or activities that occur outside of the boundaries of the RSA where a potential effect of the Project may occur;

ix. proposed monitoring and follow-up measures;

x. the residual effects, significance conclusions and rationale for such conclusions using evaluation criteria and definition of significance specific to cultural and physical heritage VCs and considering mitigation measures listed above;

xi. an assessment of the potential to return affected areas to pre-disturbance conditions to support cultural and spiritual activities; and

xii. identification of where the views of Indigenous groups have been taken into account in the conclusions or the views of Indigenous groups on the conclusions separately where they differ.

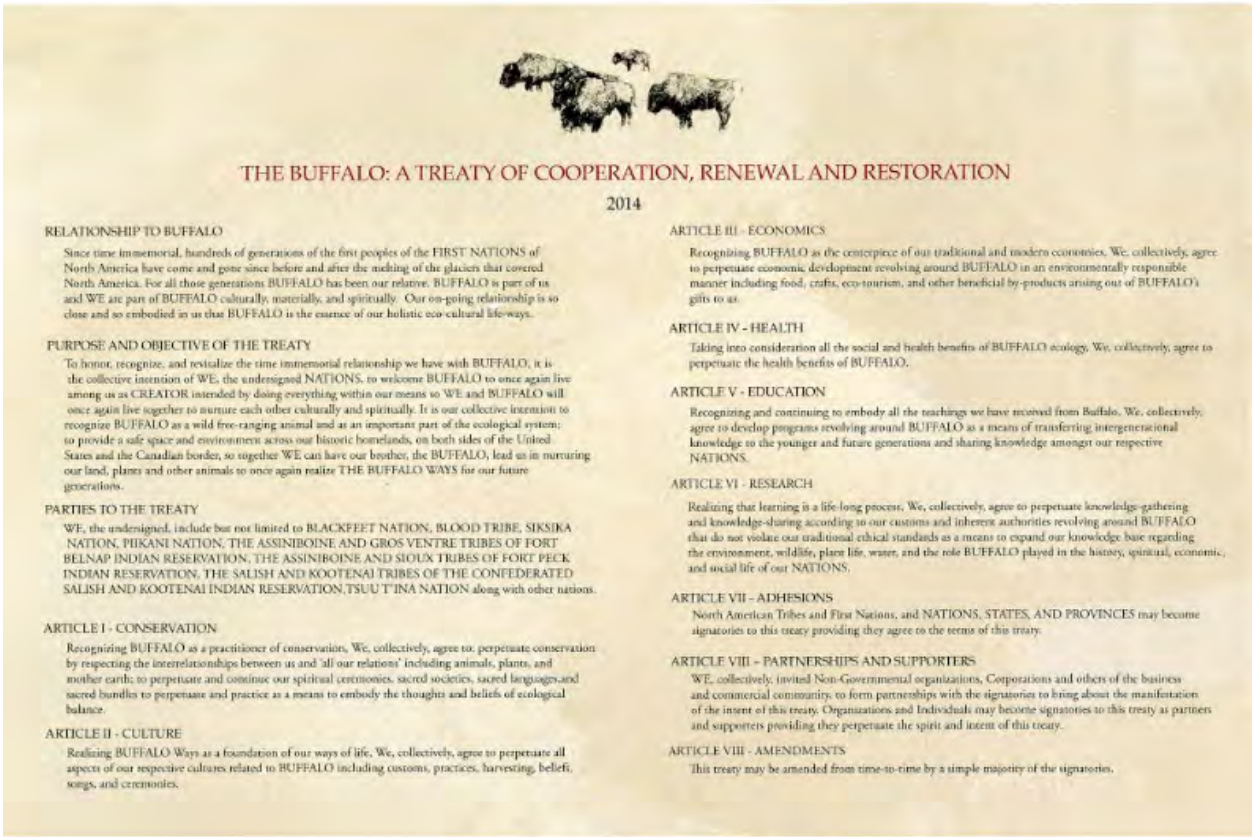
Response:

Appendix 4.1-1 to this Addendum is a document entitled "An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups". This updated assessment provides the requested analysis.

b) an analysis of potential impacts of the Project on the Modern Buffalo Treaty's objective to honour, recognize, and revitalize the time immemorial relationship Indigenous people have with Buffalo. This should include commentary from biophysical, current use, and cultural and physical heritage perspectives.

Response:

A number of Indigenous groups signed "The Buffalo: A Treaty of Cooperation, Renewal and Restoration" (The Buffalo Treaty) in 2014. The over-arching objective of the Buffalo Treaty is to honor, recognize, and revitalize the time immemorial relationship Indigenous peoples have with the buffalo recognizing buffalo as a wild free-ranging animal and as an important part of the ecological system.



THE BUFFALO: A TREATY OF COOPERATION, RENEWAL AND RESTORATION

2014

RELATIONSHIP TO BUFFALO

Since time immemorial, hundreds of generations of the first peoples of the FIRST NATIONS of North America have come and gone since before and after the melting of the glaciers that covered North America. For all those generations BUFFALO has been our relative. BUFFALO is part of us and WE are part of BUFFALO culturally, materially, and spiritually. Our on-going relationship is so close and so embodied in us that BUFFALO is the essence of our holistic eco-cultural life-ways.

PURPOSE AND OBJECTIVE OF THE TREATY

To honor, recognize, and revitalize the time immemorial relationship we have with BUFFALO, it is the collective intention of WE, the undersigned NATIONS, to welcome BUFFALO to once again live among us as CREATOR intended by doing everything within our means so WE and BUFFALO will once again live together to nurture each other culturally and spiritually. It is our collective intention to recognize BUFFALO as a wild free-ranging animal and as an important part of the ecological system; to provide a safe space and environment across our historic homelands, on both sides of the United States and the Canadian border, so together WE can have our brother, the BUFFALO, lead us in nurturing our land, plants and other animals so once again realize THE BUFFALO WAYS for our future generations.

PARTIES TO THE TREATY

WE, the undersigned, include but not limited to BLACKFEET NATION, BLOOD TRIBE, SIKSIKA NATION, PIIKANI NATION, THE ASSINIBOINE AND GROS VENTRE TRIBES OF FORT BELNAP INDIAN RESERVATION, THE ASSINIBOINE AND SIOUX TRIBES OF FORT PECK INDIAN RESERVATION, THE SALISH AND KOOTENAI TRIBES OF THE CONFEDERATED SALISH AND KOOTENAI INDIAN RESERVATION, TSUU T'INA NATION along with other nations.

ARTICLE I - CONSERVATION

Recognizing BUFFALO as a practitioner of conservation, We, collectively, agree to: perpetuate conservation by respecting the interrelationships between us and 'all our relations' including animals, plants, and mother earth; to perpetuate and continue our spiritual ceremonies, sacred societies, sacred languages,and sacred bundles to perpetuate and practice as a means to embody the thoughts and beliefs of ecological balance.

ARTICLE II - CULTURE

Realising BUFFALO Ways as a foundation of our ways of life, We, collectively, agree to perpetuate all aspects of our respective cultures related to BUFFALO including customs, practices, harvesting, beliefs, songs, and ceremonies.

ARTICLE III - ECONOMICS

Recognizing BUFFALO as the centerpiece of our traditional and modern economies, We, collectively, agree to perpetuate economic development revolving around BUFFALO in an environmentally responsible manner including food, crafts, eco-tourism, and other beneficial by-products arising out of BUFFALO's gifts to us.

ARTICLE IV - HEALTH

Taking into consideration all the social and health benefits of BUFFALO ecology, We, collectively, agree to perpetuate the health benefits of BUFFALO.

ARTICLE V - EDUCATION

Recognizing and continuing to embody all the teachings we have received from Buffalo, We, collectively, agree to develop programs revolving around BUFFALO as a means of transferring intergenerational knowledge to the younger and future generations and sharing knowledge amongst our respective NATIONS.

ARTICLE VI - RESEARCH

Realizing that learning is a life-long process, We, collectively, agree to perpetuate knowledge-gathering and knowledge-sharing according to our customs and inherent authorities revolving around BUFFALO that do not violate our traditional ethical standards as a means to expand our knowledge base regarding the environment, wildlife, plant life, water, and the role BUFFALO played in the history, spiritual, economic, and social life of our NATIONS.

ARTICLE VII - ADHESIONS

North American Tribes and First Nations, and NATIONS, STATES, AND PROVINCES may become signatories to this treaty providing they agree to the terms of this treaty.

ARTICLE VIII - PARTNERSHIPS AND SUPPORTERS

WE, collectively, invited Non-Governmental organizations, Corporations and others of the business and commercial community, to form partnerships with the signatories to bring about the manifestation of the intent of this treaty. Organizations and Individuals may become signatories to this treaty as partners and supporters providing they perpetuate the spirit and intent of this treaty.

ARTICLE VIII - AMENDMENTS

This treaty may be amended from time-to-time by a simple majority of the signatories.

Bison were reduced from numbering in the millions to some hundreds of individuals by the end of the 1800s and have not been present in the Crowsnest Pass area of the Project in recent memory. In their paper "Reintroduction of Bison into the Rocky Mountain Parks of Canada: Historical and Archaeological Evidence"[3], Kay and White establish that bison were not only present on the plains but also in mountainous areas of the eastern slopes of the Rocky Mountains and quite likely were present at some time in the Crowsnest Pass and the Project area.

Kay and White found however that it is unlikely that bison herds in mountainous areas could have survived without a direct connection and constant replenishment from the larger herds found on the prairies. They found that " … *unless constantly replenished with animals from the plains, it is unlikely that bison could have maintained viable populations in the mountains*" and concluded that *"Some bison may have summered in the mountains, but non-migratory animals would have been under intense predation by Native Americans, wolves, and bears."* In other words, the Project site may have been a site where bison could be found but would not be an

[3] Kay, Charles E.; Clifford A. White (2001). "Reintroduction of bison into the Rocky Mountain parks of Canada: historical and archaeological evidence" (PDF). Crossing Boundaries in Park Management: Proceedings of the 11th Conference on Research and Resource Management in Parks and on Public Lands. Hancock, Michigan: The George Wright Society, Inc. pp. 143–151. www.georgewright.org/24kay.pdf .

ideal location to attempt to re-establish the species without a connection to a significant herd on the adjacent plains.

The Buffalo Treaty not only speaks to the re-establishment of the bison as a wild species but also to the maintenance of the cultural connection between the bison and Indigenous groups by perpetuating all aspects of their cultures related to buffalo including customs, practices, harvesting, beliefs, songs, and ceremonies.

In the report by Ktunaxa FN (CEAR #189, Page 16), they mention that:

> *"Ktunaxa citizens consider the Project area as a place where bison were once abundant and harvested as a staple food by Ktunaxa ancestors up until the animal's industrial extirpation in the late 19th century under colonial pressure. Plains bison are critically important, both culturally and ecologically, to past and future practice of KNC rights in the Project area and eastern slopes of the Rockies. While bison are currently extirpated and habitat in the area of the Project is currently vacant, the return of plains bison and Ktunaxa harvest of bison in the Project area is planned and reasonably foreseeable."*

In 2017, Parks Canada reintroduced a small herd of plains bison to Banff National Park as a pilot project to assess the feasibility of longer-term bison restoration in the area.[4] This five-year project provides a focal point for Parks Canada to work collaboratively with Indigenous people while beginning to restore the roles of bison in the ecosystem. Currently, plains bison occur in only five isolated wild subpopulations and occupy less than 0.5% of their original range in Canada.[5]

Given the complexity of reintroducing a species that has been absent from the area for over 140 years, Parks Canada conducted a detailed environmental impact analysis prior to initiating the pilot project, to gain a clear understanding of the potential impacts.

While a duplication of the Banff pilot is not feasible at this time within the Project area, Benga has committed to work with Ktunaxa and other Indigenous groups to ensure that Indigenous goals are effectively incorporated in the reclamation planning process and would consider inclusion of measures specific to a possible re-establishment of bison to the area. This could include, for example, an Indigenous-led assessment of the potential carrying capacity of the land to support quality bison habitat essential for successful future reintroduction of the species. This

[4] Banff National Park Plains Bison Reintroduction, Parks Canada, https://www.pc.gc.ca/en/pn-np/ab/banff/info/gestion-management/bison

[5] Status of American Bison in Alberta: Update 2017, Government of Alberta, https://open.alberta.ca/dataset/7a095312-6f90-4fca-a992-591d3f4c7780/resource/cab47b51-bf70-4ce4-8aa6-b098aeafec3c/download/sar-statusamericanbisonalberta-2017update-feb2017.pdf

could also include taking measures in the reclamation of the site to include bison friendly vegetation and topography. Both of these opportunities align with the Buffalo Treaty objectives.

An assessment of the Project impacts on plains bison habitat is provided in the response to JRP IR-5.40.

4.3 Information Request 4.3

Final Environmental Impact Statement Guidelines. (CEAR #11).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section F – Conservation and Reclamation Plan. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H – Aboriginal Consultation. (CEAR #42).

Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project Between the Minister of the Environment, Canada and the Alberta Energy Regulator, Alberta (Including Terms of Reference). (CEAR #80).

Eighth Addendum to the Environmental Impact Assessment. Appendix A-1 – Cumulative Effects Assessment. (CEAR #89).

Comments from JFK Law Corporation on behalf of Káinai First Nation. (CEAR #184).

Ninth Addendum to the Environmental Impact Assessment. (CEAR #185).

Ktunaxa Nation Rights and Interests Study in relation to the Grassy Mountain Coal Project. (CEAR #189).

Comments from the Tsuut'ina Nation. (CEAR #192).

The EIA Terms of Reference (CEAR #80) requires the assessment to include consideration of comments received from Indigenous groups and peoples during the environmental assessment. The EIS Guidelines further state that the proponent will incorporate into the EIA the community knowledge and Aboriginal traditional knowledge to which the proponent has access or that is acquired through Indigenous and public engagement activities. It is important to recognize that traditional knowledge goes beyond current use and includes any information pertaining to observations of the environment.

While Benga references Aboriginal traditional knowledge in the EIA and mentions that it was incorporated into the EIA and the assessment of potential effects to Indigenous groups (CEAR #42), the EIA does not clearly demonstrate the use of traditional knowledge in supporting the analysis of potential environmental effects.

The "Technical Guidance for assessing the Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012*" states that a VC represents an environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance. The value of an ecosystem component may be determined based on cultural

ideals or scientific concern. Section 5 of the EIS Guidelines (CEAR #11) requires that the EIA document the VCs suggested by Indigenous groups, whether they were included and the rationale for any exclusions.

Section H of the EIA (CEAR #42) presents Benga's assessment of potential effects on Aboriginal valued components. Table H.2.2-1 identifies the 'Aboriginal valued components and subcomponents, potential effects to Aboriginal interests', and 'associated valued components' which include: wildlife, land and resource use, aquatics/fisheries, vegetation, historical resources, human health, and socio-economics. In the same section, Benga states that: "[…] culturally important species identified in the TK/TU study reports and through consultation, informed the selection of valued components from the vegetation and wildlife assessment sections." From this statement, it is unclear whether Benga considered traditional knowledge / traditional use (TK/TU) information beyond the selection of valued components for vegetation and wildlife, and whether TK/ TU was used to select those valued components identified as 'Aboriginal Valued Components'.

In Addendum 9 Káínai First Nation notes that the valued components they proposed were not considered, but rather Benga chose surrogate VCs (CEAR #185). In their respective technical reviews, Ktunaxa Nation Council (CEAR #189) and Tsuut'ina Nation (CEAR #192) have also expressed concern with the selection and assessment of VCs.

Benga has also stated the Conservation and Reclamation Plan and Closure Plan were developed with input from extensive public and Aboriginal engagement (CEAR #42), yet there is no explanation as to how traditional knowledge was considered in the design of the plan. In addition, Indigenous groups have expressed concern with the proposed reclamation landscape and its suitability for traditional uses (CEAR #178, #184, #192).

a) Describe how traditional knowledge and traditional use was used in the selection of Aboriginal valued components, as well as 'associated valued components', including for land and resource use, aquatics/fisheries, vegetation, historical resources, human health, socio-economics and wildlife VCs.

Response:

A discussion of the selection of Aboriginal Valued Components can be found in Section 3.1.2 of Appendix 4.1-1 to this Addendum in a document entitled "An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups". This analysis also deals with Current Use of Lands and Resources for Traditional Purposes.

With regard to the valued components considered for other associated disciplines, TK/TU was used as follows:

Aquatics and Fisheries

A preliminary list of candidate VCs (Table 3.1, Addendum 1, CEAR #44; reproduced here as Table 4.3-1) was identified for the Project in consultation with regulators, fisheries professionals experienced with Gold Creek and Blairmore Creek watersheds, interested public and Indigenous

groups feedback. The baseline information presented in this report considers fisheries and aquatic resources broadly; however, it focuses primarily on one particular VC: westslope cutthroat trout (WSCT).

Table 4.3-1 Summary of Candidate Valued Components (from CR#6, Addendum 1, CEAR #44)

	Recovered in FWMIS Database	Traditional Use	Captured in Baseline Field Studies	Status of Special Concern
Fish				
Westslope Cutthroat Trout	X	X	X	X
Fish Health				
Brook Trout (surrogate for WSCT)	X	X	X	
Rainbow Trout (surrogate for other fish species)	X	X	X	
Macroinvertebrates	X	X	X	
Periphyton	X	X	X	
Aquatic Sediment	X	X	X	

WSCT are the primary fish VC because of their provincial and federal status and presence, distribution, and abundance in the local study area (LSA) and because they are the only native fish species within the LSA to be potentially affected through potential direct habitat loss and/or alteration (*i.e.*, changes in stream flow). The Fish Health VC was included to consider potential water quality-related effects throughout the life of the mine and includes other fish species (non-native brook trout [*Salvelinus fontinalis*; BKTR] and rainbow trout [*Oncorhynchus mykiss*; RNTR]) and lower trophic organisms. Given the conservation sensitivities surrounding WSCT, non-native BKTR and RNTR were used as a surrogate to evaluate potential water quality-related effects to the health of WSCT in the LSA. "WSCT Health" was, thus, included in the WSCT VC and is discussed in this assessment but is predominantly addressed through the CR #5, EIA August 2016, CEAR #42.

Because the Project has the potential to cause effects on fish habitat in Blairmore Creek and Gold Creek including several local tributary streams in each watershed, fish and fish habitat in these watercourses are expected to be vulnerable to Project effects. The WSCT is the only native fish species documented in historical reports and supported by Project baseline surveys within both

Blairmore and Gold Creek watersheds (Table 3.2 reproduced from Addendum 1, CEAR #44 as Table 4.3-2).

Table 4.3-2 Valued Components for the Aquatic Ecology Effects Assessment (from CR#6, Addendum 1, CEAR #44)

Valued Component	Rationale for Selection
Westslope Cutthroat Trout	• The only native fish species documented in Blairmore and Gold Creek watersheds and its tributaries, and also distributed throughout the Crowsnest River watershed • The Alberta population of WSCT is listed in Schedule 1, part 3 of the *Species at Risk Act* (SARA) as a "*Threatened*" species; listed as Threatened as identified by the Alberta *Wildlife Act* • WSCT inhabiting Blairmore Creek mainstem identified as a "Core Population", just below "Core Population" status due to hybridization levels being slightly less than 99%, but is a naturally self-sustaining population; WSCT inhabiting Gold Creek are deemed *Threatened* as per SARA • Valued by local Aboriginal groups • An important and highly sought after sportfish that is angled recreationally • Species of socio-economic importance • Susceptible to habitat perturbation, including changes in water quality, hydrology, and hydrogeology that could alter health of productivity of the species

Vegetation

For vegetation, VCs were chosen with reference directly to species of interest identified through consultation with Aboriginal groups. As noted in Section 2.4.2 of EIA Volume 6, CR#8 Vegetation and Wetlands Assessment (CEAR #42) and as reiterated in Addendum 9, Section 4.1.4.2 (CEAR #185):

> Assessing the Project's potential effects on all vegetation and wetland resource components is not possible; consequently, in accordance with current practice, this assessment focuses on a number of vegetation and wetland elements that were selected as VCs. These VCs represent vegetation and wetland resources that may be affected by the proposed Project. All chosen VCs are known to occur in the LSA and can be monitored by accepted scientific methods.
>
> Additionally, VCs must fit into one of the following categories:
> - is an important contributor to biodiversity at the local, landscape, or regional level;
> - is considered to be a "Threatened" or "Endangered" species at the provincial or federal level, or is known to be declining in the region;
> - is valued by Aboriginal Group traditional users (specifically Treaty 7 First Nations); and
> - is a unique habitat type that is limited in area and may be impacted by the Project.

During the Aboriginal Consultation process, a list of species used by Aboriginal Groups was compiled. Additional species were later added to the list upon review of the TEK reports. TEK species observed in the LSA during vegetation field surveys were used to determine the potential for ecosite phases to support TEK species based on the number of TEK species found in each ecosite phase, other studies in the area, and information gathered during consultation with the Treaty 7 First Nations.

Wildlife

With respect to wildlife, VCs were chosen through consultation with Indigenous groups, as mentioned in Section 3.2 of EIA Volume 6, CR#9 Wildlife Assessment (CEAR #42), and reiterated in Addendum 9, Section 4.1.4.1 (CEAR #185):

> It is not feasible to assess all wildlife species; therefore, Benga selected a set of wildlife VCs that are representative of wildlife in the area. Similarly, while Benga recognizes the traditional and cultural value of many wildlife species to Indigenous groups, not all species with traditional value identified in the available TU reports or from Indigenous consultation sessions are individually assessed.
>
> The approach taken for the Project to identify wildlife VCs focused on the selection of species that are representative species for other wildlife species/groups that exhibit similar use of various habitat types at various spatial (foraging) and temporal (*e.g.*, breeding, overwintering) scales. To determine the representative wildlife species the following criteria were used:
>
> - known or reported occurrence in and overlap with the WLSA;
> - reported to have value to traditional (Aboriginal Groups), recreational (hunters), subsistence (trappers), and/or non-consumptive (wildlife viewing) users;
> - provincial ("At Risk", "May Be At Risk", or "Sensitive") and/or federal (Schedule 1 SARA species, "Endangered", "Threatened", or "Special Concern") status, or is known to be declining in the region;
> - use of major habitats and/or reliance on habitat types that are limited in geographic extent and that may be affected by Project development; and
> - is a "keystone" species that has a disproportionate effect on the ecosystems it is found in or other species require its presence to persist in the area.

Based on this approach, ten wildlife VCs consisting of two amphibian, two avian, and six mammalian species were selected for the wildlife Baseline Assessment and Application Assessment.

Before commencing with the assessment based on these 10 VCs, the VCs were presented to the Treaty 7 First Nations included in the Indigenous consultation process for their approval or recommended additions or alternatives. An additional eight species were included in a higher

level assessment to provide supplemental information to the wildlife assessment. These eight species were chosen based on the same criteria as the VCs, and are considered special status species.

Also see the response to JPR IR 5.35.

Historical Resources

For the Historical Resources Impact Assessment, the terms of reference required that each site be assessed and specific mitigation measures determined on a site by site basis. During the initial HRIA surveys, a number of Indigenous crew members were engaged from a nearby First Nation to assist with the investigation. Recognizing the cultural, spiritual, historical and educational value of the archaeological sites to First Nations, a presentation on the HRIA findings and *Historic Resources Act* recommendations was offered to each First Nation that expressed an interest in the findings. In addition, Benga sponsored field investigations of the human pre-contact HRIA sites by Stoney Nakoda Nation, Piikani Nation, Kainai Nation and Siksika Nation and has integrated values identified by these First Nations into archaeological resource management and further HRIA archaeological survey planning. Some of the culturally based observations from the field programs are contained in the recent reports by Kainai Nation and Siksika Nation (CEAR #185). Tsuut'ina Nation was offered similar opportunities to conduct HRIA field investigations, however, they have not engaged in these activities to date.

Human Health

The valued component for the Human Health Risk Assessment was "Human Health". In order to assess the impact of the project on Indigenous communities, an "Indigenous" receptor was included in the study located in the vicinity of the Project. In order to assess pathways for project effects, the HHRA depended on lists of wildlife, fish, and plants that would normally be consumed by this Indigenous receptor which were developed through consultation as discussed above.

Socio-economic

Traditional land use and aboriginal culture was selected as one of the VCs for the Socio-economic Study and the Project Effects to this VC were evaluated based on the pathways listed in the following Table (Table 9.1, reproduced from CR#11, EIA, CEAR #42 as Table 4.3-3):

Table 4.3-3 Project Effect Pathways

Project Effect Pathways	Effects on the Local Aboriginal Population
Access to traditional lands	• Industrial development may lead to decreased opportunities to carry out traditional activities on project-affected lands and to transmit traditional culture and oral history while on the land. • Increased incomes from employment with industrial projects may lead to the purchase of hunting and harvesting equipment that increases the effectiveness of traditional pursuits (*i.e.*, vehicles, rifles) and allows participants to cover greater distances, thus mitigating some of the limited land use resulting from development.
Concerns over pollution	• The real or perceived contamination to traditional lands, water, plants and animals from development can directly affect how and where traditional practices are carried out, thereby affecting cultural values associated with these traditional practices.
Drawing on regional sources of water	• The perceived or actual use of water by industry may impact the quantity and quality of water in the region that is relied upon for carrying out traditional activities (*e.g.*, fishing, means of accessing traditional lands).
Participation in the wage economy	• Participating in the wage economy may reduce the opportunities to carry out traditional pursuits and transfer traditional knowledge to Aboriginal youth while on the land. • Households may see an increase in spending power, lower need for government transfer payments, and an improved sense of self-worth for some. • Increased incomes may lead to increased disparity and social stratification within Aboriginal communities. This may also contribute to negative behaviours, including increased alcohol and drug abuse and gambling, especially among those lacking financial experience.
Increased non- Aboriginal population	• Non-Aboriginal workers migrating to the area for employment opportunities may increase competition for traditional resources from non-Aboriginal community members. An influx of non-Aboriginal migrants may increase exposure to outside cultural values.

b) Provide a consolidated list of the VCs suggested by each Indigenous group that were not selected as Aboriginal valued components and a rationale for their exclusion.

Response:

A list of wildlife and fisheries species indicated to be of interest by Indigenous groups is attached as a table in Appendix 4.3-1. As mentioned in part a), not all species of interest could be selected for study. Benga chose species based on the process and criteria mentioned above.

A list of vegetation species of interest has been supplied by various Indigenous groups and is documented in the EIA and Benga will continue to add to the list as new species are identified. As indicated above, VCs for the vegetation assessment used in the identification of ecosites potentially favorable for harvesting of traditional species of interest. As such, there is not a one-to-one relationship between species of interest and VC selection. The area has been identified by Indigenous groups as having vegetation of sacred, medicinal and spiritual value, however, Benga

is only aware of the species identified during the consultation process and those which are provided in the public TU/TEK reports.

Benga has consulted with Indigenous communities and will continue to consult on the further development of the Conservation and Reclamation plans to ensure that wildlife, vegetation and other natural resources of traditional and cultural value are considered as the site is reclaimed.

Through additional traditional use assessments and on-going engagement, Benga has been and will continue to work with Indigenous communities to identify landscape attributes that support traditional practices, uses and cultural learning. These attributes will be preserved through avoidance or integrated into the reclaimed landscape to the extent possible. Various Indigenous groups have identified archeological sites of significant cultural, educational and historic value. Benga, in its assessment, has considered all archeological sites as VCs and has therefore taken an inclusive position when considering options for site management or mitigation. In particular, Benga has committed to revise some design details s such that two culturally significant sites, DjPo-98 and DjPo-130, on the southern end of the proposed Coal Processing Plant and near the proposed road respectively are preserved. For sites where avoidance is not possible due to their location within the project area, Benga is consulting with all Indigenous communities regarding steps to be taken to consider and minimize the impacts of archaeological site loss to the well-being of the communities. Site relocation and ceremonies are examples of activities under consideration to mitigate the impact of the loss of archaeological sites of particular concern to Kainai First Nation, Siksika First Nation and Piikani First Nation.

On January 28, 2019, Ktunaxa Nation also submitted the Technical Memorandum Ktunaxa Nation Rights and Interests in relation to Benga's proposed Grassy Mountain Coal Project (Ktunaxa Report) (CEAR #189). Table 4.3-4 below lists the values identified in the Ktunaxa Report and the corresponding Indigenous VC categories of the EIA under which the values fall. Benga considers that these values identified by Ktunaxa are fully captured in the framework of Indigenous VCs used for the Project analysis.

Table 4.3-4 Identification of VCs, Resources, or Species

Values identified by Ktunaxa	VC category of EIA
Cultural-spiritual values (*i.e.*, sacred and ceremonial areas, teaching areas, place names)	Aboriginal Physical and Cultural Heritage
Environmental features and associated cultural-spiritual values (*i.e.*, specific highly valued habitat)	Current Use of Lands and Resources for Traditional Purposes – Hunting, Plant Gathering, Fishing Aboriginal Physical and Cultural Heritage
Habitation sites (*i.e.*, camps, cabins)	Aboriginal Physical and Cultural Heritage
Subsistence values (*i.e.*, harvesting and kill sites)	Current Use of Lands and Resources for Traditional Purposes – Hunting, Plant Gathering, Fishing
Transportation values (*i.e.*, trails, passes, navigation sites)	Current Use of Lands and Resources for Traditional Purposes – Trails and Travelways

c) Explain how the Aboriginal valued components selected by Benga are representative of elements of importance raised by Indigenous groups.

Response:

Please see response to part a) and b)

d) Demonstrate how traditional knowledge and traditional use information contributed to Benga's approach to the collection of baseline information and TK/TU was considered as a source of information in the assessment of effects for all VCs. Provide an explanation of how different knowledge or perspectives were taken into account. This can be done through providing examples of (including but not limited to) mitigation measures, monitoring plans, selection of species etc.

Response:

Traditional Knowledge and Traditional Land Use (TK/TU) is interwoven into existing conditions and the assessment of potential effects to Indigenous groups. The objective of interweaving TK/TU with western science is to support or fill gaps in the assessment about species of importance, characteristics, behaviours, population trends, abundance, habitat, migration, and relationships with other species.

Further, the incorporation of TK/TU brings cultural and spiritual elements to the assessment that would otherwise be missing. The key principles guiding this two-pronged approach into the assessment are:

- TK/TU is considered on par with scientific knowledge; and
- Indigenous groups are key contributors to the assessment of potential effects of the Project to the environment.

The collection of baseline data from Indigenous communities began in 2014 as described in the initial TK/TU studies that were filed with the EIA in August 2016. Indigenous views and perspectives were included in the selection of Aboriginal specific VCs, in identifying potential effects, and in the assessment of potential effects on VCs. The EIA integrated information regarding valued components of the social and physical environment using information provided in the TK/TU reports, and through consultation efforts.

Following are a few examples of mitigation measures adopted by Benga to take into account knowledge and perspectives gleaned from engagement with Indigenous communities:

- Through on-going consultation, Benga became aware that additional mitigation measures were required to facilitate access to areas for plant harvesting and other cultural activities. To meet this need, Benga has been working with Indigenous communities to develop an Access Management Plan (AMP) that accommodates access to the Project site where it is safe to do so. In addition, Benga has opened up other

privately held lands in the area for controlled harvesting activities. Finally, Benga has agreed to provide advance notice of clearing activities to ensure that indigenous groups have enough time to conduct harvesting in those areas prior to clearing. The first notice for clearing to be done on project commencement has been issued in February 2019. Further discussion of the AMP can be found in the response to JRP IR-4.5 and the AMP itself is attached as Appendix 4.5-1.

- For archeological sites of cultural value, Benga has continued to conduct field studies with a number of Indigenous communities since filing the EIA to communicate the results of the Historic Resources Impact Assessment (HRIA) and to obtain feedback on the recommendations for site mitigation and management presented in the HRIA. As a result of these interactions and the input from Indigenous communities, Benga has reviewed its plans and has committed to adjust certain design details to avoid two important archaeological sites of pre-contact origin. Benga has continued to support additional fieldwork and discussions with Indigenous communities to integrate Indigenous values into the archaeological interpretative framework and to identify culturally appropriate mitigation measures for sites that that will be impacted by the project.
- As a third example of use of TK and TU feedback in the design of the Project, Benga has understood from Indigenous communities that on-going monitoring of the Project is necessary to ensure transparency of information and communication through involvement. To this end, Benga has committed to implement an Indigenous-led monitoring program that will engage Indigenous communities as a means of providing an objective and complimentary perspective to the Project's western-based environmental performance and monitoring program. Additionally, Benga is working with Indigenous communities to develop an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise.

e) Discuss how traditional knowledge and traditional use (including cultural and spiritual values, cultural transmission, and intergenerational knowledge) was considered in the selection of spatial and temporal boundaries for Project effects as well as cumulative effects.

Response:

Spatial and temporal boundaries for Project effects were framed by the expected effects of the Project on Indigenous values and lifestyles. As such, Benga considered a spatial boundary in line with Project effects that could be perceived and which may affect the enjoyment of the land. Benga understands that "enjoyment of the land" is a broad term that not only encompasses activities such as hunting, fishing and gathering but also tranquility, being able to access culturally valued locations, transmission of traditional knowledge and other culture-specific values. Temporal boundaries likewise were associated with project effects which will commence with construction and end when the majority of the reclamation is complete. This is a

conservative approach as Benga intends to progressively reclaim the site so that a portion of the site will be returned to productive capacity sooner.

For the cumulative effects assessment, Benga understood that Indigenous communities have a perspective that assesses cumulative effects from a time before European settlers came to the area. As such, Benga has established a temporal boundary for the cumulative effects assessment that begins before this period and ends when reclamation is complete. Spatial boundaries were set to coincide with the Grizzly Bear Regional Study Area which is the largest of the "environmental" regional study areas. Benga understands that this dimension is not precisely based on the perspective of an Indigenous community member but deemed this dimension to be a fair balance between a study area that is too big to perceive the effects of the Project and conversely an area that is too small to capture other contributing factors.

f) Describe how end land-use objectives will be informed by traditional knowledge, based on direct input from Indigenous groups, and whether end land-use objectives are intended to meet the needs and desires of Indigenous groups in addition to regulatory requirements.

Response:

Benga has committed to continue to engage with Indigenous communities through the life of mine regarding the conservation and reclamation plan and specifically regarding end use land objectives. In particular, Benga has committed to the establishment of an Environmental Stewardship Committee comprised of Indigenous members that will among other duties provide a forum for on-going input into the reclamation program and the monitoring of reclamation performance during the progressive reclamation of the site.

g) Describe how Benga collaborated with Indigenous groups to integrate traditional knowledge and traditional use into draft management plans including the Conservation and Reclamation Plan, the Closure Plan, the Aboriginal Access Management Plan and the Cultural Site Discovery Contingency plan.

Response:

With the exception of the Access Management Plan, most of the draft management plans have been largely based on the experience of Subject Matter Experts and previous experience with similar projects. That being said, through consultation to date, Benga understands that a number of Indigenous communities are interested in participating in the development of the management plans to differing degrees. Consequently, Benga has committed to continuing to work with those communities to develop the final management plans in coordination with regulatory proceedings, project approvals, and engineering and design schedules. A discussion of the Access Management Plan, which is complete and functioning today, is included in the response to JRP IR-4.5.

Benga has committed to implement an Indigenous-led monitoring program, over the life of the Project, which will include, but will not be limited to, monitoring for culturally valued resources and monitoring of reclamation success. Additionally, Benga is working with Indigenous communities to develop an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise.

4.4 Information Request 4.4

Canadian Environmental Assessment Agency interim Technical Guidance "Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012*". (March 2018).

Canadian Environmental Assessment Agency "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act, 2012*". (December 2015).

Canadian Environmental Assessment Agency "Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act, 2012*". (March 2015)

Canadian Environmental Assessment Agency interim Technical Guidance "Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the *Canadian Environmental Assessment Act, 2012.* (March 2018)

From the Canadian Environmental Assessment Agency to Benga Mining Limited re: Comments on the conformity (Package 1) of the Environmental Impact Statement submitted for the proposed Grassy Mountain Coal Project. (CEAR #33).

From the Canadian Environmental Assessment Agency to Benga Mining Limited re: Request for Additional Information for the Environmental Impact Statement for the Grassy Mountain Coal Project. (CEAR #43).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section E - Environmental Assessment. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H - Aboriginal Consultation. (CEAR #42).

From the Canadian Environmental Assessment Agency to Benga Mining Limited re: Request for Additional Information (Package 4) for the Environmental Impact Statement for the Grassy Mountain Coal Project. (CEAR #60).

From the Canadian Environmental Assessment Agency to Benga Mining Limited re: Request for Additional Information (Package 5) for the Environmental Impact Statement for the Grassy Mountain Coal Project. (CEAR #77).

From the Joint Review Panel to Benga Mining Limited re: Additional Information Required from Benga Mining Limited by the Joint Review Panel for the proposed Grassy Mountain Coal Project. (CEAR #86).

Eighth Addendum to the Environmental Impact Assessment. Appendix A-1 – Cumulative Effects Assessment. (CEAR #89).

Ninth Addendum to the Environmental Impact Assessment. (CEAR #185).

Previous requests from the Canadian Environmental Assessment Agency on cumulative effects (AIR #16 in CEAR #33, AIR #26 in CEAR #43, AIR #2 in CEAR #60 and CEAA-R2-IR-5 in CEAR #77), have resulted in the submission of additional information and a 'stand-alone' cumulative effects assessment document provided as Appendix A-1 to Addendum 8 (CEAR #89).

Section 15 of Addendum 8 (CEAR #89) contains cumulative effects information for Indigenous groups, including Benga's cumulative effects assessment with respect to current use of lands and resources for traditional purposes and Aboriginal cultural and physical heritage. This cumulative effects assessment however relies on the consideration of residual effects to biophysical VCs and 'associated valued components' and does not directly assess effects to Aboriginal VCs, or intangible components such as consideration of experience, culture, governance, knowledge and other factors.

Indigenous groups noted, for Aboriginal VCs, Benga did not substantiate its reasoning with respect to conclusions on the significance of effects (CEAR #178, #192). In addition, Addendum 8 (CEAR #89) appears to be lacking a clear framework for the criteria to be used in the cumulative effects assessment on current use of lands and resources for traditional purposes and physical and cultural heritage.

An update to the cumulative effects assessment that is specific to effects to Indigenous people including current use of lands and resources for traditional purposes and physical and cultural heritage is required support the Panel's mandate under CEAA 2012 and in light of the other information requests in this Package.

a) Provide an updated cumulative effects assessment for the current use of lands and resources for traditional purposes and physical and cultural heritage, including any updated information contained in Addenda 1-9, Traditional Land Use studies, Cumulative Effects Assessments, consultation tables, submissions to the Panel directly from Indigenous groups, and work done in response to the other information requests posed by the Panel. As stipulated in previous requests, use the applicable Canadian Environmental Assessment Agency guidance to complete an assessment, including the interim Technical Guidance for "Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012*"[6], the interim Technical Guidance for "Determining Whether a Designated Project is Likely to

[6] Available online: Interim Technical Guidance "Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012*". https://www.canada.ca/en/environmental-assessment-agency/services/policy-guidance/assessing-cumulative-environmental-effects-ceaa2012.html.

Cause Significant Adverse Environmental Effects under the *Canadian Environmental Assessment Act, 2012"*[7], the "Technical Guidance for Assessing the Current Use of Lands and Resources under the *Canadian Environmental Assessment Act, 2012"*, and "Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act, 2012"*.

i. summarize the residual effects from the Project that are carried over to the cumulative effect assessment that may have changed in response to IRs contained in this and other packages. Where Indigenous groups commented on the choice of temporal and spatial boundaries selected by Benga, consider inclusion of these comments in the updated assessment, or provide a discussion on how the selection of boundaries remains justified for the purpose of the environmental assessment of the Project;

ii. as was done in Appendix 2, Table 22A of Addendum 8, clearly outline how the criteria for cumulative effects related to the current use of lands and resources for traditional purposes and physical and cultural heritage were defined. Describe how these criteria inform the assessment of significance. Demonstrate how the information available to Benga from Indigenous groups informed the criteria ratings and the conclusion regarding significance. Describe the approach used by Benga to assess likelihood only in cases where an effect is assessed as significant.

Response:

An updated cumulative effects assessment is included in Appendix 4.1-1 to this Addendum in a document entitled "An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups". This updated assessment provides the requested analysis.

4.5 Information Request 4.5

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Appendix 7d (i) – Aboriginal Access Management Plan Framework. (CEAR #42).

Fifth Addendum to the Environmental Impact Assessment. (CEAR #69).

The Aboriginal Access Management Plan Framework (CEAR #42) states that it provides a framework for the proposed Aboriginal Access Management Plan (AAMP) for the Grassy Mountain Coal Project. The plan will apply to the construction, operation and reclamation phases of the Project. The key objectives of the AAMP are to:

- identify protocols for early notification of project activities;
- control access to protect project facilities and components;

[7] Available online: Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the *Canadian Environmental Assessment Act, 2012* https://www.canada.ca/en/environmental- assessment-agency/services/policy-guidance/determining-project-cause-significant-environmental-effects- ceaa2012.html.

- reduce effects of increased access or change in access to key habitat including culturally important wildlife habitat;
- identify alternate locations for maintaining access to culturally important harvesting species;
- control access to private lands; and
- provide information about the planning process for the ongoing reclamation and the ultimate closure of the Project.

In response to SIR #55 of Addendum 5 (CEAR #69), Benga indicates that an AAMP is being developed and will be finalized after discussion with Indigenous groups during the first half of 2018 including final access control points and procedures. In addition, Benga provides examples of how it may manage access to the mine permit boundary. A more detailed version of the AAMP is required to understand how the potential effects of the Project on current access to lands and resources for traditional purposes will be mitigated.

a) Provide an updated draft of the AAMP including a framework for developing and amending the details of the AAMP in the future.

Response:

The AAMP is now entitled simply "Access Management Plan" (AMP) and is attached here as Appendix 4.5-1. The AMP is an internal procedure governing access to Benga properties and may be modified from time to time based on input from Indigenous users or at the discretion of Benga. Significant changes to the AMP will be discussed with the Indigenous communities in advance except where a serious safety or security issue is concerned; in this case, the change will be discussed with the Indigenous communities as soon as possible after implementation.

b) For each Indigenous group that would be acknowledged access under the AAMP, provide a detailed description (and maps, if possible) illustrating how the access to, through or around the Project site for that group is predicted to change. Use the TLU studies, CEA and any other traditional knowledge provided to the Proponent, to determine whether access to current use and physical and cultural heritage locations will be restricted by overlaying current use, active zones of the Project area and Project components to demonstrate which areas and associated resources will be affected for each Indigenous group.

Response:

Figure 4.5-1 shows the area around the Project and important features that are necessary to understand current and future access. None of the Indigenous groups consulted by Benga for the Project identified unique physical and cultural heritage locations therefore, it is convenient for the purposes of this response to refer to the features listed below, and identified on the map in Figure 4.5-1, where many Indigenous groups have indicated a desire to have continued access for hunting, fishing, gathering and other traditional activities.

The Project footprint is outlined in Figure 4.5-1 and can be seen to be approximately half on Benga owned lands, which are designated by gold coloring, and half on Crown land. The Project is bounded by Blairmore Creek to the West and Gold Creek to the East with Bluff Mountain to the South.

The following physical and cultural heritage locations have been mentioned by several Indigenous groups and access during the Project will be managed as described below:

Blairmore Creek

Blairmore Creek is used for fishing and hunting and will continue to be available to Indigenous groups for these activities while the Project is on-going. Access to Blairmore Creek at present is primarily from Highway 40 due to the steep terrain between the Project and the creek. Access from Highway 40 will not be affected by the Project nor does it fall under the Project's AMP.

Crown Land West of the Project

Crown Land to the West of the Project is currently used for traditional activities including hunting and gathering. The Blood Tribe identified a number of camp sites near Blairmore Creek that are currently used for cultural and hunting activities in this area. Access to this area, including the sites identified by the Blood Tribe, is primarily from Highway 40 which will be unaffected by the Project and is not controlled by the AMP.

Gold Creek

Gold Creek is used for fishing and hunting and will continue to be available to Indigenous groups for these activities while the Project is on-going. Gold Creek is accessible from the Town of Frank for the portions of the creek South of the Project. For areas immediately to the East and North of the Project access is available through trails that run through Benga's private land, as well as by trails and roads to the North of the Project.

Access from the Town of Frank, and access from the North of the Project, will not be affected by the Project; however, the access route through Benga's land (*i.e.*, the Project footprint) will not be useable during construction and operations phase of the Project for safety reasons. Alternate access to this area will continue to be available. The alternate access route is approximately noted in Figure 4.5-1 and is not controlled by the AMP.

Crown Land East of the Project

Crown Land to the East of the Project is currently used for traditional activities including hunting and gathering. As is the case with Gold Creek, current access to this area is either from the South, through trails that are located on Benga-owned private land, or by trails and roads to the North of the Project. The access routes currently on Benga lands will not be useable during the life of the Project for safety reasons. Access to this area from the South and the North will not

be affected by the Project. Alternate access to Gold Creek area, and to crown land east of the Project is marked in Figure 4.5-1 and is not controlled by the AMP.

Site DjPo – 98 and Site DjPo - 130

These historic archeological sites have been identified as culturally important by all of the Treaty 7 Bands. Both of these sites are located on freehold (Benga-owned) land near Blairmore Creek on the Southern boundary of the proposed coal handling and processing plant. Benga has agreed to protect these sites and anticipates that, although these sites have not been used frequently for cultural activities, the new awareness of these sites made possible by the Project investigations will lead to more use in the future. As these sites are very close to the Project, access will be managed along the main access road using the AMP to ensure that access is safe and coordinated with other Project activities. Access to these areas will require that visitors be admitted through the Project Access Control Point and may require a Benga guide to ensure communication and safety for any visitors.

Crown Land within the Project Footprint

Benga has committed to providing one year of notice prior to clearing activities for the Project so that Indigenous groups have sufficient amount of awareness and time to harvest plants prior to clearing. It is anticipated that by Year 5 of Operations, the entire Project footprint will have been cleared. During these first 5 years of the Project, Benga will coordinate harvesting activities within the Project footprint using the AMP to ensure that access is safe and coordinated with other Project activities. Access to these areas may require a Benga guide to ensure communication and safety for any visitors.

Crown Land North of the Project

Crown Land to the North of the Project is currently used for many traditional activities including hunting and gathering. Access to this area is currently primarily from Highway 40 and as mentioned above, this access will be unaffected by the Project.

Benga Owned Private Lands

Benga currently owns approximately 700 hAs of freehold (private) land to the South of the proposed pit and dump footprints along the proposed Project Access Road. This land is clearly marked in Figure 4.5-1. Benga has committed to permit restricted use of these private lands for Indigenous traditional activities. To ensure that use of the Project Access Road and Benga's private lands are safe and comply with Benga's safety and environmental protection plans, the AMP will be used for these areas. Benga considers that this access to private lands for traditional indigenous activities is an improvement for Indigenous groups over previous access restrictions in these areas.

c) Identify any management actions proposed to either facilitate or restrict access by Indigenous groups.

Response:

In addition to the control point mentioned in the response to part b), Benga intends to augment existing fences and topographical features to reasonably restrict access to areas that may become unsafe once construction and operations begin. Signage to ensure the Project limits are clear will also be erected at appropriate locations and intervals.

Finally, Benga has agreed with Indigenous communities to allow access to approximately 700 hA of privately-owned Benga lands along the Grassy Mountain Road for certain activities such as harvesting and gathering. To ensure that the safety of Indigenous people taking advantage of this facility, Benga will also use the AMP to manage access to these non-project lands. Benga has committed to work with Indigenous communities to implement protocols or to restrict access by others when harvesting is taking place through the AMP.

d) Provide evidence of the efficacy of access management plans in mitigating effects to current use of lands and resources for traditional purposes and discuss how Benga will incorporate lessons learned from those examples into the Aboriginal Access Management Plan for the Project.

Response:

Benga has no evidence from other projects that demonstrates the efficacy of access management plans in mitigating effects to current use of lands and resources for traditional purposes. Further, Benga considers access management for projects to be characterized by the unique features and access needs associated with each project. The unique nature of each project does not allow for a useful comparison of access management plans in general.

A key feature of this AMP, which may be unique to this Project, in terms of effects mitigation, is that Benga is committing to allow Indigenous access to approximately 700 hA of Benga owned private lands adjacent to the Project Access Road under terms and conditions contained in the AMP.

The AMP has been in effective use since late in 2018 and has been used by a number of Indigenous people. Most usage to date has been to take advantage of the access to Benga private lands for the purposes of harvesting lodgepole pine and in some instances, medicinal plants. Benga has received verbal positive feedback from users.

Benga will continue to communicate with Indigenous groups for the life of the Project and will be open to suggestions and recommendations to improve the AMP.

4.6 Information Request 4.6

Final Environmental Impact Statement Guidelines. (CEAR #11).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H – Aboriginal Consultation. (CEAR #42).

Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project Between the Minister of the Environment, Canada and the Alberta Energy Regulator, Alberta (Including Terms of Reference). (CEAR #80).

Comments from JFK Law Corporation on behalf of Káinai First Nation. (CEAR #184).

Comments from the Tsuut'ina Nation. (CEAR #192).

The Panel is mandated to consider and include in its report, the effects of the Project on asserted or established Aboriginal or Treaty rights, to the extent the Panel receives such information as provided in Part III (CEAR #80).

The Panel must also invite Indigenous groups and peoples to provide information related to:

- the nature, scope, location and extent of asserted or established Aboriginal or Treaty rights that could be impacted by the Project,
- the potential adverse environmental effects and the potential impacts that may be caused by the Project on asserted or established Aboriginal or Treaty rights,
- any potential adverse effects that may be caused by the Project on the health, social or economic conditions of Indigenous people,
- any measures proposed to avoid, mitigate or accommodate the potential adverse environmental effects of the Project and the potential adverse impacts on asserted or established Aboriginal or Treaty rights,
- cumulative environmental effects and cumulative impacts to asserted or established Aboriginal or Treaty rights and related interests,
- historic, current and intended future uses of lands and resources, and
- information on determining thresholds for significance of environmental effects as defined under s. 5 of CEAA 2012, and for severity of impacts to asserted or established Aboriginal or Treaty rights, including Indigenous perspectives and criteria.

The Panel may also:

- receive information in this regard provided by the proponent, government bodies, the public and other interested parties,
- use this information to make conclusions and recommendations that relate to the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights as described by Indigenous persons or groups, and
- incorporate any Indigenous perspectives and Traditional Aboriginal Knowledge that it has received into its report.

As such, the Panel invites Benga to provide information to it on the matters which the Panel will also invite Indigenous groups and peoples to address.

The Panel requests that Benga consider the "Methodology for Assessing Potential Impacts on the exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine" proposed by the Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (Annex A – CEAR #184) in responding to the items below.

Benga should consolidate the response by information received from each Indigenous group, in a manner which considers the criteria listed above. In all cases, the Panel understands that the Proponent is being asked to provide its perspective and views on these matters. If available to Benga, information provided should include the following:

a) each Indigenous group's description, if any, of its asserted or established rights (including geographical extent, nature, frequency, timing of exercise of rights) when this information is provided by an Indigenous group to the proponent or available through public records;

b) each Indigenous group's description, if any, of the conditions that support each community's exercise of their rights, including understanding how historic, existing, and approved activities have affected these conditions;

c) each Indigenous group's description, if any, of the importance of the Project's location in relation to the exercise of rights for each Indigenous group;

d) each Indigenous group's description, if any, of the potential adverse impacts of each of the Project components and physical activities, in all phases, on asserted or established Aboriginal and Treaty rights based on

    i. a comparison of the exercise of the identified rights between the predicted future conditions during Project operation and in closure and the predicted future conditions without the Project;

    ii. identification of the pathways for potential impacts of the Project (positive and negative) on the exercise of rights, accounting for the nature of rights, regional/historic/cumulative impacts, community thresholds, cultural landscape, preferred expression of rights, distribution of benefits/impact equity, and present and future generations;

    iii. consideration to experience, culture, governance, intergenerational transmission of knowledge and other factors identified as important to the continue practice of rights by the Indigenous group throughout life of the mine;

e) each Indigenous group's description, if any, of information for determining thresholds for severity of impacts to asserted or established Aboriginal or Treaty rights, including Indigenous perspectives and criteria.

f) each Indigenous group's description, if any, of mitigation measures that specifically address potential impacts to rights and accommodation measures that have been identified through engagement with Indigenous groups.

g) recommendations, if any, raised by each Indigenous group for mitigating the effects of changes to the environment on Indigenous peoples or for accommodating potential adverse impacts of the Project on asserted or established Aboriginal and Treaty rights;

h) views, if any, expressed by each Indigenous group on the effectiveness of the mitigation or accommodation measures, including views on residual and cumulative effects;

i) each group's description, if any, of the effects of changes to the environment on Indigenous peoples or potential adverse impacts on asserted or established Aboriginal or Treaty rights that have not been fully mitigated or accommodated as part of the environmental assessment.

Response:

Benga has considered the "Methodology for Assessing potential Impacts on the exercise of Aboriginal and Treaty Rights of the proposed Frontier Oil Sands Mine" proposed by the Mikisew Cree First Nation and the Canadian Environmental Assessment Agency prepared for the Frontier Oil Sands Mine.

Benga has summarized the input that it has received from each Indigenous group in the document entitled "An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups" included as Appendix 4.1-1 of Addendum 10. This updated assessment provides the requested analysis in summary form for each Indigenous group.

Benga further submits attached Tables 4.6–1 through 4.6–14 that consolidate the information received from each consulted Indigenous group pertaining to categories a) through i) above.

Benga points out for consideration by the JRP that five of the seven Treaty 7 First Nations have provided letters indicating that they have no objections to the Project. First Nations that have submitted such letters include:

- Stoney Nakoda Nation (CEAR #207) representing:
  - Chiniki First Nation;
  - Wesley First Nation; and
  - Bearspaw First Nation.
- Piikani Nation (CEAR #152 and #200); and
- Blood Tribe or Kainai First Nation (CEAR #234).

Table 4.6-1 Indigenous Rights, Land Use and Culture – Views of Kainai Nation

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	"Kainai participated in, and to a certain context continue to practice, a seasonal round, whereby people travel from one place to another during the annual cycle of hunting and gathering resources when those resources could be acquired in a given location at a given time. Kainaiwa have intimate connections to the land as a result of their collective experiences and particularly due to their pre-European lifeways. Large game animals and widely used plant resources were exploited in the Crowsnest Pass during all seasons. Kainai still use the Crowsnest Pass area for the acquisition of plants and spiritual purposes as well as hunting and traveling." P. 12 "For Kainai members, the land itself is bound up in the history and identity of the Blackfoot people." P. 18	Kainai Nation. 2015. *Public Report on Kainai Traditional Knowledge and Use of the Grassy Mountain Area.* Compiled by Kai Scott for Riversdale Resources, July 2015.
	"Southwestern Alberta, including the Crowsnest Pass, is the traditional territory of the Blackfoot Nation, including Kainai Nation. The Blackfoot Confederacy Nations used the Crowsnest Pass and surrounding areas of southwestern Alberta for many millennia before the arrival of Europeans. Blackfoot histories, ethnographical data, archaeological data, linguistic data, and other information support the Blackfoot occupation and use of their traditional territories in southwestern Alberta for a very long period, since "time immemorial." In particular, the area in and around the proposed Project has important Blackfoot place names." P. 11 "Crowsnest Mountain (approximately 10 km west of Grassy Mountain) is a mountain, which is located near the continental divide in the Crowsnest Pass. The mountain is known to be near the headwaters of the Oldman River. The mountain is geologically unique and semi-isolated from other mountains, making it an important landscape marker and easily recognizable. It is associated with Blackfoot myths and traditional religion and is still used for ceremonial and religious purposes. Another important sacred site, Chief Mountain (approximately 100 km southwest of Crowsnest Pass), is known as the home of Thunder." P. 11 Crowsnest Pass is known to have numerous remains of former vision questing areas and these locations have both historical and religious significance." P. 15	Kainai Nation. 2015. *Public Report on Kainai Traditional Knowledge and Use of the Grassy Mountain Area.* Compiled by Kai Scott for Riversdale Resources, July 2015.
b) Conditions that Support Exercise of Rights	"Natural wildlife and fish populations would have supported traditional land use throughout the region. Since European settlement, however, a substantial transformation has occurred, with almost half of the regional landscape surrounding the Blood Tribe reserve converted to anthropogenic cover types" P. 6 Overall, the declines in elk, mule deer and fish have resulted in reduced opportunities to fish and to hunt on the regional landscape, an issue compounded by limited accessibility for TLU due to private land ownership, non-traditional land use activities, and community member avoidance due to concerns about contamination, safety, and overall negative experiences on the land." P. 6/7 "The majority of the regional landscape surrounding the Kainai First Nation reserve has been converted to anthropogenic cover types, primarily farmland. The loss of natural land cover and high linear footprint densities have detrimentally affected fish and wildlife, resulting in moderate risk to the fish community and high risk to elk and mule deer. Accessibility of the land for traditional activities is also of concern, with only 20% of the land estimated to be accessible. These impacts have resulted in substantially reduced opportunities for Blood Tribe members to fish and to hunt in the region, which has made the comparatively intact landscapes to the west important for traditional land use.	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Kainai First Nation. Prepared for Kainai First Nation, Standoff, AB, and JFK Law, Vancouver, BC. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.

Table 4.6-1 Indigenous Rights, Land Use and Culture – Views of Kainai Nation

Question to Address	Direct Comment from Nation	Reference
c) Importance of the Project's Location	"It is estimated that 80% of the regional study area is inaccessible for traditional land use due to presence of private land, protected areas, and non-traditional land use activities. When accessibility for TLU is considered, the opportunity for mule deer and elk hunting has declined from natural conditions by 87% and 88%, respectively (Figures 3 and 4). The low opportunity for TLU across much of the regional study area makes the comparatively intact landscapes along the foothills to the west critical for Blood Tribe members to be able to practice TLU activities." P. 7	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Kainai First Nation. Prepared for Kainai First Nation, Standoff, AB, and JFK Law, Vancouver, BC. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
	"During the site tour and ground-truthing, Kainai Elders and technicians spoke extensively about their strong and historically-rooted cultural and spiritual connection to the land and animals surrounding the proposed mine site. One of the Kainai Elders articulated Kainai spiritual connection to the land by indicating the location of rock art in 2 caves, one 15 km west of the proposed Project and another 8 km east of Grassy Mountain." P. 16 "Members of the Kainai Nation have used and continue to use the land in and around Grassy Mountain, including regular travel throughout the landscape taking advantage of seasonally available resources and to maintain contact and relationships with other members of the culture." P. 18 "During the site tour and ground-truthing efforts, Kainai technicians and Elders gave a rich tapestry of history, land use, cultural practices, spirituality and seasonal harvest, and travel in and around the proposed Project area. This level of knowledge underscores Kainai's long history connection to and using the area's plant and animal resources." P. 22 "The area in and around Grassy Mountain has several hundred plant species that were and are used for medicinal, spiritual, and food purposes." P. 22 Today, the area is home to populations of bighorn sheep, moose, bear, mule deer, elk, and various avian species. Some of these species remain important sources of food for members of the Kainai Nation." P. 30 "The main focus of discussions during field work was on the medicinal and ceremonial importance and uses of alpine plants found on Grassy Mountain. The plants that were identified and/or harvested by Kainai Elders during the site visit and ground-truthing included bearberry, sweet pine, juniper, lodgepole pine, aspen, wild licorice, horsetail, moss, yarrow, rosehip, raspberries, thimbleberries, mushrooms, cottonwood, and birch. The value of wildlife and bird species was also discussed, including elk, deer, cougar, wolf, rabbit, squirrel, woodpecker, wild turkey, crows, red-tailed hawk, and golden eagles." P. 39	Kainai Nation. 2015. *Public Report on Kainai Traditional Knowledge and Use of the Grassy Mountain Area.* Compiled by Kai Scott for Riversdale Resources, July 2015.

Table 4.6-1 Indigenous Rights, Land Use and Culture – Views of Kainai Nation

Question to Address	Direct Comment from Nation	Reference
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	"Although simulated footprint growth for the next five decades is relatively minor at the scale of the focal study area, the Grassy Mountain mine accounts for the majority of projected footprint growth in the watershed. The mine would contribute to ongoing loss of habitat and associated opportunities for traditional land use, and impacts may be greater if consequences of water contamination (*e.g.*, selenium, calcite) were to be considered. Any further decline in opportunities for traditional land use may be of concern given that risk to traditional land use is already assessed as high. " P. 38 "Due to conversion of land to agriculture, potential elk habitat is assessed to be below natural conditions, and high linear disturbance density causes still lower levels for effective habitat. The same is true for mule deer habitat, although the departure of potential habitat from natural condition is less severe because tame pasture is a preferred habitat for that species." P. 2	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Kainai First Nation. Prepared for Kainai First Nation, Standoff, AB, and JFK Law, Vancouver, BC. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	"Community members expressed that the conversion of TLU suitable crown lands to private property and other restricted land uses (*e.g.*, parks, ecological reserves) is the primary driver of decreased access to TLU suitable lands." P. 21 "Numerous studies in Alberta have suggested that motorized use of linear features (roads, seismic lines, pipelines) can have negative effects on wildlife species (*e.g.*, Frair *et al*. 2008, Quinn and Chernoff 2010, Ciuti *et al*. 2012, Hebblewhite and Merrill 2008, Muhly *et al*. 2013, Gaines *et al*. 2003, Farr *et al*. 2017)." P. 15	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Kainai First Nation. Prepared for Kainai First Nation, Standoff, AB, and JFK Law, Vancouver, BC. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.

Table 4.6-1 Indigenous Rights, Land Use and Culture – Views of Kainai Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	Recommendation: "Finally, Kainai Elders expressed a strong interest in harvesting lodgepole pine to develop a Kainai Elder's Lodge in the community of Standoff." P. 38 "Kainai knowledge holders also provided initial ideas for mitigation of potential effects of the proposed Project. In general, these entail: • Interest in lodgepole pine cleared from the site; • Continued communications and collaboration between Riversdale and Kainai Nation; • Development of an Emergency Preparedness Plan; • Development of a reclamation program; and • Avoidance of plant and wildlife species (where possible)." P. 39	Kainai Nation. 2015. *Public Report on Kainai Traditional Knowledge and Use of the Grassy Mountain Area.* Compiled by Kai Scott for Riversdale Resources, July 2015.

Table 4.6-1 Indigenous Rights, Land Use and Culture – Views of Kainai Nation

Question to Address	Direct Comment from Nation	Reference
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	"The large difference between effective and potential habitat identifies linear features to be an important risk to ungulates due to human-caused mortality that they facilitate. More detailed analysis that simulates the response of populations (as opposed to just habitat) is needed to explore the effectiveness of strategies to manage human-caused mortality. Another area for further investigation is the relative contribution of various types of linear features to risk of wildlife mortality." P. 12/13 "Examples of mitigation strategies that are available to address adverse effects of access to wildlife populations include: 1. Establishment of a network of provincial, national parks and sanctuaries where hunting is prohibited. These areas provide refugia for wildlife and act as source areas for repopulating adjacent areas where mortality rates may be higher. 2. In a sense, Alberta's hunting "constraint" regulations (number of available tags, when and where one can harvest) reflect the basic understanding that hunters with extensive "access" to the regional landscape of a wildlife species can, if unregulated, create a combined mortality rate that is excessive relative to population objectives. The greater the extent to which the hunting community can access wildlife habitat with vehicles (including OHVs), the greater the need for regulatory constraints. 3. Road sanctuary buffers on selected roads. These buffers are generally applied to roads where hunting is prohibited within 365 m of the road right of way. 4. Prohibition of some forms of transportation (such as OHVs) along selected linear features (roads, seismic lines) during defined times of the day or week. 5. Integrated landscape management strategies that seek to reduce the quantity of linear footprint that is needed to extract natural resources." P. 14	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Appendix C: Wildlife Habitat Analysis of Effective and Potential Habitat. Cumulative Effects Assessment for Kainai First Nation. Prepared for Kainai First Nation, Standoff, AB, and JFK Law, Vancouver, BC. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
	"Throughout the site tour and ground-truthing field work, Kainai Elders and technicians commented on the importance of the medicinal and ceremonial plants that are prevalent in and around the proposed Project. They recommended protection of these important species (where possible) or harvesting where they are proposed for removal for development purposes. Kainai Elders also commented on the importance of maintaining habitat for wildlife. In particular, Kainai Elders expressed concerns about the effects of the proposed Project on animals, plants, eagle, and turkeys in this area." P. 37/38 "During the workshop on December 2, 2014, several Elders recommended an emergency preparedness plan in the event of leaks, spills, or other disasters. This plan is to address concerns they have about effects on water quality and species dependent on clean water sources.	Kainai Nation. 2015. *Public Report on Kainai Traditional Knowledge and Use of the Grassy Mountain Area.* Compiled by Kai Scott for Riversdale Resources, July 2015.
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	The Blood Tribe does not object to the above-named application and its related applications on the basis that Benga has adequately addressed its project-specific concerns. The Blood Tribe is therefore of the view that Benga's consultation should be deemed adequate. As a result of our work with Benga, the Blood Tribe supports the development of the Project.	Letter dated July 10, 2019 from Blood Tribe to CEAA. (CEAR #234)

Table 4.6-1 Indigenous Rights, Land Use and Culture – Views of Kainai Nation

Question to Address	Direct Comment from Nation	Reference
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	The Blood Tribe does not object to the above-named application and its related applications on the basis that Benga has adequately addressed its project-specific concerns. The Blood Tribe is therefore of the view that Benga's consultation should be deemed adequate. As a result of our work with Benga, the Blood Tribe supports the development of the Project.	Letter dated July 10, 2019 from Blood Tribe to CEAA. (CEAR #234)

Table 4.6–2 Indigenous Rights, Land Use and Culture – Views of Piikani Nation

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	"Currently, Piikani Nation has over 4500 registered members and a land mass of approximately 46,677 hectares, encompassing some of the most resource rich land in the world. The area where Grassy Mountain is located sits within the Piikani Nation Territory. At the Signing of the Blackfoot Treaty (Referred to: Treaty# 7) signed between the Federal Crown and the Piikani Nation, along with the Blood Tribe, Siksika Nation, Sarcee, and the Stoney Tribe, on September 22, 1877, at Blackfoot Crossing situated on the Siksika First Nation, located east of Calgary, Alberta. Our Piikani Nation Chief who signed Treaty on behalf of the Piikani Nation, Chief Sitting Behind an Eagle Tail, outlined the territory for the Piikani Nation, which included the area where Grassy Mountain is located."	Letter from Piikani to JRP dated January 18, 2019. (CEAR #152)
	"A portion of southwestern Alberta, including the Crowsnest Pass, is the traditional territory of the Piikani Nation. They used the Crowsnest Pass and surrounding areas of southwestern Alberta for many millennia before the arrival of Europeans. Piikani ethnographical data, archaeological data, linguistic data, and other information support the Piikani occupation and use of their traditional territories in southwestern Alberta for a long period of time. Piikani oral histories describe this period of history as since "time immemorial." In particular, the area in and around the proposed Project has important Blackfoot place names." P. 11	Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area.
	"Piikani have long engaged in and continue to practice a seasonal round, whereby people travel from one place to hunt, gather resources, and go to certain places at certain times when and where conditions are optimal." P. 17	
	"One of the Piikani Technicians described the nomadic way of life for Blackfoot people: *Our whole area, wherever the game was, we followed it. We were nomadic people. We didn't live in Brocket and go up to the mountains and hunt. We were living down that way, by that river, by these hills, because that's where the game was. Maybe that area, those passes, they would go use those areas to pass through to go to other tribes…..They might be using that area for shelter, water, lodging, temporary lodges. War lodges, they would rendezvous there after the raid and travel home together. Hidden shelters in the bush. There were quick makeshift camps. These areas in the mountains were stop-over places during the war raids and horse stealing raids. They would be hunting there, too.* ~ Piikani Technician (Breakout Session, June 2014)" P. 29	

Table 4.6–2 Indigenous Rights, Land Use and Culture – Views of Piikani Nation

Question to Address	Direct Comment from Nation	Reference
b) Conditions that Support Exercise of Rights	"One of the Piikani Elders described the changes to the size of Piikani lands before, during, and after the signing of the treaties with the Blackfeet and the North Piegans. Before the signing of the treaty in the mid-1800s in the United States with the Blackfeet, and before the signing of the treaty in the late 1800s in Canada with the North Piegans, the Piikani camped, traveled, and defended their territory against neighboring groups." P. 12 "Piikani continue to share a relationship of respectful reciprocity in their intimate connections to the land as a result of their collective experiences, particularly through their pre-European lifeways." P. 18 "The Piikani Elders and knowledge holders explained the history of hunting wildlife and birds in the past when Piikani had free access to their entire traditional territory through the introduction of European settlers who limited Piikani traditional activities and travel to reserves and through the recent revival of hunting among Piikani members." P. 39	Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area
c) Importance of the Project's Location	"Regarding PROPONENT project the Piikani Consultation office completed a Traditional Land Use {TLU) site visit on various dates throughout 2015-2018 and the outcome of the site visits have not identified any significant traditional sites in the immediate identified project area and/or right of way and therefore the Piikani Nation does not object to the project at this time. " "The subsequent sections describe the history of the Piikani people and these important place names, including their origin, meaning, and distance to the proposed Project. These places are Oldman River, Crowsnest Mountain, Napi's Playground, Crowlodge Mountain and Creek, Chief Mountain, Little Bow River, Sweetgrass Hill, and Porcupine Hills. These places on Piikani land feature prominently in their stories, especially of Napi (the Creator), and also serve as important harvesting locations. While some of them are quite a distance from the proposed Project area, they are relevant because they are interconnected through travel and time and function as a system in Piikani use patterns and way of life. " P. 12 "Large game animals and widely used plant resources continue to be exploited in the Crownsnest Pass during all seasons. Piikani still use the Crowsnest Pass area for the acquisition of plants and spiritual purposes as well as hunting." P. 18 "Crowsnest Mountain (approximately 10 km west of Grassy Mountain) is located near the continental divide in the Crowsnest Pass. The mountain is about 50 km south of the headwaters of the Oldman River near outside of Beehive Natural Area. The mountain is geologically unique and semi-isolated from other mountains, making it both an important landscape marker and easily recognizable. It is associated with Blackfoot myths and traditional religion and is still used for ceremonial and religious purposes." P. 18/19 "Plant species found in the alpine at Grassy Mountain are crucial to Piikani ceremony, healing practices, and spirituality and are particularly important because they are not found at low elevations where most Piikani presently reside." P. 33	Letter from Piikani to Benga dated March 7, 2019. (CEAR #200) Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area.

Table 4.6–2 Indigenous Rights, Land Use and Culture – Views of Piikani Nation

Question to Address	Direct Comment from Nation	Reference
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	"Concern – Adverse effects on wildlife and wildlife habitat: … *When the mine goes ahead and the mountain is gone, it will alter the migration routes and the presence of more humans are going to alter the migration routes of these animals. That has a chain effect: if you alter their migration and then alter their food source, then with mining activities, their health might be affected. In the long run, people will use these animals and then their health will be affected… It is going to affect their travel routes as they will have different interactions wit humans. They will use the highway more and there will be more wildlife collision. It will affect their behaviour in some ways.* ~ Piikani Technician (Breakout Session, June 2014)." P. 50	Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area.
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	"Concern – Impacts to hunting and access, now and for future generations: *We want to mitigate impacts to hunting rights, too. We must think of long-term impacts.* ~ Piikani Technician (Plenary Session, June 2014)." P. 49 "Piikani elders and knowledge holders also expressed a mix of sadness for ancestors and past damages witnessed on Grassy Mountain with tempered hope for the future to carry out the proposed Project better than in the past, together with Riversdale." P. 60 "The workshop also provided a focused opportunity to identify the potential effects of the proposed Project including effects on Piikani hunting and access, few remnants of Piikani presence in the area previously disturbed by historic mining, impacts to water quality, and missed economic opportunity during historic mining." P. 59 "Concern – Observations from existing mining operations: *So, in Crow, they have a coal mine. I've been there, I've toured it. There is a lot of impact to the ground. A lot of the land in the mountainous area is disturbed. That land does not look like it will go back to the state it was before. Just because it was open mined, exactly what they want to do here. Once you start taking, it's hard to put back exactly what was there. With regards to the equipment that goes there, an open mine pit, there is big machinery…* (gives example of coal mine Big Bertha down south) ~ Piikani Technician (Workshop, September 2014)" P. 251	Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area.

Table 4.6–2 Indigenous Rights, Land Use and Culture – Views of Piikani Nation

Question to Address	Direct Comment from Nation	Reference
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	"One of the Piikani Technicians explained how his experiences of the connection between today and the past: *I wanted to talk about our old history and current history. When we go and see these sites and go on these field visits, it is like a double-edged sword. You go out there and you're lucky enough to be on this team. Since the settlement of these lands, we are the first Natives to be back. But it puts a big onus on us guys. We have to go out there and all the history before us before we went out there, those sites have not been dealt with. Then it's up to us how to figure out how, what we should do with them, document them as much as we can and bring them back to the Elders to see to get some insight what there is. It is a heavy burden to carry to go out and do these. It's an honour and, on other side, it's a heavy burden to carry.* ~ Piikani Technician (Workshop, September 2014)" P. 29 "Some knowledge comes from observing behaviour, while other knowledge is handed down from one generation to the next. This knowledge base was expanded through insights made during the site tour or ground-truthing efforts and combined to provide important understanding of the Grassy Mountain area." P. 47 "Concern – Loss of culture, now and future generations*: If the program proceeds, it will impact our younger generation. It will be part of our culture, our history, our storytelling. Form what I heard when I grew up, I used to hear stories form my Elders, from my grandfather (naahsa), Wolf Tail (aapi'sosoysis), Small Legs, they used to sit around and talk about the old days, about the mountains, about history. We were just young kids, we had to sit around and listen. You [Riversdale] will impact our future, our storytelling will change. The sites that we have seen so far that is just a fraction of what's up there and what's going to be disturbed. It is against our culture*. ~ Piikani Elder (Workshop, September 2014). *So my kids down the road, they (and their kids) are the ones that are going to be robbed of all those sites that will be impacted. I have not even heard 1% of the stories, the different things that are out there that are powerful that helped our people for thousands of years. I have not even heard 1%. So what's going to happen to my kid's kids when all those sites are destroyed? Who is going to know the stories, proper protocol? What a vision question is to really about? If you take away those sites, who is going to have the opportunity to do that*? …. ~ Piikani Member (Workshop, September 2014)." P. 52	Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area.
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	The Piikani Nation also reserves the right to maintain an on-going Environmental & Cultural Monitoring Program and regime funded by the PROPONENT in accordance with the guidelines as set forth by the Piikani Consultation Policy, to ensure the integrity of the project area remains intact, prior to, during and throughout the project area life.	Letter from Piikani to Benga dated March 7, 2019. (CEAR #200)

Table 4.6–2 Indigenous Rights, Land Use and Culture – Views of Piikani Nation

Question to Address	Direct Comment from Nation	Reference
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	"Waypoints 10, 11, and 26 are ceremonial plant locations requiring harvest of the plants before this area is developed." P. 31 "Recommendation – Provide employment opportunities for young Piikani: …. *We should have training programs set up for people that will be set to work hand in hand with the promise of employment for our people and younger generations. Right now, we are not benefiting from it…* ~ Piikani Technician (Workshop, September 2014) *Let's create jobs for our people. Too many of us depend on welfare…* ~ Piikani Elder (Workshop, September 2014)." P. 57 "Piikani knowledge holders provided initial ideas for mitigation, monitoring, and management of the potential effects of the proposed Project. In general, these entail: • Interest in lodgepole pine cleared from the site; • Avoid disturbance to areas flagged for protection; • Transparent communications between Riversdale and Piikani Nation; • Piikani cultural orientation for Riversdale employees and contractors; • Piikani ceremonies for protection of the land and the workers; • Interest in jobs involving security and communications for members of Brave Dog Society; • Interest in employment opportunities for Piikani youth; and • Reclamation after mining." P. 60 "A Piikani Elder noted the value of developing a plan that included Piikani spiritual practices as a way of moving forward together with Riversdale: *This project is in the infant stages…. A the end of the day, it is critical that we map it all out and have a path. We have to walk out there and talk about it….. We have to unravel this in a way that the message goes out peacefully and the understanding is there.* ~ Piikani Elder (Plenary session, June 2014)." P. 60	Piikani Nation. 2015. Piikani Traditional Knowledge and Land Use in the Matoyihko Yiistak Area.
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	" Piikani Nation proudly supports the Grassy Mountain Coal Project. We have been involved with Riversdale Resources since their arrival in the region. Throughout our years of consultation, they have shown great respect for our traditions, cultural values and concerns for the land. For this reason, we signed a formal impact Benefit Agreement (IBA) in 2016 to enter into a partnership with Riversdale Resources." "Our partnership with Riversdale Resources will allow us to provide employment, training and education to our members. It will spur business development opportunities for local entrepreneurs and help build economies on our reserve. It will increase the administration's capacity to provide community programming and robust support for our members. Most importantly, our partnership will ensure we can continue to be stewards of our land by working with Riversdale Resources on environmental protection and mitigation activities that encompass both traditional and modern methods."	Letter from Piikani to JRP dated January 18, 2019. (CEAR #152)

Table 4.6–2 Indigenous Rights, Land Use and Culture – Views of Piikani Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	"Regarding PROPONENT project the Piikani Consultation office completed a Traditional Land Use {TLU) site visit on various dates throughout 2015-2018 and the outcome of the site visits have not identified any significant traditional sites in the immediate identified project area and/or right of way and therefore the Piikani Nation does not object to the project at this time. "	Letter from Piikani to Benga dated March 7, 2019. (CEAR #200)

Table 4.6–3 Indigenous Rights, Land Use and Culture – Views of Stoney Nakoda Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	"The Project is located within the traditional territories asserted by the Stoney Nakoda. The Stoney Nakoda are part of the Great Sioux Nation (Lakota, Dakota, and Nakota commonly referred to as Nakoda)." P. 1 "Honouring spirit is crucial to linking different worlds (*i.e.*, animal, people, Creator). Stoney Nakoda spirituality and peoples' connection to the land is profound; the land is where spirit is renewed. Honouring, respecting, and trying to understand Stoney Nakoda spirituality is at the core of an appreciation for Stoney Nakoda traditional knowledge and land use." P. 6 "Stoney Nakoda TK has long guided TU of the land, water, and air in terms of hunting, harvesting, lifeways, and stewardship." P. 6	Stoney Nakoda Nation, 2015, Grassy Mountain Coal Project – "We Could Write a Book about this Place" – Non-Confidential Summary of Traditional Use: Site Tour in the Grassy Mountain area in June 2014.
b) Conditions that Support Exercise of Rights	"There should have been an abundance of medicinal plants, but there was nothing. Lots of plow disturbance, making the land all grasses and sedges and no medicinal plants." P. 7	Stoney Nakoda Nation, 2015, Grassy Mountain Coal Project – "We Could Write a Book about this Place" – Non-Confidential Summary of Traditional Use: Site Tour in the Grassy Mountain area in June 2014.

Table 4.6–3 Indigenous Rights, Land Use and Culture – Views of Stoney Nakoda Nation

Question to Address	Direct Comment from Nation	Reference
c) Importance of the Project's Location	"The mountains have always been known to have important plants and plants of interest to the Stoney Nakoda." P. 9 "Lodgepole pine stand used for poles. Forested area just near entrance into Riversdale property." P. 7 "Several wildlife species are culturally, spiritually, and nutritionally important to the Stoney Nakoda people. During the site tour, participants explained how buffalo used to be hunted and that hunting deer, elk, and other animals continues today." P. 15 "The Stoney Nakoda participants in the site tour painted a rich tapestry of history, land use, cultural practices, spirituality, harvest, and travel in and around the proposed Project area. Collectively these understandings are an important part of the Stoney Nakoda way of life that work at different time scales (*e.g.*, past, present, and future), types of geography (*e.g.*, mountain, plains, lakes, and rivers), levels of existence (*e.g.*, physical and spiritual worlds), seasons (*e.g.*, seasonal round), and elevation scales (*e.g.*, climate, surface, and subsurface). "Many of the plant species found in the alpine at Grassy Mountain are central to Stoney Nakoda ceremony, healing practices, and spirituality." P. 9 "Participants did not discuss exact locations of sacred places within the Project area and wanted to follow-up with their Elders. However, Lennie stated that there are areas on the mountain that are recognized by the Stoney Nakoda People as meditation sites." P. 16	Stoney Nakoda Nation, 2015, Grassy Mountain Coal Project – "We Could Write a Book about this Place" – Non-Confidential Summary of Traditional Use: Site Tour in the Grassy Mountain area in June 2014.
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	No information was received regarding this subject.	
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	

Table 4.6–3 Indigenous Rights, Land Use and Culture – Views of Stoney Nakoda Nation

Question to Address	Direct Comment from Nation	Reference
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	"The Stoney Nakoda Nations do not object to the above-named application and its related applications on the basis that Benga has adequately addressed our project-specific concerns. The Stoney Nakoda Nations are therefore of the view that Benga's consultation should be deemed adequate. As a result of our work with Benga, the Stoney Nakoda Nations support the development of the Project."	From the Stoney Tribal Administration to the Joint Review Panel re: Letter of No Concern for the Grassy Mountain Coal Project (CEAR #207)
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	Lifeways, Travel, and Trails: "Participants did not discuss exact details of how the Project area was used and wanted to follow-up with their Elders. When surveying the area from high vantage points, Lennie pointed out possible trails according to geomorphology, elevation, and landscape features." P. 15/16	Stoney Nakoda Nation, 2015, Grassy Mountain Coal Project – "We Could Write a Book about this Place" – Non-Confidential Summary of Traditional Use: Site Tour in the Grassy Mountain area in June 2014.
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	"The Stoney Nakoda Nations do not object to the above-named application and its related applications on the basis that Benga has adequately addressed our project-specific concerns. The Stoney Nakoda Nations are therefore of the view that Benga's consultation should be deemed adequate. As a result of our work with Benga, the Stoney Nakoda Nations support the development of the Project."	From the Stoney Tribal Administration to the Joint Review Panel re: Letter of No Concern for the Grassy Mountain Coal Project (CEAR #207)
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	"The Stoney Nakoda Nations do not object to the above-named application and its related applications on the basis that Benga has adequately addressed our project-specific concerns. The Stoney Nakoda Nations are therefore of the view that Benga's consultation should be deemed adequate. As a result of our work with Benga, the Stoney Nakoda Nations support the development of the Project."	From the Stoney Tribal Administration to the Joint Review Panel re: Letter of No Concern for the Grassy Mountain Coal Project (CEAR #207)

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	"All sites in the spiritual complex on Grassy Mountain were in continuous, regular use by Siksika members for no less than 8,000 to 9,500 years, up until about the beginning of the 20th century. At that point, we were recovering from outbreaks of disease in our communities brought upon us by non-Natives such as smallpox. Concurrently, non-Native settlers began to claim our lands for themselves and restrict access to our sites at Grassy Mountain, which continues to this day." P. 3/8 "The Grassy Mountain spiritual complex is believed to be the oldest Blackfoot spiritual site in Alberta. It is older by many millennia than our medicine wheels at Majorville and Sundial Butte (which origins date to about 5.200 years ago). The Majorville medicine wheel is protected by Alberta Heritage legislation. Like Majorville, the Grassy Mountain spiritual site has been in continuous use for 8,000 to 9,500 years. All three — Majorville, Sundial Butte and Grassy Mountain are living spiritual sites to us." P. 8 "Siksika use of the Southern Gate (Crowsnest Pass) and Crowsnest Mountain spiritual sites continued uninterrupted for at least 8,000- 9,500 years, until non-Blackfoot settlers began to deny us access to them." P. 4 "It is incorrect to understand our limited use of Grassy Mountain in the last century as a lack of interest, desire or right on our part to continue our traditions there and to access our sites located on the proposed project lands." P. 8	Siksika Consultation Office (SCO) and the Elders of Siksika Horn Society (sHorns), 2018, Siksika Traditional Use Study Report #4, EIA Addendum 9, Appendix D (CEAR #185)
b) Conditions that Support Exercise of Rights	"Natural wildlife and fish populations would have supported traditional land use throughout the region. Since European settlement, however, a substantial transformation has occurred, with almost half of the regional landscape surrounding the Blood Tribe reserve converted to anthropogenic cover types" P. 6 Overall, the declines in elk, mule deer and fish have resulted in reduced opportunities to fish and to hunt on the regional landscape, an issue compounded by limited accessibility for TLU due to private land ownership, non-traditional land use activities, and community member avoidance due to concerns about contamination, safety, and overall negative experiences on the land. It is estimated that 80% of the regional study area is inaccessible for traditional land use due to presence of private land, protected areas, and non-traditional land use activities." P. 6/7	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Siksika Nation. Prepared for Siksika Nation, Siksika, AB, and MLT Aikins, Calgary, AB. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
	"The Grassy Mountain mine has been operated in the past by other owners. Riversdale Resources acquired the property in 2013 along with other coal projects. The previous owners paid little attention to remediation of the property desecrating a sacred site of the Blackfoot people proximate to Crowsnest Mountain, with little regard to our rights, interests and heritages sites protected by the Constitution of Canada." P. 1	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Interim TUS Assessment and Report, EIA Volume 3, Appendix 7c
	"The Grassy Mountain mine site has been desecrated in the past by its previous owners. Despite this, the animals and plants have returned, adapting as best as they can to the sacred environment." P. 3	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Final TUS Assessment and Report (TUS Part 2), EIA Volume 3, Appendix 7c

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
c) Importance of the Project's Location	"It is estimated that 80% of the regional study area is inaccessible for traditional land use due to presence of private land, protected areas, and non-traditional land use activities. When accessibility for TLU is considered, the opportunity for mule deer and elk hunting has declined from natural conditions by 87% and 88%, respectively (Figures 3 and 4). The low opportunity for TLU across much of the regional study area makes the comparatively intact landscapes along the foothills to the west critical for Blood Tribe members to be able to practice TLU activities." P. 7	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Siksika Nation. Prepared for Siksika Nation, Siksika, AB, and MLT Aikins, Calgary, AB. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
	"Our sites in the Crowsnest Pass region proximate to Crowsnest Mountain, and the ceremonial, medicinal, spiritual, hunting and burial sites at Grassy Mountain have been in continuous, intensive use for millennia (see Figures 1-4). That use was briefly interrupted in the last century as a consequence of non-Native settlers barring our access to them, supported more recently by sharp dealing on the part of the Government of Alberta. Notwithstanding that brief interlude in our use, our interest in and spiritual ties to the lands at Grassy Mountain remain undiminished to this day. Our ceremonies — especially the sacred Thunder pipe ceremony held at Grassy Mountain for millennia — tie us to the mountain… The area [Grassy Mountain] has been used by our hunters for at least as long; there is abundant evidence of that use in the archeological finds and sites at the project location" P. 2 "Our Elders are clear that the sites identified in the project archeological report are part of a single, roughly crescent-shaped ceremonial and spiritual complex that comprises principally the Gold Creek and Blairmore Creek valleys and benches, and the saddle of land connecting those between Grassy Mountain and Grassy Mountain South.... This ceremonial and spiritual complex includes locations where we have and will worship at Crownest Mountain — especially our sacred Thunder Pipe ceremony — where our youth have engaged in Vision Quests, for millennia and where our dead have been buried." P. 3 "Crowsnest Mountain, located adjacent to Grassy Mountain, is one of the most sacred sites to Siksika within our entire Territory. It is there that the Thunder Pipe was given to us by Thunder before he was forced out by Crow to live at Chief Mountain. The Thunder Pipe ceremony has been held at Grassy Mountain for millennia, when the first thunder is heard each year….	Siksika Consultation Office (SCO) and the Elders of Siksika Horn Society (sHorns), 2018, Siksika Traditional Use Study Report #4, EIA Addendum 9, Appendix D
	"Siksika use of the Southern Gate, Crowsnest Mountain other sacred sites nearby has continued unabated for millennia." P. 4 "The site of the proposed mine is a core area of Siksika's Traditional Use in its Traditional Territory and has been for millennia." P. 7 "There is an abundance of wildlife and plants that make up important parts of our traditional use of the lands and waters in the Southern Gate, found in the Grassy Mountain project area." P. 7	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Interim TUS Assessment and Report, EIA Volume 3, Appendix 7c

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
	"There is a clearly abundance of wildlife living at or in proximity to the site, and plant life in small microclimates along the principal waterways roughly running the length of the project, Gold Creek (east side) and Blairmore Creek (west side)." P. 3 "Grassy Mountain is prime eagle nesting habitat, located along a major eagle migratory flyway." P. 5	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Final TUS Assessment and Report (TUS Part 2), EIA Volume 3, Appendix 7c
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	"Although simulated footprint growth for the next five decades is relatively minor at the scale of the focal study area, the Grassy Mountain mine accounts for the majority of projected footprint growth in the watershed. The mine would contribute to ongoing loss of habitat and associated opportunities for traditional land use, and impacts may be greater if consequences of water contamination (*e.g.*, selenium, calcite) were to be considered. Any further decline in opportunities for traditional land use may be of concern given that risk to traditional land use is already assessed as high." P. 38	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Siksika Nation. Prepared for Siksika Nation, Siksika, AB, and MLT Aikins, Calgary, AB. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
	"If one extrapolates the current trend of industrial development in Alberta into the future, at some point Siksika will have no practical traditional use rights or sites remaining in our Territory — meaning possible extinguishment of our Blackfoot culture. This trend is inconsistent with Section 35 of the Constitution of Canada, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) which the Government of Canada has committed to adopting, and, Siksika's understanding of the spirit of Treaty 7. This trend must be redirected so that Siksika's traditional use of the lands and waters in its Traditional Territory are assured into the long-term. Industrial development must be compatible with, and accommodate, our traditional use rights and ceremonial, spiritual, hunting and burial sites." P. 2	Siksika Consultation Office (SCO) and the Elders of Siksika Horn Society (sHorns), 2018, Siksika Traditional Use Study Report #4, EIA Addendum 9, Appendix D
	"The Grassy Mountain project, as proposed, using one of the three proposed materials dumps sites in addition to the mine site, will severely impact the movement and well-being of those animals by displacing them from their homes for many years and blocking their migratory routes. Perhaps more importantly the springs and streams running off Grassy Mountain and hillsides nearby that will be impacted by the project seem likely to become polluted by the mine run-off causing unnecessary deaths of animals we're sworn to protect." P. 7	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Interim TUS Assessment and Report, EIA Volume 3, Appendix 7c

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	*"Siksika ceremonial and spiritual sites at Grassy Mountain located on Crown lands and private lands owned by Benga are proposed to be irreversibly destroyed by the project. They comprise a spiritual complex at Grassy Mountain, identified in a project archeological report by Bison Archeological in 2015." P. 4* *"A Siksika burial site marked in the Bison report as a cairn (DkPo-7) is likely only one of many burials at Grassy that will be substantially impacted or destroyed by the project." P. 4*	Siksika Consultation Office (SCO) and the Elders of Siksika Horn Society (sHorns), 2018, Siksika Traditional Use Study Report #4, EIA Addendum 9, Appendix D
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	"This therefore is a paramount concern of ours: The Grassy Mountain project plans to continue the diminution of our traditional culture by irreversibly destroying our spiritual and ceremonial use sites on the Mountain from which we worship at Crowsnest Mountain. Traditional Blackfoot spirituality is the fabric that binds our culture and people together." P. 2	Siksika Consultation Office (SCO) and the Elders of Siksika Horn Society (sHorns), 2018, Siksika Traditional Use Study Report #4, EIA Addendum 9, Appendix D
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	"Although simulated footprint growth for the next five decades is relatively minor at the scale of the focal study area, the Grassy Mountain mine accounts for the majority of projected footprint growth in the watershed. The mine would contribute to ongoing loss of habitat and associated opportunities for traditional land use, and impacts may be greater if consequences of water contamination (*e.g.*, selenium, calcite) were to be considered. Any further decline in opportunities for traditional land use may be of concern given that risk to traditional land use is already assessed as high." P. 38	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Siksika Nation. Prepared for Siksika Nation, Siksika, AB, and MLT Aikins, Calgary, AB. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	"There are sacred plants and traditional use medicines growing on the Grassy Mountain project site that must be protected, as well as ceremonial paints referred to as ochres." P. 2 "Seasonal camp sites along the Crowsnest River dating to 8,000-9,500 years also require protection." P. 4 "At Grassy Mountain, the ceremonial and spiritual complex must be protected similarly [to the Blackfoot site at Healy Bridge, Alberta]; this may require adapting the design and operation of the mine to go around our spiritual sites and permit us to continue using it into the long-term future, following a process of meaningful consultation between the company and Siksika." P. 8 Burial Sites: "A stone cairn found in the proposed south pit area of the project (DkPo-07) is of particular concern. We have buried our dead on high ground for millennia, some interred and some laid on the ground. More study needs to be done to located other burial sites within about one kilometre of the cairn." P. 9 Plants: Medicinal and Ceremonial: "There are a number of sacred, medicinal and ceremonial plants growing in the microclimate of Gold Creek and elsewhere at Grassy Mountain which need protection from the project but were omitted from the project Environmental Impact Assessment (EIA). We are aware they grow there but have not located them yet, because they only bloom at certain times of the year. Once located, a plan for their protection can be developed through a formal consultation process with the company. The most recent TUS study identified yellow ochre at our sites near the golf course. No further impacts to this sacred paint source should be permitted." P. 9 Wildlife: "Our concern is for all animals living on the mountain. There is abundant evidence of a variety of animals living there, drinking from the springs that run down the side of the mountain and eating and resting in protected areas nearby. The lagoons holding runoff from the mountain and effluent from the mine pit should be fenced so that animals big and small do not drink from them. Alternative clean water drinking spots for those animals should be created for them nearby." P. 9	Siksika Consultation Office (SCO) and the Elders of Siksika Horn Society (sHorns), 2018, Siksika Traditional Use Study Report #4, EIA Addendum 9, Appendix D
	"The operations of the mine should include awareness training for non-Native employees of the sacred nature of the Southern Gate and Crowsnest Mountain through workshops with Siksika Elders and Society members. Riversdale should sponsor ceremonial and other important Siksika events in the region including the opening of the pipe on its site before, during and after the project is operated as a mine to maintain the sanctity of the relationship between the Creator, the animals and Man at that location." P. 8	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Interim TUS Assessment and Report, EIA Volume 3, Appendix 7c

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	"Examples of mitigation strategies that are available to address adverse effects of access to wildlife populations include: 1. Establishment of a network of provincial, national parks and sanctuaries where hunting is prohibited. These areas provide refugia for wildlife and act as source areas for repopulating adjacent areas where mortality rates may be higher. 2. In a sense, Alberta's hunting "constraint" regulations (number of available tags, when and where one can harvest) reflect the basic understanding that hunters with extensive "access" to the regional landscape of a wildlife species can, if unregulated, create a combined mortality rate that is excessive relative to population objectives. The greater the extent to which the hunting community can access wildlife habitat with vehicles (including OHVs), the greater the need for regulatory constraints. 3. Road sanctuary buffers on selected roads. These buffers are generally applied to roads where hunting is prohibited within 365 m of the road right of way. 4. Prohibition of some forms of transportation (such as OHVs) along selected linear features (roads, seismic lines) during defined times of the day or week. 5. Integrated landscape management strategies that seek to reduce the quantity of linear footprint that is needed to extract natural resources." P. 14	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Siksika Nation. Prepared for Siksika Nation, Siksika, AB, and MLT Aikins, Calgary, AB. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.
	Water: "The springs appearing at elevation throughout the mine property seem likely to be destroyed by the project. If this is the case, it must be done in such a way that no industrial sediment or other downstream effects are allowed to impact Blairmore or Gold Creeks or the Crowsnest River because those impacts could cause serious hard to the animals that rely on the that spring water to live." P. 4 Animals: "The animals that live on the property must be allowed time to find a new home meaning that the project must be developed slowly and their access to water managed to be always available. There is an abundance of eagle – sacred in Blackfoot culture – that live and nest seasonally on the property since the site is on a major eagle migratory flyway. The project should include establishment of appropriate, alternative nesting locations off the site but nearby for those eagles that will be impacted by the project." P. 4	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Final TUS Assessment and Report (TUS Part 2), EIA Volume 3, Appendix 7c
	"traditional Use plants that will otherwise be destroyed by the mine should be dug up and moved just off site, or to the edge of the mine site property out of harms way. Year round access to those plants should be made available for Siksika traditional use. The TU mitigation and remediation strategy should address this;	Siksika Consultation Office (SOC), 2015, Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Final TUS Assessment and Report (TUS Part 2), EIA Volume 3, Appendix 7c
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information has been received relative to this subject.	

Table 4.6–4 Indigenous Rights, Land Use and Culture – Views of Siksika Nation

Question to Address	Direct Comment from Nation	Reference
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	"Although simulated footprint growth for the next five decades is relatively minor at the scale of the focal study area, the Grassy Mountain mine accounts for the majority of projected footprint growth in the watershed. The mine would contribute to ongoing loss of habitat and associated opportunities for traditional land use, and impacts may be greater if consequences of water contamination (*e.g.*, selenium, calcite) were to be considered. Any further decline in opportunities for traditional land use may be of concern given that risk to traditional land use is already assessed as high." P. 38	Carlson M, Berg K, Dyck T, Stelfox B, Straker J. 2018. Cumulative effects assessment for Siksika Nation. Prepared for Siksika Nation, Siksika, AB, and MLT Aikins, Calgary, AB. Prepared by Integral Ecology Group, Ltd., Duncan, BC, and the ALCES Group, Calgary, AB.

Table 4.6–5 Indigenous Rights, Land Use and Culture – Views of Tsuut'ina Nation

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	"Indigenous peoples have been present in what is now southwestern Alberta for 10,000 or more years. Prior to the arrival of Europeans, indigenous peoples had a stable and long lived economy based on the acquisition of naturally occurring plant, animal and other resources. In the highly seasonal environment of the northern plains, a hunting and gathering economy meant that peoples were nomadic and practiced a seasonal round, where people travelled from one place to another during the annual cycle to exploit resources when those resources could be acquired in a given location at a given time. This economic regime and seasonal round guided their respective cultures." P. 9	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c
b) Conditions that Support Exercise of Rights	"Today, First Nations still use the Crowsnest Pass area for the acquisition of plants and spiritual purposes as well as hunting, although clearly the scope of traditional hunting and gathering is much less intensive than it was in the past. Once development of Grassy Mountain began over a century ago, the Tsuut'ina sought out other areas for hunting and harvesting that were less disturbed." P. 9 Concern - Access to and health of plants: "*We didn't see the full plant life since we were only there in June, August, and October. They have different cycles when they are usable.*" P. 43 "It appears that there are few remnants of Tsuut'ina presence in the area previously disturbed by historic mining, and significant impacts to the environment, water quality, landscape, and spirit. Further, Tsuut'ina know there was missed economic opportunity during historic mining and do not want history to repeat in this way." P. 50 "The Tsuut'ina Nation Consultation Team expressed a mix of sadness for ancestors and past damages witnessed on Grassy Mountain. They hope for the future of working together with Riversdale on the proposed Project better than was done in the past." P. 51	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c

Table 4.6–5 Indigenous Rights, Land Use and Culture – Views of Tsuut'ina Nation

Question to Address	Direct Comment from Nation	Reference
c) Importance of the Project's Location	"The Crowsnest Pass provided a range of important resources and Tsuut'ina both visited and lived in the Pass and exploited the resources it offered. In addition, there were well-established trading routes (*e.g.,* Shuswap) that Tsuut'ina used throughout the Crownest Pass. Geophysical and landscape elements of the Crowsnest Pass and surrounding area also play important parts in Tsuut'ina religion and spirituality. Large game animals and widely used plant resources were exploited in the Pass during all seasons." P. 9 "Multiple alpine plants found at Grassy Mountain that are crucial to Tsuut'ina Nation ceremony, healing practices, cultural identity, and spirituality are not found at lower elevations near Tsuut'ina Nation communities." P. 18 "Lodgepole pine is plentiful in the Grassy Mountain area and the Tsuut'ina Nation Consultation Team expressed a strong interest in harvesting logs to make teepee poles for various celebrations throughout the summer." P. 18 "Mountains are important to preserving original plant species in Tsuut'ina territory, especially as there are introduction of new plant species. There are stories of Tsuut'ina trying to transplant plants from one place to another, but this did not work because it can only grow in certain areas because of the elevation and soil unique to the mountains. Climate change impacts that threaten alpine environments, increase the need for a comprehensive understanding of plants in the Grassy Mountain area." P. 20 "The area is part of the watershed and these little streams and creeks are the headwaters of one of the major rivers in our traditional territory." P. 38 "The main focus of discussions during the site visit and ground-truthing was on the importance and uses of alpine plants, wildlife, and birds found on Grassy Mountain. The Tsuut'ina Nation Consultation Team covered a range of plants, including berries, sweet pine, lodgepole pine, juniper, bear root, muskeg tea, lichen, fungus, tree moss, willow, and poplar." P. 49	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	Concern - Access to and health of plants: "*Right now the roads are locked off and only Riversdale has access right now. Is there a possibility for us to still go up and harvest our plants? In the future? We can't always assume that all the plants are going to be accessible all the time, in the future.*" P. 43 Concern for continuing to carry out ceremonies and to respect ceremonies held in the past: *"Will First Nations still be able to actively use the land for traditional practices?"* p.44	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c

Table 4.6–5 Indigenous Rights, Land Use and Culture – Views of Tsuut'ina Nation

Question to Address	Direct Comment from Nation	Reference
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	"In the past more than today, people would travel along these lifeways and trails, setting up camp along the way. Hunting trails tied strongly to wildlife trails and other key habitat types, continue to exist today and are used throughout the Grassy Mountain area." P. 38	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	Concern - Access to and health of the land: "*The way that I was taught about our place is that we are not here to own the earth, we are here as stewards. We are here to take care of it and protect it*." P. 44 Concern – Protecting traditional lands, regardless of whether they are considered Crown or private lands: "*Traditional land is traditional land. Private land is the depth of the plow. First Nations don't distinguish between the Crown and private lands. We didn't exploit our lands. The Creator gave us everything that we needed to live – plants, animals, water.* *A lot of companies don't have an understanding of this.* *They have a responsibility to protect the land. Our people talk about the seven generations, protecting the land for those ahead of us to keep everything intact to sustain life. Proponents should do everything possible to protect wildlife, waters, vegetation, etc. Western medicine cannot heal everything.*" P. 45 Recommendation - Hold workshop with Tsuut'ina Elders knowledgeable about plants of interest in the Crowsnest area: "*We want to hold a workshop and have interviews with our Elders that are plant experts and know of the Grassy Mountain Area to understand more about plants* (*i.e.,* their uses and importance)." P. 46 "Based on rights transferred through songs and stories for each animal, particular Tsuut'ina members are granted the privilege of harvesting specific species, many of which are only found in specific environments (*e.g.*, alpine areas such as at Grassy Mountain). Such rights are designated within the context of celebrations and customs, such as annual bundle openings and Sun Dance ceremonies. Indeed, the Tsuut'ina "feel closer to the Creator" at elevations and vision quest sites such as those on Grassy Mountain." P. 49	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c

Table 4.6–5 Indigenous Rights, Land Use and Culture – Views of Tsuut'ina Nation

Question to Address	Direct Comment from Nation	Reference
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	Concern - Access to and health of plants: "*Right now the roads are locked off and only Riversdale has access right now. Is there a possibility for us to still go up and harvest our plants? In the future?"* P. 43 Recommendation - Negotiate and sign Agreement between Tsuut'ina and Riversdale so that Tsuut'ina can still go hunt and practice their traditional ways on-site: "*The agreement would state that the Tsuut'ina Nation would still be able to access their territory for hunting.*" P. 47	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	"Springs running down the west side of the mountain. Tsuut'ina would like to see these protected. That is, prevent waste and tailings from getting in them. This area is a "teepee pole heaven." There is an abundance of straight lodgepole pine. Tsuut'ina would like the opportunity to harvest the lodgepole pines for their use." P. 11 Waypoint 03: "Sheltered area surrounded by trees with rocks stacked on top of one another. Possible fasting area for vision quest. Fasting typically lasts for 4 days. This is an important area. Tsuut'ina suggested that any disturbance be avoided. For Moose Mountain Project, Tsuut'ina suggested a 100m buffer around vision quest areas. The same buffer should be applied here." P. 11 "*We want to be notified if any new developments arise, like finding a site of interest.*" P. 47 "Should the Project proceed, Tsuut'ina knowledge holders provided initial ideas for mitigation, monitoring, and management of potential effects of the proposed Project. These include: • Harvest lodgepole pines on a regular and ongoing basis • Harvest plants of interest on a regular and ongoing basis • Protect and monitor water • Hold workshop with Tsuut'ina Elders knowledgeable about plants of interest in the Crowsnest area • Impose no-go buffer zone of 100 m around all sacred sites • Negotiate and sign Agreement between Tsuut'ina and Riversdale so that Tsuut'ina can still go hunt and practice their traditional ways on-site • Tsuut'ina Nation members to carry out environmental monitoring • Efforts for research focus: areas that have not been disturbed • Continue traditional knowledge work as part of healthy business relations and to respect Tsuut'ina input • Riversdale to provide adequate funding for ongoing Project involvement costs associated with indigenous traditional environmental monitoring, harvesting vegetation throughout the Project, and annual Project review with Riversdale as long as the life of the Project." P. 51	Tsuut'ina Nation, 2015, Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, EIA Volume 3, Appendix 7c

Table 4.6–5 Indigenous Rights, Land Use and Culture – Views of Tsuut'ina Nation

Question to Address	Direct Comment from Nation	Reference
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	The Proponent has not assessed the impact of the Project on Tsuut'ina's right to fish, despite the likely extirpation of west slope cutthroat trout populations in the watercourse flanking the Project area to the east and west. The Proponent has not assessed the impacts of the Project on Tsuut'ina's incidental Treaty and Inherent Right to access harvest areas based on current travel patterns. The Proponent has not assessed the indirect effects of this Project such as the avoidance of the area due to increased disturbance from noise, workers and coal dust. The Proponent has also not assessed the impacts from coal dust which will adversely affect the surrounding areas, polluting the water, contaminating plants and deterring Tsuut'ina harvesters from using the area. Tsuut'ina is concerned by all water impacted by this Project whether it is groundwater, surface run off, lakes, rivers and wetlands. The Proponent limits its assessment of impacts on hunting and gathering to the Crown lands component of the Project. However, Tsuut'ina exercises their Treaty and Inherent Right to hunt and gather on private lands as well as Crown lands. The EIS has not assessed the impacts of the Project on Tsuut'ina's ceremonial practices. The Project area has been one of the most preferred sites for Tsuut'ina Elders to conduct spiritual ceremonies, and this Project will adversely affect their ability to continue to do so into the future. This impact has not been included in this EIS. There are sacred sites that are in the area, ceremonial sites, rock paintings, burial sites and natural materials to make ceremonial paint and items. The EIS does not address the impact to Tsuut'ina of disruption of this area and inability to use the Project area and pass on knowledge of the location of these sacred sites to future generations.	Letter from Mandell Pinder on behalf of Tsuutina Nation to the JRP dated February 15, 2019, Table 10. (CEAR #192)
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	The Proponent has taken a "bones and stones" approach to assessing the impact on culture. The Proponent has not assessed the impact to intangible culture, such as the inability to transmit knowledge and stories on the land, Tsuut'ina has many oral stories that depict their history and where they traveled. The ability of Tsuut'ina to pass on these stories by taking the next generation out on the land will be impacted by the Project. This impact is not assessed in the EIS.	Letter from Mandell Pinder on behalf of Tsuutina Nation to the JRP dated February 15, 2019, Table 10. (CEAR #192)

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	"The Ktunaxa Nation maintains underlying sovereign and sui generis rights to all lands and waters within its territories. The Crowsnest Pass area, like the Michel and Elk valleys to the west, has been used and occupied continuously by the Ktunaxa Nation since time immemorial. Based on historic treaties and agreements with neighboring First Nations, the Ktunaxa Nation recognizes that other First Nations from further east also have histories and rights in the Project area, alongside those of the Ktunaxa Nation." (P. 2) "The Project is located within the spatial bounds of Treaty No. 7, signed in 1877 by Canada and several Indigenous nations residing east of the Rocky Mountains. The Ktunaxa Nation was not a party to Treaty No. 7, or any other treaty with the Canadian Crown. The Ktunaxa Nation maintains that Treaty No. 7 has no impact on Ktunaxa rights or interests associated with the Project area, and that pre-confederation Ktunaxa rights in the area continue to be in place under Indigenous law and Canada's Constitution Act of 1982, and have never been ceded, surrendered, or given up to the Canadian Crown." (P. 2) "The Ktunaxa Nation maintains unceded Aboriginal title in much of what is now considered the East and West Kootenays. The British Columbia (BC) portion of the traditional territory is subject to ongoing treaty negotiations with the Province of BC and the Government of Canada. On November 30th, 2018, Canada, BC and the Ktunaxa Nation signed the "Ktunaxa Nation Rights Recognition and Core Treaty Memorandum of Understanding". Among other things, this MOU confirms that the Ktunaxa Nation treaty negotiations have moved from stage 4 to stage 5." (P. 4) "Ktunaxa Use and the Seasonal Round in Qukin ?amak?is and Adjacent Areas: The *kaqawakanmitu*k are discussed in current Ktunaxa oral histories, and those documented in Schaeffer's field notes (1935-37, 1966), as relying on a seasonal round that included regular bison hunts east of the Rockies, as well as residence, agriculture, and harvesting in the Elk Valley and nearby areas. The annual round included hunting for sheep, deer, elk and goat, as well as other species in the Crowsnest Pass and adjacent valleys, fishing for cutthroat trout and other fish in streams and lakes, fishing salmon at Columbia Lakes and along the Columbia River drainage, and fishing for mariah or ling in winter in the area of Tobacco Plains." (P. 8) "Archival and oral history records indicate that the Crowsnest Pass was traditionally used and occupied regularly by the Ktunaxa Nation prior to and after 1846 (the date of the Oregon Boundary Treaty) and prior to and after the signing of Treaty No. 7 in 1877. While impacts to Ktunaxa rights through land privatization, coal-related industrial development, extirpation of bison, and government policy has been widespread, Ktunaxa elders and land users continue to use and value the LSA and the surrounding area." (P. 6)	The Firelight Group, 2019, Ktunaxa Nation Rights and Interests in relation to Benga Mining Limited's proposed Grassy Mountain Coal Project, CEAR #189
	Consistent with Ktunaxa rights in adjacent areas of BC, Ktunaxa title, rights and interests in the Grassy Mountain include cultural use, occupancy and stewardship or governance rights, rights to associated resources (surface and subsurface, including economic and commercial interests) and	Email from Ktunaxa Nation to Benga dated August 19, 2019

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation

Question to Address	Direct Comment from Nation	Reference
	conditions necessary for the practice of rights. Evidence of pre-1846 Ktunaxa practices in the area that are maintained in modern form, to the extent possible under current conditions, include: • Agricultural use (including cultivation and grazing of horses); • Water use; • Cultural use, including access, naming, habitation, occupation and cultural practice; • Harvest and trade of fish, animal, tree and plant resources including hunting, trapping, fishing and harvesting; • Mining and trade of surface and sub-surface mineral resources; and, • Governance, stewardship, resource management (including use of fire to regenerate landscapes) and decision-making.	
b) Conditions that Support Exercise of Rights	"Ktunaxa experience with past mining in the Crowsnest Pass area is one where most or all socio-economic benefits are received by non-Indigenous communities and workers, and a disproportionate share of impacts are received by Indigenous communities, including the Ktunaxa Nation. This 'business as usual' approach results in a net adverse impact for Ktunaxa citizens and continued erosion of Ktunaxa use, rights, and interests." (P. 3) "The Project is located in the eastern foothills of the Rocky Mountains in an area valued by Ktunaxa citizens for clean freshwater sources, and wildlife habitat for culturally-important species such as bison, grizzly bear, mountain goat, sheep, elk, moose and wolverine which are critical to Ktunaxa harvesting, and Ktunaxa stewardship." (P. 16) "Based on Ktunaxa use and knowledge of the Project area, the Project area and Crowsnest Pass contain a multitude of ecological values tied to cultural use and stewardship of the landscape by Ktunaxa including rutting areas for bighorn sheep, hunting areas for moose and elk, and values related to other plant and animal species of critical importance including whitebark pine, grizzly bear, mountain goat, and bison." (P. 16)	The Firelight Group, 2019, CEAR #189
c) Importance of the Project's Location	"Available information indicates that the Project is proposed just east of the Alberta-BC border in an area considered by Ktunaxa knowledge holders to be ʔamakʔis Ktunaxa3 (Ktunaxa territory or homeland) and associated with the traditional land district of qukin ʔamakʔis (Raven's Land) which includes Kuɬwiaʔki (the Crowsnest Pass), as well as the Michel Creek and Elk Valleys." (P. 2) "Archival and oral histories indicate that Ktunaxa citizens rely on the Project area for the preferred practice of a range of rights and interests that rely on particular preferred or critical places, species, and practices. These include subsistence harvesting, cultural-spiritual practices including teaching of oral histories and transmission of knowledge, and use of trails and roadways that allow access to important areas and resources." (P. 2) "The Project area and adjacent areas, including Crowsnest Mountain, Crowsnest Pass, Crowsnest Lake, and the area of Frank, represent a deeply important cultural landscape for Ktunaxa citizens. The cultural landscape is associated with particular oral histories relating to	The Firelight Group, 2019, CEAR #189

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
	bison hunting, relationships with Piikani and other groups, ancestral Ktunaxa villages east of the Rockies, Ktunaxa creation stories related to particular landforms and to the Frank slide, and areas connected to specific ceremonial practices, including an important Ktunaxa ceremonial location just east of Crowsnest Mountain. Documented values include Ktunaxa place names tied to key stories and landscape features, and teaching areas used to pass on Ktunaxa knowledge and history, including within the Project LSA and footprint in the area of Blairmore and Frank." (P. 13) "For Ktunaxa citizens, qukin ʔakitɬaʔis (Raven's House or Crowsnest Mountain, spelled in Schaeffer as Kokinakitteis), and the headwaters area of Crowsnest River around Kuɬwiaʔki (Crowsnest Lake), are considered especially sensitive, sacred, and tied to Ktunaxa oral history. qukin ʔakitɬaʔis is considered the home of the creation being Raven, and is associated with oral histories of Ktunaxa chiefs from the area, as well as with specific ceremonial practices, and as a literal lookout to watch the movements of Blackfoot groups and buffalo in the Crowsnest Pass and the surrounding valleys." (P. 13) "The Project is located in the eastern foothills of the Rocky Mountains in an area valued by Ktunaxa citizens for clean freshwater sources, and wildlife habitat for culturally-important species such as bison, grizzly bear, mountain goat, sheep, elk, moose and wolverine which are critical to Ktunaxa harvesting, and Ktunaxa stewardship." (P. 16) "Based on Ktunaxa use and knowledge of the Project area, the Project area and Crowsnest Pass contain a multitude of ecological values tied to cultural use and stewardship of the landscape by Ktunaxa including rutting areas for bighorn sheep, hunting areas for moose and elk, and values related to other plant and animal species of critical importance including whitebark pine, grizzly bear, mountain goat, and bison." (P. 16)	

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation

Question to Address	Direct Comment from Nation	Reference
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	"It is unclear from the proponent's assessment if any consideration was given to understanding Project impacts on currently vacant bison habitat, including movement corridors, that are likely to become critical to bison, and Ktunaxa harvest of bison, once sufficient populations have been restored to the area." (P. 16) "Anticipated Project impacts include mobilization of mining contaminants into adjacent waterways by airborne deposition, runoff from the mine site, and releases of treated wastewater into the environment. Based on the location of the Project, Blairmore Creek and Gold Creek drainages appear likely to receive impacts from upslope development of the Project. Both waterways flow into Crowsnest River." (P. 17) "Historic use of Crowsnest Pass by Ktunaxa for bison hunting, and its ongoing importance as an area for bison restoration, is confirmed by Ktunaxa knowledge holders, ethnographic evidence, and the *Buffalo Treaty*. It is reasonably foreseeable that Ktunaxa and other indigenous harvest of bison, and related cultural practices (*e.g.*, transmission of knowledge, resumed use of hunting camps), in the Project area will resume once conditions change as planned under the Bison treaty. Anticipated Project impacts: • Reduction of habitat for food animals and plants that support and sustain Ktunaxa harvesting rights. • Loss of confidence in the quality of traditional foods due to contamination concerns associated with the Project. • Increased sensory disturbance in key harvesting areas associated with activities and increased traffic at the Project site, as well as along the rail route through *ʔamakʔis* Ktunaxa, resulting in sense of place impacts, and avoidance of the areas by animals targeted by Ktunaxa harvesters." (P. 18) "Anticipated impacts associated with increased use of the CP railway for the transport of coal, an activity which the Proponent describes as "incidental" in their project description (Millennium EMS Solutions Ltd. 2015: 18), is a major concern for KNC and Ktunaxa citizens. Numerous Ktunaxa values occur along the CP Railway's route westward through *ʔamakʔis* Ktunaxa, and beyond the Crowsnest Pass, including areas and values critically important to the practice of rights, subsistence and cultural practices." (P. 19)	The Firelight Group, 2019, CEAR #189

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
	Absent adequate mitigation, impacts on Ktunaxa rights and interests include removal of economically valuable resources from Ktunaxa lands, as well as the following impacts detailed in existing Ktunaxa submissions regarding the Project: • Impacts on cultural-spiritual values, including sense of place and ability to pass on place-specific knowledge related to sacred landforms and Ktunaxa oral history of the Crowsnest Pass. This place-specific knowledge is reliant on the integrity of the viewscape and sensory environment surrounding qukin ʔakitɬaʔis (Crowsnest Mountain), Kuɬwiaʔki (the Crowsnest Pass, and specifically Crowsnest Lake), Turtle Mountain and Frank, and other important areas within and beyond the Ktunaxa LSA; • Impacts on environmental and cultural-spiritual values associated with the integrity of water resources at the headwaters of the Crowsnest River and downstream; • Impacts on use of trails for travel and access to cultural landscapes, including important traditional Ktunaxa travel routes connecting lands west of the Rockies with the southern Alberta plains, including routes generally followed by the current Crowsnest Highway corridor; • Impacts on preferred habitation (camp) areas and subsistence harvest areas (hunting, fishing, plant gathering), including in the area of Grassy Mountain. The viability of the Project area is especially important as it is located in the only area in ʔamakʔis Ktunaxa where Ktunaxa citizens can practice hunting rights on both sides of the Rockies without interruption and interference from National Park restrictions; • Impacts on ecological values, particularly related to currently vacant habitat, movement corridors, and hunting areas for plains bison, but also for grizzly bear and other culturally important species and habitats; and • Potential impacts on Ktunaxa governance, stewardship, and relationships with neighbouring Indigenous communities in the Crowsnest Pass region.	Email from Ktunaxa Nation to Benga dated August 19, 2019

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation

Question to Address	Direct Comment from Nation	Reference
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	"Practice of Ktunaxa rights in the Project area are ongoing and current, despite serious impacts from past coal mining, road development, extirpation of bison, and ongoing Canadian colonial policies, including those associated with National Parks and protected areas." (P. 2) "During a site visit to the Project site at Grassy Mountain, Ktunaxa knowledge holders and KNC staff identified the close proximity of the proposed mine to *qukin ʔakitɬaʔis* (Crowsnest Mountain). The potential for negative changes to the viewscape and sensory environment (*e.g.*, noise, smell, air quality) associated with direct (mine construction and operations) and incidental (*e.g.*, rail traffic) Project activities are a primary concern for Ktunaxa current and future use, and stewardship of the values associated with of *qukin ʔakitɬaʔis, Kuɬwiaʔki,* and nearby areas associated with place-based cultural-spiritual practices. *Kuɬwiaʔki* is especially vulnerable to increased rail traffic related to the Project, but increased frequency of rail disturbance is likely to result in impacts to multiple sensitive areas within Ktunaxa territory. Increased use of the rail route will impact access and sense of place for Ktunaxa citizens at this important site. Maintaining a sensory environment around *qukin ʔakitɬaʔis* and *Kuɬwiaʔki* that supports and sustains Ktunaxa citizens' current and future use and connection to these places is of high important." (P. 15) "Maintaining healthy water quality and avoiding mining or rail-related contamination (*e.g.*, sulphate and selenium) is a primary Ktunaxa concern in relation to the Project and the Crowsnest River watershed. Mobilization of selenium into waterways from nearby surface coal mining is a known issue. High levels of selenium in the Elk River from adjacent coal mining (McDonald and Strosher 1998) have resulted in serious concerns for the health of westslope cutthroat trout and other species. Past Ktunaxa studies have shown that contamination and health concerns associated with upstream mining often result in a direct impact on Ktunaxa citizen's confidence in wild foods, and on Ktunaxa ability to confidently rely on preferred places and species. Increased impacts on water in the area are likely to result in impacts on Ktunaxa use, including use of camp and habitation areas adjacent to the Crowsnest River and its tributaries. Potential impacts on water quality in the vicinity of coal transport and rail routes are also a concern." (P. 17) A more detailed summary of impacts anticipated by the Ktunaxa Nation can be found in pages 12 -19 of the KNC's January 28, 2019 Technical Memorandum.	The Firelight Group, 2019, CEAR #189

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation

Question to Address	Direct Comment from Nation	Reference
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	"As discussed further below, the Project is likely to contribute further adverse residual impacts on Ktunaxa use, rights and interests in the Project area including, but not limited, to: • Impacts on cultural-spiritual values, including sense of place and ability to pass on place-specific knowledge related to sacred landforms and Ktunaxa oral history of the Crowsnest Pass. This place-specific knowledge is reliant on the integrity of the viewscape and sensory environment surrounding *qukin ʔakitɬaʔis* (Crowsnest Mountain), *Kuɬwiaʔki* (the Crowsnest Pass, and specifically Crowsnest Lake), Turtle Mountain and Frank, and other important areas within and beyond the Ktunaxa LSA; • Impacts on environmental and cultural-spiritual values associated with the integrity of water resources at the headwaters of the Crowsnest River and downstream; • Impacts on use of trails for travel and access to cultural landscapes, including important traditional Ktunaxa travel routes connecting lands west of the Rockies with the southern Alberta plains, including routes generally followed by the current Crowsnest Highway corridor; • Impacts on preferred habitation (camp) areas and subsistence harvest areas (hunting, fishing, plant gathering), including in the area of Grassy Mountain. The viability of the Project area is especially important as it is located in the only area in *ʔamakʔis Ktunaxa* where Ktunaxa citizens can practice hunting rights on both sides of the Rockies without interruption and interference from National Park restrictions; • Impacts on ecological values, particularly related to currently vacant habitat, movement corridors, and hunting areas for plains bison, but also for grizzly bear and other culturally important species and habitats; and • Potential impacts on Ktunaxa governance, stewardship, and relationships with neighbouring Indigenous communities in the Crowsnest Pass region." (P. 2/3) A more detailed summary of impacts anticipated by the Ktunaxa Nation can be found in pages 12 -19 of the KNC's January 28, 2019 Technical Memorandum.	The Firelight Group, 2019, CEAR #189
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	"Based on past work in the Elk Valley, KNC has determined that cumulative effects on Ktunaxa rights and interests stemming from impacts to lands and waters within the Elk Valley drainage have already exceeded a threshold of significance, and that without substantial mitigations and other measures, adverse impacts from other projects in the region will act cumulatively to increase the magnitude and duration of significant effects." (P. 19) In reaching conclusions regarding the current severity of impacts on Ktunaxa rights and interests, factors include the extirpation of key species (plains bison) from the area, impacts of multiple stressors on existing resources, expansion of private property in the area, as well as accumulated impacts resulting from Canadian colonial administration, including exclusion of Ktunaxa rights and interests from decision making in the area. Where impacts are already severe, even small additional impacts that further worsen impacts are, by definition, severe.	The Firelight Group, 2019, CEAR #189 Email from Ktunaxa Nation to Benga dated August 19, 2019

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation

Question to Address	Direct Comment from Nation	Reference
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	The KNC has extensive experience with mitigation and offsetting measures undertaken for similar mines in adjacent areas of BC. Discussions are ongoing, but KNC anticipates that additional mitigations and other measures to reduce, mitigate, or offset impacts, and increase benefits, will be needed.	Email from Ktunaxa Nation to Benga dated August 19, 2019
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	"Due to deficiencies in the Proponent's assessment, additional assessment of increased sensory disturbance (viewscape, noise, sense of place) in the area of Crowsnest Pass, including increased frequency of rail related disruption as a result of the Project, is likely needed." (P. 15) "As a signatory to the Buffalo Treaty, the KNC wishes to ensure the Project provides a reasonable assessment of impacts on bison habitat suitability and capability, that it provides reliable habitat offsetting supportive of bison for the duration of Project impacts, and that end land use goals are clearly supportive of long term future habitat restoration for bison and Ktunaxa harvest in the area. KNC is concerned that the assessment currently fails to take into consideration potential effects (positive or negative) of the proposed Project on bison habitat and bison recovery, particularly in light of the proximity of reintroduced bison in the National Parks, the potential for range expansion into the Project area, and plans under the modern Buffalo Treaty, to which KNC is a signatory and accountable to partner nations. At minimum, the assessment should include Ktunaxa and other Indigenous knowledge expertise to consider: how bison range is likely to expand from national parks and other restoration areas; the potential of the Project area to support bison habitat and habitat connectivity; and opportunities available to offset Project related losses through targeted habitat recovery or protection. The proponent should also be required to identify a clear and reliable plan for inclusion of bison, Ktunaxa knowledge of bison, and Ktunaxa bison harvest within end land use goals for reclamation and restoration." (P. 17) Discussions with the proponent are ongoing regarding reliable and effective means to reduce, mitigate, or offset impacts and Ktunaxa cultural values, lands and resources, as well s social, economic, and educational and employment related values.	The Firelight Group, 2019, CEAR #189 Email from Ktunaxa Nation to Benga dated August 19, 2019
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	The proponent's assessment of cumulative effects on Ktunaxa rights, title, and interests is inadequate in several ways. 1) the proponent focusses on impacts on water downstream of the Grassy Mountain Project but does not consider Project residual impacts on regional airborne deposition of contaminants that would impact the Elk River watershed; 2) The proponent does not consider impacts on regional movement of animal populations including grizzly bear, wolverine, sheep or other ungulates that cross over between the Elk and Crowsnest watersheds; 3) The proponent does not consider residual Project effects on KNC title, rights and interests themselves, and beyond impacts to the Elk Valley, including impacts in close proximity to the Project itself. These include impacts to potential for restoration of bison to currently vacant bison habitat within the Project area, impacts on access and enjoyment of preferred hunting, harvesting, and habitation areas, and cultural-spiritual impacts on Crowsnest Mountain and the headwaters of the Crowsnest River. (P.7)	Comments on the Grassy Mountain Coal Project Environmental Impact Assessment and Addenda, January 21, 2019, CEAR #178

Table 4.6–6 Indigenous Rights, Land Use and Culture – Views of Ktunaxa Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
	Discussions with the proponent are ongoing, but based on past Ktunaxa experience with similar projects in adjacent areas, standard mitigations and standard reclamation approaches are far from reliable and substantial additional effort will be needed.	Email from Ktunaxa Nation to Benga dated August 19, 2019
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	The proponent's assessment of cumulative effects on Ktunaxa rights, title, and interests is inadequate in several ways. 1) the proponent focusses on impacts on water downstream of the Grassy Mountain Project but does not consider Project residual impacts on regional airborne deposition of contaminants that would impact the Elk River watershed; 2) The proponent does not consider impacts on regional movement of animal populations including grizzly bear, wolverine, sheep or other ungulates that cross over between the Elk and Crowsnest watersheds; 3) The proponent does not consider residual Project effects on KNC title, rights and interests themselves, and beyond impacts to the Elk Valley, including impacts in close proximity to the Project itself. These include impacts to potential for restoration of bison to currently vacant bison habitat within the Project area, impacts on access and enjoyment of preferred hunting, harvesting, and habitation areas, and cultural-spiritual impacts on Crowsnest Mountain and the headwaters of the Crowsnest River. (P.7) The proposed Project is in an area of ʔamakʔis Ktunaxa with a deep history of Ktunaxa use and occupancy, and ongoing cultural-spiritual importance...the Project is considered likely to result in significant adverse effects, including impacts on Ktunaxa traditional use and access to lands and resources, sensory experience and cultural connection to sacred areas nearby, impacts to ecological values including fisheries in the Crowsnest River and wildlife, and Ktunaxa stewardship commitments related to bison *(i.e.,* . Buffalo Treaty) and ʔaˑkxaṁis q̓api qapsin (all living things). (p. 20)	Comments on the Grassy Mountain Coal Project Environmental Impact Assessment and Addenda, January 21, 2019, CEAR #178

Table 4.6-7 Indigenous Rights, Land Use and Culture – Views of Montana Cree Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	At the introductory meeting on February 7, 2019, the Montana Cree Nation indicated that there were some members who were living with the Piikani and who may practice traditional activities near the Project area.	Meeting notes February 7, 2019.
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	

Table 4.6-7 Indigenous Rights, Land Use and Culture – Views of Montana Cree Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	No information was received regarding this subject.	
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	No information was received regarding this subject.	
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information was received regarding this subject.	
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-8 Indigenous Rights, Land Use and Culture – Views of Louis Bull Tribe

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	LBT is a signatory of Treaty 6 and is located in central Alberta, within the Alberta White Zone. Due to extensive development and alteration of the natural landscape, LBT members now must travel further and further from the Tribe Reserve lands to practice constitutionally protected Aboriginal and Treaty Rights. Simply put, habitat loss in the White Zone, in combination with private land ownership have limited access to the plants and wildlife LBT members may wish to use, which in turn has affected the locations and the level of use by Tribe members. Generally, traditional use rights can only be exercised on reserve, on Crown lands, or on private lands through arrangements with the landowner, a fairly limited geographic scope. Further, historical limitations on the movement of Alberta's Aboriginal peoples off reserve, and government actions to prevent the practice of traditional land use activities, have reduced the number of active practitioners. While this is changing today, use of recent historical and current use of lands as a metric for Aboriginal and Treaty Rights is inherently biased. Current use may not necessarily reflect past patterns of use, or the interests of a community in the health of ecosystems that could support growing interest in traditionally or culturally practices. These constraints on the ability to exercise Aboriginal and Treaty Rights within LBT Traditional Territory, and the interests of an Indigenous community in maintaining the ecological health of those natural resources to which they have legal access must be acknowledged when assessing impacts of any project. (P. 1)	Louis Bull Tribe Grassy Mountain EIA Scientific Review, April 2019 (CEAR 226)
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	Changes to cultural and spiritual connections to the land and water have already occurred in the regional project area. Although some community members have harvested plants, fish or wildlife from those lands to which they have access (*e.g.*, the Castle Area just to the south of the Project), for the most part, private land ownership has denied access to these lands. Opportunities for pursuit of cultural practices that are important to the cultural identity of community members, or to transfer knowledge of the land, have input into the management of those lands, or even quietly enjoy the land itself must be viewed in the context of past, cumulative effect on land access. (P. 2)	Louis Bull Tribe Grassy Mountain EIA Scientific Review, April 2019 (CEAR 226)

Table 4.6-8 Indigenous Rights, Land Use and Culture – Views of Louis Bull Tribe

Question to Address	Direct Comment from Nation	Reference
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	Within this Project, LBT and other Indigenous communities consulted during the EIS have noted the opportunity to improve access to lands in this area and restore some of these cultural and experiential benefits derived from land use. Specifically, LBT and other communities have identified the opportunity to provide access to the mining lands for Indigenous use, involve community members in the reclamation of disturbed areas (including efforts to plant traditionally or culturally important plants), and engage community members in long-term monitoring efforts. Each of these mitigation measures offers opportunity to derive cultural benefits from land use, but also the direct involvement in land management decisions, thus exercising governance through co-management of the area. (P. 2)	Louis Bull Tribe Grassy Mountain EIA Scientific Review, April 2019 (CEAR 226)

Table 4.6-8 Indigenous Rights, Land Use and Culture – Views of Louis Bull Tribe		
Question to Address	**Direct Comment from Nation**	**Reference**
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	LBT is concerned that the methods and analyses used to assess impacts on wildlife and vegetation lack rigor and validity. (P. 3).	Louis Bull Tribe Grassy Mountain EIA Scientific Review, April 2019 (CEAR 226)
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-9 Indigenous Rights, Land Use and Culture – Views of Ermineskin Cree Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	At the introductory meeting on February 7, 2019, the Ermineskin Cree Nation described a traditional use study that is ongoing and showed a map currently under development that describes use areas around the Province of Alberta including near the Project Area	Meeting notes February 7, 2019.
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	No information was received regarding this subject.	

Table 4.6-9 Indigenous Rights, Land Use and Culture – Views of Ermineskin Cree Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	No information was received regarding this subject.	
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information was received regarding this subject.	

Table 4.6-9 Indigenous Rights, Land Use and Culture – Views of Ermineskin Cree Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-10 Indigenous Rights, Land Use and Culture – Views of Samson Cree First Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	Samson Cree Nation, of the Nipisikopahk Maskwacis Cree Iyiniwak, is a northern member of the Nehiyawak Confederacy and a signatory of Treaty No. 6, underlying the central portions of Alberta. Treaty No. 6 was concluded between the Plains Cree and the Crown in 1876 at Fort Pitt & Fort Carlton. Kiskaquin, or Chief Bobtail, signed his "x" mark in an adhesion to Treaty No. 6 at the signing of Treaty No. 7 at Blackfoot Crossing in 1877. Samson's traditional land use area covers the following land use regions: South Saskatchewan, Red Deer, North Saskatchewan, Upper Athabasca, Lower Athabasca, Lower Peace and Upper Peace. Samson's Aboriginal and Treaty rights are inextricably connected to the land, waters, air, species and resources with Samson traditional territory from which its people/military, spirituality/beliefs, identity, economy, culture, heritage, language and traditions arose. Samson's rights pre-exist Treaty No. 6 and exist in Canadian law not as a result of governmental recognition, but because they were not extinguished upon the Crown's assertion of sovereignty. Samson's Aboriginal and Treaty rights are protected by section 35 of the *Constitution Act, 1982* The Project is located within Samson's traditional territory. The Project will have adverse effects to the environment and Samson's traditional territory, uses, interests and freedom of religion and basic human rights.	Letter from Samson Cree to CEAA dated June 22, 2015 (CEAR #24)
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	

Table 4.6-10 Indigenous Rights, Land Use and Culture – Views of Samson Cree First Nation

Question to Address	Direct Comment from Nation	Reference
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	The Project is located within Samson's traditional territory. The Project will have adverse effects to the environment and Samson's traditional territory, uses, interests and freedom of religion and basic human rights.	Letter from Samson Cree to CEAA dated June 22, 2015 (CEAR #24)
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	No information was received regarding this subject.	

Table 4.6-10 Indigenous Rights, Land Use and Culture – Views of Samson Cree First Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information was received regarding this subject.	
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-11 Indigenous Rights, Land Use and Culture – Views of Shushwap Indian Band		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	No information was received regarding this subject.	
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	No information was received regarding this subject.	
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	

Table 4.6-11 Indigenous Rights, Land Use and Culture – Views of Shushwap Indian Band		
Question to Address	**Direct Comment from Nation**	**Reference**
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	No information was received regarding this subject.	
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information was received regarding this subject.	
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-12 Indigenous Rights, Land Use and Culture – Views of Foothills Ojibway First Nation

Question to Address	Direct Comment from Nation	Reference
a) Asserted or Established Rights	No information was received regarding this subject.	
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	No information was received regarding this subject.	
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	No information was received regarding this subject.	

Table 4.6-12 Indigenous Rights, Land Use and Culture – Views of Foothills Ojibway First Nation		
Question to Address	**Direct Comment from Nation**	**Reference**
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information was received regarding this subject.	
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-13 Indigenous Rights, Land Use and Culture – Views of Metis Nation of Alberta		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	"The Métis in this region have resided, worked, recreated and practiced their Aboriginal rights within the Project area since the 1800s when lands in the area were offered to the Métis as scrip. According to the Statistics Canada, 170 Aboriginal people reside within the Crowsnest Pass, 130 of which declare to be Métis. The Métis community within this area consists of members of the Métis Nation of Alberta Region3 (MNAR3) as well as the Pincher Creek Métis Local 1880 (Local), not all MNAR3 members are members of the local. The Aboriginal rights of the Métis community are directly linked to the health of the environment as they hunt wild game, fish, and gather plants and berries for food and medicinal purposes." (P. 1)	Metis Nation of Alberta, Region 3 Traditional Land Use Report, July 2016 (CEAR#194 Appendix A).
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	"MNAR3 identified access to Crown Lands beyond the project area as a major concern, historically, the Local members have been permitted to use trails and undeveloped roadways to access areas north of the proposed mine. Recently, Riversdale has restricted access to the roads leading to areas such as Daisy Creek which has resulted in a greatly extended travel time to reach areas for traditional use as land users must go around the project area." (P. 8)	Metis Nation of Alberta, Region 3 Traditional Land Use Report, July 2016 (CEAR#194 Appendix A).

Table 4.6-13 Indigenous Rights, Land Use and Culture – Views of Metis Nation of Alberta

Question to Address	Direct Comment from Nation	Reference
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	"MNAR3 suggests the following mitigation measures be applied during construction to protect local plant populations; • Reduce stripping when possible and retain roots of plants for reclamation; • Limit use of chemical application; • Retain riparian species when possible; • Replace native plant species during reclamation; and • Allow for harvesting of medicinal and culturally significant plants prior to construction." (P.9) "Acknowledge and be cognizant of elk calving grounds between Grassy Mountain and the Livingstone range. Ensure elk have clear passage." (P. 11)	Metis Nation of Alberta, Region 3 Traditional Land Use Report, July 2016 (CEAR#194 Appendix A).

Table 4.6-13 Indigenous Rights, Land Use and Culture – Views of Metis Nation of Alberta

Question to Address	Direct Comment from Nation	Reference
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	"MNAR3 suggests the following mitigation measures be applied during construction to protect local wildlife populations; • Adherence to species-specific time constraints; • Noise reduction; • Limit use of chemicals; and • Incorporate traditional knowledge into reclamation planning." (P.10) "MNAR3 is also concerned about the restricted access of the area, which limits their ability to practice traditional land use. However, they believe this may be alleviated by entering into a Métis Access Agreement with Riversdale." (P. 10) "Reclaim the area utilizing native plants. Ensure methods used stabilize and revegetate affected lands that in time achieve land productivity within the project area equivalent to the adjacent plant populations." (P. 12)	Metis Nation of Alberta, Region 3 Traditional Land Use Report, July 2016 (CEAR#194 Appendix A).
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	"The Métis Nation of Alberta Region 3 appreciates the detail and efforts that went into developing this assessment and look forward to working with Benga Mining Limited in the future on the Grassy Mountain Coal Project and other future projects they may have."	MNA comments to JRP in response to Public Comment Period, January 2019. (CEAR #165)
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

Table 4.6-14 Indigenous Rights, Land Use and Culture – Views of Metis Nation of BC		
Question to Address	**Direct Comment from Nation**	**Reference**
a) Asserted or Established Rights	"To be clear, absence of use around the project above is reflective of the lack of research and not an admission of lack of use. Additionally, our harvester card holders have reported harvesting the following in the vicinity of the project as part of our annual harvest survey system: firewood, prospecting for gold, whitetail deer, grouse, rocky mountain elk, mule deer, moose, rabbit, bear, and trout. These features are not mapped above but indeed neighbour the project. Additionally, Métis make up roughly 90% of the neighbouring communities in terms of the aboriginal population which is important."	Letter from MNBC to Benga, EIA, Appendix 7C, P 307. (CEAR #42)
b) Conditions that Support Exercise of Rights	No information was received regarding this subject.	
c) Importance of the Project's Location	No information was received regarding this subject.	
d) i.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Comparison Between Predicted Future Project Conditions and Predicted Future Conditions Without the Project	No information was received regarding this subject.	
d) ii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Identification of Pathways for Potential Impacts of the Project and on the Exercise of Rights, Accounting for the Nature of Rights, Regional/Historic/Cumulative Impacts, Community Thresholds, Cultural Landscape, Preferred Expression of Rights, Distribution of Benefits/Impact Equity, and Present and Future Generations	No information was received regarding this subject.	

Table 4.6-14 Indigenous Rights, Land Use and Culture – Views of Metis Nation of BC		
Question to Address	**Direct Comment from Nation**	**Reference**
d) iii.) Adverse Impacts of the Project on Aboriginal and Treaty Rights Based on Consideration to Experience, Culture, Governance, Intergenerational Transmission of Knowledge and Other Factors Identified as Important	No information was received regarding this subject.	
e) Information for Determining Thresholds for Severity of Impacts to Aboriginal or Treaty Rights	No information was received regarding this subject.	
f) Description of Mitigation Measures that Address Potential Impacts to Rights and Accommodation Measures	No information was received regarding this subject.	
g) Recommendations for Mitigating the Effects of Changes to the Environment on Indigenous peoples or for Accommodating Potential Adverse Impacts of the Project on Aboriginal and Treaty rights	No information was received regarding this subject.	
h) Views on the Effectiveness of the Mitigation or Accommodation Measures	No information was received regarding this subject.	
i) Description of the Effects of Changes to the Environment on Indigenous Peoples or Potential Adverse Impacts on Aboriginal or Treaty Rights that have not been Fully Mitigated or Accommodated as part of the Environmental Assessment	No information was received regarding this subject.	

4.7 Information Request 4.7

Final Environmental Impact Statement Guidelines. Section 5. (CEAR #11).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H – Aboriginal Consultation. (CEAR #42).

Eighth Addendum to the Environmental Impact Assessment. (CEAR #89).

In Section H of the updated EIA (CEAR #42), Benga summarized comments, specific issues, and concerns raised by Indigenous groups and provided responses for each Indigenous groups potentially affected by the Project (with the exception of Shuswap Indian Band and Foothills Ojibway First Nation).

In its response to AER question A.10 in Addendum 8 (CEAR #89), Benga provided "Concerns and Responses Tables" for each of the Treaty 7 First Nations, as prescribed by the Aboriginal Consultation Office. However tables pertaining to Indigenous groups outside of Treaty 7 were not provided to the Panel.

Section 5 of the EIS Guidelines (CEAR #11) states that the EIA will document comments, specific issues, and concerns raised by Indigenous groups and how concerns were responded to or addressed as well as any changes made to the project design and implementation directly as a result of discussions with Indigenous groups.

a) Provide comments, specific issues, concerns and project recommendations raised by Indigenous groups and how concerns were responded to or addressed for each Indigenous group specified in the EIS Guidelines as well as those specified in CEAR #147 (not only Treaty 7 First Nations) since submission of the updated EIA;

Response:

Benga points out that the response to AER question A.10 (Addendum 8, CEAR #89) was specifically requested to address only Treaty 7 First Nations. Appendix 4.1-1 to this Addendum, a document entitled "An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups", provides a complete update regarding Indigenous consultation including a discussion of concerns raised since the filing of the EIA in August 2016.

b) Indicate any changes made to the project design and implementation directly as a result of discussions with Indigenous groups.

Response:

Key changes to the Project design and implementation directly as a result of discussion with Indigenous groups include:

- commitment to the establishment of an Indigenous Environmental Stewardship Committee, to advise on factors such as environmental stewardship, end land use values and on-going reclamation planning;
- commitment to form an Indigenous environmental monitoring program with Indigenous communities;

- commitment to provide advanced notice of clearing activities to allow Indigenous communities to harvest plants in those areas prior to clearing;
- commitment to make adjustments to the project during detailed design to avoid disturbance to archeological sites DjPo – 98 and DjPo – 130; and
- provision for Indigenous members to conduct limited harvesting on adjacent Benga-owned lands following the provisions of the Access Management Plan.

4.8 Information Request 4.8

Final Environmental Impact Statement Guidelines. (CEAR #11).

Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project Between the Minister of the Environment, Canada and the Alberta Energy Regulator, Alberta (Including Terms of Reference). (CEAR #80).

From the Canadian Environmental Assessment Agency to the Joint Review Panel re: Indigenous Groups Participation. (CEAR #147).

The EIS Guidelines (CEAR #11) indicate that the proponent is expected to engage with Indigenous groups that may be affected by the Project, as early as possible in the Project planning process noting that "the proponent will make reasonable efforts to integrate traditional Aboriginal knowledge into the assessment of environmental impacts". Information gathered through the environmental assessment process and associated engagement by the proponent with Indigenous groups will also be used to inform decisions under CEAA 2012 and is intended to contribute to the Crown's understanding of any potential adverse impacts of the Project on asserted or established Aboriginal or Treaty rights and the effectiveness of measures proposed to avoid or minimize those impacts.

The Terms of Reference (CEAR #80) state that the Panel shall take into account any community knowledge and Aboriginal Traditional Knowledge (such as, but not limited to, traditional use studies) received during the environmental assessment. The Panel shall also consider and include in its report the effects of the Project on asserted or established Aboriginal or Treaty rights.

Recent correspondence from the Agency (CEAR #147) indicated that three additional Indigenous groups have been included on the list of groups to be consulted for this Project:

- Louis Bull Tribe
- Montana First Nation
- Ermineskin Cree Nation

The EIS Guidelines (CEAR #11) note, with respect to the identified Indigenous groups, that the groups may change as more is understood about the environmental effects and components of the Project and indicates that the Agency reserves the right to alter the list of Indigenous groups that the proponent must engage as additional information is gathered during the assessment.

Furthermore, the EIS Guidelines note that upon receipt of knowledge or information of potential effects to an Indigenous group not listed above, the proponent shall provide that information to the Agency or review panel at the earliest opportunity.

In addition to the information requested in the above IRs, provide the following information for each of the three aforementioned Indigenous groups:

a) any potential adverse effects that may be caused by the Project on the health, social, or economic conditions of Indigenous people.

Response:

Following receipt of the referenced correspondence from CEAA (CEAR# 147), Benga organized and conducted Project meetings with all three additional First Nations. Meetings with Montana First Nation and Ermineskin Cree Nation were held on February 7, 2019 and with Louis Bull First Nation on March 26, 2019. In all of the meetings, Benga provided information about the project, listened and responded to questions and concerns raised and made sure that the nations were aware of the capacity funding available through CEAA relative to participation in the Project.

Based on the distance from the Project to these communities, approximately a 5-hour drive, Benga considers it unlikely that the Project will have any adverse effects on the health, social or economic conditions. In all three cases, there were concerns that there may be individual members who from time to time may want to exercise traditional hunting rights in the Project area and so those individuals would experience an adverse effect due to the Project. Benga does not consider these adverse effects to be frequent, generalized, or of a significance relative to the community condition as a whole.

HUMAN HEALTH

4.9 Information Request 4.9

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #12 - Human Health and Wildlife Screening Risk Assessment. (CEAR #42).

Fifth Addendum to the Environmental Impact Assessment. (CEAR #69).

Eighth Addendum to the Environmental Impact Assessment. (CEAR #89).

Comments from the Government of Canada - Health Canada submission. (CEAR #167).

Health Canada recommended, in their submission to the Panel (CEAR #167), that Benga update the Human Health Risk Assessment (HHRA) with additional information, including the addenda 1-9, Excel data tables of predicted incremental lifetime cancer risks (ILCR), and hazard quotients (HQ) provided since submission of the updated EIA in August 2016.

Furthermore, the updated EIA presents separate inhalation and multi-media exposures (exposures arising from deposition of airborne contaminant on soil, surface water and vegetation) (CEAR #42). Addendum 5 (CEAR #69) confirms that combined inhalation and oral exposures were not considered in the multiple exposure pathway assessment (CEAR #69). Health Canada recommended that multi-media exposure (acute and chronic) be presented as the sum of exposures to a given contaminant by all routes (including inhalation exposure), by which the total exposure is compared to the Toxicological Reference Value (TRV). Health Canada has also noted in question HC-R2-11 in Addendum 8 (CEAR #89) that for HHRAs, a target hazard quotient (HQ) of 1 should only be applied to a particular chemical if the risk assessor can demonstrate that all potential on-site and background exposure media and pathways for that chemical have been considered in both the baseline and baseline-plus project exposure estimates. Alternatively, a more conservative target HQ of 0.2 is recommended.

It is difficult to assess the overall impact of the Project on human health when information is provided as separate additions to the original HHRA.

a) Provide an updated HHRA that fully integrates any information related to human health provided in Addenda 1 through 9, any additional material on the record, and that reflects responses to and incorporation of, all information provided as a result of information requests in this package. This should include, but not be limited to, the revised hazard quotient (HQ) and incremental lifetime cancer risk (ILCR) data tables, updated nitrogen dioxide HQs, and predicted additive HQs and ILCRs. Highlight all the changes from the 2016 HHRA.

Response:

In response to this request, the HHRA has been updated and is provided in Appendix 4.9-1.

b) In the updated HHRA, provide total exposure estimates (combined inhalation and multi-media exposures) and compare to HQ of 0.2.

Response:

Total exposure estimates (combined inhalation and multi-media exposures), which have been compared to HQ of 0.2, are provided in Appendix 4.9-1.

4.10 Information Request 4.10

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #1 – Air Quality. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #7 – Terrain and Soils. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #12 - Human Health and Wildlife Screening Risk Assessment. (CEAR #42).

Sixth Addendum to the Environmental Impact Assessment. (CEAR #70).

Eighth Addendum to the Environmental Impact Assessment. (CEAR #89).

Comments from Alistair Des Moulins (CEAR #155).

Comments from Allan Garbutt. (CEAR #158).

Comments from the Government of Canada - Health Canada submission. (CEAR #167).

Coal contains numerous metals and organic compounds, some known to be toxic and others that are potentially toxic. Toxic substances found in coal include polycyclic aromatic hydrocarbons (PAHs) which can act as mutagens, cancer promoters, and endocrine disrupters. Toxic compounds can be leached from coal into water supplies, or be present in dust and be subsequently deposited into soil. Participants have noted concerns with respect to coal dust in Sparwood, BC (CEAR #155) and near the Teck Elkview Operation (CEAR #158).

In response to question IR-HC-6b in Addendum 6 (CEAR #70) Benga indicates that coal dust was included in the calculation of fugitive dust emissions generated from the Project activities, however it appears that coal dust was not considered as a separate contaminant of potential concern within the HHRA (CEAR #42).

In Consultant Report #1 (CEAR #42), Benga states that the primary sources of project fugitive dust emissions will bel from mining operations such as drilling, blasting, bulldozing, loading and hauling and dust generation from travel on haul roads. Fugitive dust emissions from all other pit operations were estimated using AP-42 emission factors. In response to HC-R2-4 of Addendum 8 (CEAR #89), Benga re- states that the primary sources of particulate emissions during operations are dust from haul road activity and material handling. Benga does not provide information regarding the expected proportion of fugitive dust that would be coal dust.

Health Canada is of the view that coal dust can be analyzed for its constituent contaminants (e.g. heavy metals, PAHs), such that baseline/background conditions could be used to predict future loadings of contaminants to the environment via dustfall. The bioavailability of coal dust constituents may also need to be considered if coal dust is analyzed. This analysis would help to inform a more complete understanding of potential human health risk from exposures to contaminants from multiple environmental media (CEAR #167).

In addition, the presence of several siliceous sandstone beds on Grassy Mountain is mentioned in Consultant Report #7, Section B.1, B.2 (CEAR #42), however Health Canada has noted that there is no discussion with respect to silica dust (CEAR #167).

a) Justify how the modelling of fugitive dust emissions, including PM_{10} and $PM_{2.5}$ from coal mining activities (i.e. coal crushing, waste rock areas, haul roads, coal plant, blasting and train load-out) are conservative by comparing modelling to actual emissions monitoring data, where available, from relevant metallurgical coal mining operations. Include consideration of the expected proportion of total fugitive dust from the Project that would be coal dust.

Response:

Benga is not aware of any continuous air quality monitoring data – suitable for comparison to model results - from Alberta metallurgical coal mines that separates the effects of coal from other dust sources.

Nonetheless, the air quality assessment (Consultant Report CR#1, CEAR #42) provided the following comments on the conservative nature of the model predictions:

- most emissions occur continuously, but the combination of maximum emissions and meteorological conditions conductive to worst case predicted concentrations may not occur. At the same time, Project emission estimates are conservative. Therefore, it is unlikely that the two will actually occur at the same time, making the estimates conservative;
- modelling for the Project was performed on the basis of expected maximum emission rates. As such, predictions represent maximum expected concentration and deposition;
- background values were also included for volatile organic compounds (VOCs), PAH and metal calculations. However, background measurements, which were available from locations influenced by industry and transportation, were not considered representative of naturally occurring sources near the Project; and
- dispersion models are generally designed to accurately but conservatively predict concentration and deposition so that practitioners can apply model results with the understanding that effects are unlikely to be underestimated.

The air quality assessment (CR#1, CEAR #42) considered the composition of the surficial material from ground level to a depth of 144 m in three sample locations. In that depth were several coal layers. The proportion of coal dust within total fugitive dust was estimated to be

approximately 5.9% based on the total amount of material moved and the clean coal produced. Except at the loadout where all Project-generated fugitive dust concentrations are expected to be from coal, it is reasonable to assume that the proportion of coal in fugitive dust is about 5.9%.

b) If the comparison of modelling to actual emissions data shows that the modelling predictions were not conservative with respect to fugitive dust, PM_{10} and $PM_{2.5}$, and/or if the proportion of coal dust within total fugitive dust is estimated to be sufficient to affect the hazard associated with total fugitive dust:

i. Update Hazard Quotient predictions for PM_{10} and $PM_{2.5}$.

Response:

The Hazard Quotient (HQ) predictions for PM_{10} and $PM_{2.5}$ do not require updating as modelling predictions are considered conservative with respect to fugitive dust, PM_{10} and $PM_{2.5}$. The proportion of coal dust within total fugitive dust was estimated to be approximately 5.9% and would not be enough to affect the HQ as modelled in the HHRA. Coal dust as a COPC was added to the updated HHRA in support of this conclusion and is included in the updated HHRA submitted in response to JRP IR-4.9 (see Appendix 4.9-1, Sections 5.1.1, 5.2.1.1, 6.1.1.3 and 6.2.1.4).

ii. Revise the proposed mitigation measures that Benga would implement to address higher fugitive dust, including considerations such as pit watering, hydroseeding and wind fencing or provide a rationale why they will not be required.

Response:

Benga has developed a preliminary Air Quality Mitigation and Monitoring Plan presented in response to JRP IR-1.3.

c) Provide the list of the constituent contaminants (e.g. heavy metals, PAHs) found in coal dust associated with the Project activities and quantify their proportion, such that baseline/background conditions could be used to predict future loadings of contaminants to the environment via dustfall. Include the bioavailability potential of identified coal dust contaminants in the assessment of impacts to human health.

Response:

Coal is a heterogenous, carbonaceous rock formed by natural decomposition of plant matter at an elevated temperature and pressure over millions of years within the earth's crust (International Agency for Research on Cancer (IARC) 1997). Owing to its formation process the proportion of minerals and elements in coal can vary (Ruch *et al.* 1974); the predominant constituent of coal is carbon. From a toxicological standpoint, it is the chemical constituents of coal that are of interest – in particular, metals and organic compounds (*e.g.*, polycyclic aromatic hydrocarbons [PAHs]).

Source coal sample analysis for metals has not been conducted for the Project; however, metals results are available from three mines in Alberta; Genesee, Highvale, and Whitewood mines (Pollock *et al*. 1999). The chemical composition of the coal from these three mines is provided in Table 4.10-1.

Table 4.10-1 Provincial Coal Chemical Composition

Parameter	Genesee (ppm)	Highvale (ppm)	Whitewood (ppm)
Arsenic (As)	0.85-1.05	2.5-7	1.5-2.1
Barium (Ba)	525-607	288-987	261-895
Beryllium (Be)	0.6-0.9	-	-
Boron (B)	71-77	14-50	<50
Cadmium (Cd)	0.2-0.26	-	-
Chlorine (Cl)	20.1-22.7	43-127	18-212
Chromium (Cr)	26.62-108.74	2-153	0.7-802
Cobalt (Co)	1.97-2.7	1.0-23	2-17.6
Copper (Cu)	4.4-10	11-23.2	0.7-19
Lead (Pb)	4.4-12.2	-	-
Manganese (Mn)	3.2-60.4	16-249	61-230
Mercury (Hg)	0.01-0.04	-	-
Molybdenum (Mo)	10.9-60.9	1.2-9	0.5-90
Nickel (Ni)	11.6-56.8	-	2.5-491
Selenium (Se)	0.64-1.24	0.7-5.4	0.9-2.2
Thorium (Th)	2.30-5.05	-	6
Vanadium (V)	1.07-7.77	1.3-57	0.4-43
Uranium (U)	1.13-4.91	2.1	2.5
Zinc (Zn)	7.2-22.2	18.5	-

There is limited published quantitative PAH data available as it relates to its composition in coal; however, it has been found that coal contains native PAHs in considerably varying amounts from 1 to 2,500 mg/kg (Achten and Hofmann 2009). The molecular structures of extractable compounds of hard coals consists primarily of 2-6 polyaromatic condensed rings, linked by ether or methylene bridges carrying methyl and phenol side chains; however, it is expected that PAHs concentration and patterns change with increasing maturity, considering the chemical processes during coalification. The coal at Grassy Mountain is high ranking coal; therefore, due to rearrangement and fragmentation reactions, high ranking coal generally has a reduction of

compounds with 2-6 rings and an increase in polyaromatic compounds with more than 6 condensed rings (*i.e.*, alternant PAHs) and an exact source apportionment is hardly possible (Achten and Hofmann 2009).

Bioavailability of Chemical Constituents in Coal

When used in a human health risk assessment context, bioavailability refers to the absorption of a chemical from inhalation, ingestion, or dermal exposure. The bioavailability is based on the concept that before a receptor can accumulate or demonstrate a biological response to a chemical, it must be biologically available to the receptor.

In terms of the chemical constituents in coal, the leachability of the constituents and the absolute bioavailability are important factors to consider. First, the chemical constituents must have the ability to leach out of the coal dust matrix to become bioavailable. Second, the leachable fraction of the chemical must be absorbed within the receptor, referred to as the chemical absolute bioavailability. It is the absolute bioavailability (or internal dose) of the chemical that is a more direct measure of exposure potential.

Metals

The bioavailability potential of the metal constituents of coal is a complex multifaceted function of various factors. In order to understand the bioavailability potential, factors such as the various properties of the metal (*e.g.*, total concentration and speciation in physical-chemical forms) and geochemical environmental conditions and processes (*e.g.*, pH, total organic content, and suspended particulate content) should be considered (John and Leventhal 1995). That is, the concentration of each chemical constituent in the coal does not simply correspond with the metal bioavailability.

The bioavailability potential of identified coal dust contaminants was evaluated based on available information.

The potential for metals to leach out of the coal dust matrix increases in acidic conditions (*i.e.*, acidic runoff). As stated in CR#7 (Baseline Soil Survey and Impact Assessment – Sections 4.2.1 to 4.2.3) (CEAR #42), the topsoil, upper subsoil, and lower subsoil soil within or adjacent to the LSA and RSA as has a slightly alkaline pH. Additionally, as stated in CR#5 (Surface Water Quality Assessment – Section 3.2.1) (CEAR #42), both field and lab measured pH measurements conducted as part of baseline surface water assessment revealed generally alkaline surface water. This suggests that the alkaline environment in general would act to reduce the potential for metal leachability and the ability for metals to dissolve or leach out of the coal matrix will be negligible.

The generation of acid leachates from coal is primarily a function of the coal's sulphur content (Triton 2013). As the coal at Grassy Mountain has been described as having a low sulphur content this suggests that any deposits of coal dust will produce a more pH neutral runoff. A pH

neutral runoff into a generally alkaline environment is also not expected to introduce the acidic conditions required to cause the metal constituents in the coal dust to leach out of the coal matrix.

Metals that can leach out of the coat dust matrix into surface water will not necessarily be in a bioavailable form that can be taken up by aquatic life. As stated in CR#5 (Surface Water Quality Assessment – Section 3.1.6) (CEAR #42), most metals tend to associate with suspended particles and settle out of the water column, rendering them biologically unavailable to aquatic life.

Water hardness (calcium and magnesium) also reduces the bioavailability of metals in water. In general, positively charged particles of calcium and magnesium compete various metals (also present as positively charged particles) for uptake. Therefore, increased water hardness reduces the absolute bioavailability of metals and decreasing the potential for a toxic effect (Triton 2013). Furthermore, the previously sampled water courses in the RSA and LSA were found to contain hard water (CR#5 Surface Water Quality Assessment – Section 3.2.5 [CEAR #42]).

PAHs

PAHs are known to have a high affinity for particles, in air, soil, sediment, and water. Additionally, PAHs that adsorb to dust particles in the atmosphere undergo photo oxidation, which breaks down the PAHs. PAHs also have a poor solubility in water and are highly hydrophobic; therefore, creating a high affinity for particles. The strong adsorption property of PAHs to particles reduces the bioavailability and PAH concentration in leachate (Ahrens and Morrisey 2005; Canadian Council of Ministers of the Environment (CCME) 2008; Igwe and Ukaogo 2015). Even though the toxicity of PAHs is well recognized, the leaching of PAHs from soil to water is also assumed to be negligible (CCME 2008).

Specifically related to coal dust, the bioavailability of PAH constituents in coal is also very limited and independent of both coal properties and PAH content (Meyer *et al*. 2013). The known strong adsorption properties of PAHs have also been demonstrated in various studies related to coal dust.

A study by Yang *et al*. (2008) evaluated the sorbent capability of coal and coal-derived particles for PAHs in soil collected from a floodplain in Germany. The floodplain is in the vicinity of large-scale mining activities, such that coal and coal-derived particles from transportation activities, mining, and industry were present. The coal and coal-derived particles in the soil exhibited a very large sorption capacity for PAHs followed by a slow desorption process. That is, PAHs in conjunction with coal were found to have a decreased bioavailability potential, as coal has dominant geosorbent properties. Similar findings were discussed by Talley *et al.* (2002). The study also demonstrated that the binding and bioavailability of PAHs assessed from Milwaukee Harbour sediments found that PAHs were strongly bound to coal particles and were not bioavailable.

Furthermore, in the event that PAHs are leached from particulate coal, they are subjected to volatilization, photo degradation, and bacterial degradation; reducing the dissolved PAH concentrations before landing in a water body (Ahrens and Morrisey 2005).

Mitigation Measures

Mitigation measures to reduce the loadout's fugitive dust emissions, where dust fall is expected to be greatest, are described in CR#1 (CEAR #42) and in IR ECCC-13 (CEAR #69). The proposed mitigation measures to reduce the loadout's fugitive dust emissions include using full cladding on the sides of the load-out structure to create a wind shelter and a moveable discharge chute of the bin located as close as practical to the coal within the rail cars. Therefore, spills of coal outside of rail cars are expected to be uncommon and also will be cleaned up at the time they occur.

The chute systems planned for the Project also provide more control over the material transfer process than other systems (*i.e.,* clamshell systems [Katestone Environmental 2014]). Load profiling of a rail car can be successfully achieved through appropriate chute design leading to fewer incidences of coal dust spillage or overloading, which will in turn reduce the potential for coal dust emissions in the loadout or the rail corridor.

In addition, the coal atop each rail car will be sprayed with a thin coating of dust suppressant to reduce the risk of coal dust blowing out of the cars.

Summary

Based on review of available information pertaining to constituent contaminants within coal dust the following conclusions were drawn:

- metal and PAH constituents are of most interest when assessing the potential for adverse human and ecological health risk caused by coal-dust;
- the bioavailability potential of metals present in coal dust is reduced due to known Site characteristics such as the pH, suspended particles, and water hardness;
- PAHs present in coal have low bioavailability due to strong adsorption characteristics;
- neither acute nor chronic coal dust inhalation HQ results were shown to be a risk of adverse human health effect (see JRP IR-4.9, Appendix 4.9-1, Sections 6.1.1 and 6.2.1);
- Coal dust constituents are already accounted for as part of the deposition modelling as Air Quality measurements included representative information from coal as well as all layers of material handled for input to the multimedia model (see JRP IR-4.10, part a); and,
- Various mitigation measures are proposed to reduce fugitive dust emission.

Based these multiple lines of evidence the potential risk of adverse health effects caused by exposure to coal dust for the general public is low.

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d) Provide a qualitative description as to the potential for silica dust from the Project. Include any PM_{10} and $PM_{2.5}$ emissions as a result of silica dust in the justification of modelling above.

Response:

The silicon dioxide (SiO_2) group (silica) includes a group of compounds identical in composition but with different atomic arrangements. There are two sub-categories within the group: crystalline (quartz and cristobalite) and non-crystalline (amorphous silica) (Cotton and Wilkinson 1988; Moore 1999). This HHRA focuses on the crystalline form of silica (quartz and cristobalite) which is the form considered to cause toxic effect in humans; amorphous silica has a low human health hazard potential (OECD 2004). Both forms are present in bituminous and subbituminous coal at varying concentrations (typically between 1.7 and 73%) (Bragg *et al*. 2009). The National Air Pollutants Surveillance Network (NAPS) has published an extensive list of measured silicon concentrations in $PM_{2.5}$ and PM_{10} in ambient air at 24 different urban locations (NAPS 2010). The PM data was representative of several sources including dusts from paved and unpaved roads, construction activities, agricultural activities, and other anthropogenic sources. Using the information collected by NAPS (2010) Environment Canada (2013) calculated a median $\%SiO_2$ from the 24 ratios of Si to PM, and a molar ratio of 2.14 (to convert Si levels to SiO_2 levels). The median $\%SiO_2$ quantities represent all forms of silica (crystalline and non-crystalline) and are therefore an upperbound (conservative) approximation of the crystalline silica content in PM_{10} (5.22%) and $PM_{2.5}$ (2.52%) (Environment Canada 2013). The percent silica (quartz/cristobalite content [$\%SiO_2$]) from coal mining, and other sources (*e.g.*, paved and unpaved roads, construction operations, *etc.*) is summarized in Table 4.10-2

Table 4.10-2 Percent Silicate Concentration Estimate by Release Source[1]

Source	% SiO_2		Reference
	PM_{10}	$PM_{2.5}$	
Coal mining (bituminous and sub-bituminous)	1.7 to 73		Bragg (2009)
Other sources[2]	5.22	2.52	NAPS (2010)

[1]modified from Environment Canada (2013).

[2]paved roads, unpaved roads, construction operation, mobile sources, incineration, fuel combustion, open source waste, prescribed burnings and other industrial sources as identified in Environment Canada (2013).

PM10 and PM2.5 Emissions Modeling

Silica was added as a COPC as part of the updated HHRA provided in response to JRP IR-4.9. A discussion of the emission modeling for silica based on PM_{10} and $PM_{2.5}$ predictions is detailed in JRP IR-4.9, Appendix 4.9-1, Section 5.2.1.1.

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Moore, M. 1999. Cristalline silica: occurrence and use. Indoor Built Environ 8:82–88.; as referenced om Environment Canada 2013.

(NAPS) National Air Pollutants Surveillance Network. 2010. [Prepublication NAPS data on Excel spreadsheet]. Ottawa (ON): Environment Canada. Air Monitoring Data; as referenced in Environment Canada 2013.

(OECD) Organisation for Economic Co-operation and Development. 2004. Synthetic amorphous silica and silicates. SIDS initial assessment report for SIAM 19 [Internet]. Geneva (CH): United Nations Environment Programme.

e) Include coal dust as a contaminant of potential concern in the multimedia pathway assessment of the HHRA (including ingestion) and provide a description of the potential human health effects of coal dust from the Project.

Response:

An oral exposure limit for coal dust is not required as constituents within coal dust (metals and PAHs) were adequately assessed on a chemical-by-chemical basis as part of the HHRA.

Specifically, independent analysis of the chemicals within fugitive dust (*e.g.*, individual metals) is considered a more accurate method of exposure assessment and modeled results are inclusive of coal contribution. In addition, due to the limited bioavailability of PAHs from coal (see part c of this response), concentrations of PAHs used in the evaluation of human health risk are those calculated from combustion source emissions. Hence, chemical constituents of coal dust are already reflected in the modeled data and independent assessment of coal dust) as it pertains to multi-media exposure (oral pathway) is not required.

4.11 Information Request 4.11

Fifth Addendum to the Environmental Impact Assessment. (CEAR #69).

Eighth Addendum to the Environmental Impact Assessment. (CEAR #89).

Comments from the Government of Canada - Health Canada submission. (CEAR #167).

Health Canada's January 21, 2019 submission to the Panel (CEAR #167) indicated that occupational Exposure Limits (OELs) are intended only for use in occupational scenarios involving healthy adult workers, who may be supplied with personal protective equipment (PPE) to further limit exposure.

Although often based on toxicological principles, the procedures used to develop OELs for protection of adult workers are distinct from the approach used to establish toxicological reference values (TRVs) for protection of the general public. OELs generally assume that healthy adult workers are the individuals requiring protection. Occupational workers are generally exposed for 8 hr/day, 5 days/week. As such, OELs generally do not consider that exposures occur on a continuous (24 hour) or lifetime basis but instead are typically developed for a 40-hour work week and a typical career duration of 35 years. TRVs on the other hand need to consider the protection of all members of the general public including the young, pregnant women, and the elderly.

In Addendum 5 (CEAR #69), and Addendum 8 (CEAR #89) Benga identifies the Project's proximity to sensitive receptors including a hospital, senior's residence, elementary and high schools, and daycares. Nonetheless, Benga has used OELs that are primarily developed for industrial occupational exposure scenarios to assess the risks to the general public. Although Benga has applied a 10-fold safety factor to the OEL to account for this discrepancy, Health Canada indicated that the safety factor may not address the differences between industrial occupational exposures and exposure of the general public, noting a disagreement with whether the TRV is protective of human health, particularly for specific subpopulations such as individuals with G6PD deficiency with respect to naphthalene (CEAR #167).

Health Canada suggested that Benga consider using short-term naphthalene guidelines from other jurisdictions such as the Ontario Ministry of Environment and annual guidelines from Alberta Environment and Parks and British Columbia Ministry of the Environment in addition to other short- term exposure scenarios (for example 8-hour or 24-hour) (CEAR #167).

a) Re-calculate the hazard quotient (HQ) for naphthalene using a TRV developed for the public, based on available literature and an 8-hour or 24-hour exposure scenario for sensitive subpopulations.

Response:

As requested, the naphthalene HQ for short-term inhalation exposures was re-calculated using the 24-hour TRV from the Ontario Ministry of Environment (OMOE). The OMOE (2012) developed an Ambient Air Quality Criteria (AAQC) for naphthalene of 22.5 µg/m^3 based on a

24-hour averaging period. The TRV is reported by the OMOE to be based on health; however, supporting documentation is not provided and the relevance of this TRV for use in the HHRA could not be independently verified.

The re-calculated HQs using the OMOE 24-hour TRV are provided in Table 4.11-1.

Table 4.11-1 Naphthalene Acute HQ Results

Receptor	Project	Baseline	Application
RSA-MPOI	8.2E-07	1.0E-06	1.3E-06
FL-MPOI	2.5E-07	6.6E-08	2.5E-07
R1	2.2E-07	8.9E-07	1.0E-06
R2	9.2E-08	4.6E-07	5.3E-07
R3	1.0E-08	5.2E-09	1.3E-08
R4	1.2E-08	3.2E-07	3.2E-07
R5	3.6E-09	2.3E-09	5.4E-09
R6	5.5E-09	3.7E-09	9.2E-09
R7	1.8E-08	6.3E-07	6.4E-07
R8	2.0E-08	4.2E-07	4.4E-07
R9	2.2E-07	8.5E-07	1.0E-06
R10	7.0E-08	2.5E-08	8.2E-08
R11	9.0E-08	1.0E-08	9.8E-08
R12	4.1E-08	7.3E-09	4.7E-08
R13	3.4E-08	1.7E-08	4.7E-08
R14	3.1E-08	1.3E-08	4.1E-08

Using OMOE AAQC of 22.5 µg/m^3, HQs were predicted to be less than 0.2 at all receptor locations.

The results indicate that acute exposure to Project-related naphthalene is not considered to pose a risk of adverse human health effects. The updated naphthalene acute HQ was also incorporated in response to the Joint Panel request to update the HHRA (JRP IR-4.9).

Reference:

Ontario Ministry of the Environment (OMOE). 2012. Summary of Standards and Guidelines to support Ontario Regulation 419/05 – Air Pollution – Local Air Quality. Standards Development Branch.

4.12 Information Request 4.12

Final Environmental Impact Statement Guidelines. (CEAR #11).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section E – Environmental Assessment. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section H – Aboriginal Consultation. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #5- Surface Water Quality Assessment Report. (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #12 - Human Health and Wildlife Screening Risk Assessment. (CEAR #42).

Eighth Addendum to the Environmental Impact Assessment. Appendix C3 – Risk-Based Evaluation of Predicted Selenium, Sulphate and Metals. (CEAR #89).

Comments from Timberwolf Wilderness Society. (CEAR #156).

Comments from Sierra Dakin Kuiper. (CEAR #170).

Comments from the Canadian Parks and Wilderness Society - Southern Alberta Chapter. (CEAR #176).

Ktunaxa Nation Rights and Interests Study in relation to the Grassy Mountain Coal Project. (CEAR #189).

The EIS Guidelines (CEAR #11) specify that the proponent will provide, "with respect to Aboriginal peoples, a description and analysis of how changes to the environment caused by the Project will affect: human health, considering, but not limited to, potential changes in air quality, quality and availability of country foods, water quality (drinking and recreational), and noise exposure. When risks to human health due to changes in one or more of these components are predicted, a complete HHRA examining all exposure pathways for pollutants of concern may be necessary to adequately characterise potential risks to human health". There can be substantial differences between health status of Indigenous and non-Indigenous residents; however, Consultant Report #12 (CEAR #42) summarizes the current health status of residents in the South Zone with no baseline provided regarding the current health status of Indigenous people within this zone.

Section H of the updated EIA (CEAR #42) states on multiple occasions: "in order for [A]boriginal health receptors to be exposed to emissions from the Project, they must come into contact with chemicals of potential concern (COPCs)". The text goes on to explain that Indigenous groups will not access the area with high risk quotients based on the HHRA as these will be located within the mine boundary.

Consequently, Benga concludes that there will be no effects of the Project on Aboriginal health.

Benga stated in Consultant Report #12 that with mitigation, there would be no effects on water quality. As a result, the spatial boundary for the HHRA is based on air quality

effects only, together with locations of nearby communities and "other human activities" (CEAR #42). Benga sampled three historic end pit lakes from July to February 2014 and reported on the water quality in these lakes in Consultant Report #5 (CEAR #42). Benga did not model the proposed end pit lake, which could be substantially different in its physical, chemical and biological characteristics yet stated "the HHRA assumed that there will be no changes in surface water quality for the reclaimed landscape as a result of the end pit lake" (CEAR #42). Benga also states "The Project was assumed to have no direct effect on water quality…..therefore emission (sic) into air were the only Project related chemical source (sic) which required detailed exposure risk assessment in the HHRA".

Participants have noted contamination of the Koocanusa reservoir in Montana, which lies more than 100 km downstream of the discharge from the five Teck metallurgical coal mines in the Elk Valley (CEAR #156, #170, #176). Participants have also expressed concerns with respect to potential downstream contamination of the Crowsnest River and the Oldman reservoir (CEAR #42 Section G, CEAR #170, CEAR #189). Benga's risk assessment of selenium does not consider the transport of selenium downstream to the Oldman reservoir, despite potential differential behaviour of selenium in lentic habitats (lake, reservoir, wetlands) where long-term selenium loading of low water concentrations of selenium entering lentic systems can result in increased bioaccumulation in aquatic food chains.

Selenium levels are predicted to remain below Benga's proposed sulphate-based site-specific water quality objective. However, Consultant Report #5 (CEAR #42) states that selenium is predicted to be above the Alberta guidelines (2µg/L) at all modelled locations by the mid-to-late 2030s and will continue to be elevated during the rest of the operational period and in the post-closure period out to the limit of the modelled time period (2098) and sulphate concentrations in Blairmore Creek will increase steadily with time.

In summary, the HHRA conducted by Benga is incomplete, as it does not consider all the potential pathways of effects on availability of country food, such as bioaccumulation of contaminants in fish, plants, and ungulates due to water and soil contamination and the impacts on Indigenous health within the LSA and RSA. Given the predicted changes in water quality in Blairmore Creek and the potential for downstream transport of COPC, notably selenium, to the Crowsnest River and then the Oldman Reservoir, the HHRA should have included water-based exposure pathways. Furthermore, the potential human health risks associated with the end pit lake in the post-closure landscape requires assessment. Consequently the HHRA should be updated to include the effects of the Project on the availability of country food as well as appropriate mitigation measures specific to each Indigenous group.

a) Provide baseline information on the use of country foods, for each Indigenous group that may be affected by the Project, within the LSA, RSA and an extended RSA that

encompasses the Oldman Reservoir. This information should include Indigenous knowledge regarding the most sensitive rights-based receptors.

Response:

Baseline information on the use of country foods was included in the EIA (CEAR #42) and included in the response to JRP IR-4.9. Through ground-truthing field work and discussions with the Treaty 7 First Nations seven main areas were identified as hunting and plant gathering areas (Appendix 4.9-1- Figure A.3).

Specifically, as discussed in Section 2.2 of the HHRA (Appendix 4.9-1), during consultation with the Treaty 7 First Nations plant and animal species around Grassy Mountain which have historical medicinal, spiritual, and country food purposes were identified. The plant species identified included: lodgepole pine, sweet pine, birch, aspen, cottonwood, wild licorice, horsetail, juniper, bearberry, tree lichen, yarrow, rose hip, raspberries, thimbleberries, teaberry, bear root, hawthorn berry, scouring rush, Saskatoon berry, dogberry, mountain sage, sweetgrass, mountain holly fern, cranberry, and mushrooms. Animal species identified around Grassy Mountain included: trout, moose, elk, deer, cougar, wolf, badger, porcupine rabbit, buffalo, otter, squirrel, grizzly bear, lynx, woodpecker, grouse, wild turkey, crows, and golden eagle.

Sufficiently concise information was obtained through the consultation process which supported the development of a reasonably robust assessment on plants and animal species used by Indigenous groups in and around Grassy Mountain. Information pertaining to traditional food sources such as type, quantity and area of hunt and harvest is personal and sensitive information; it can be both culturally insensitive and inappropriate to require precise mapping or species identification from those communities included in the assessment. Information obtained from the consultation process is considered adequate for the purposes of this HHRA and additional survey or questioning would add unnecessary burden on the local population without adding substantially more information to the assessment.

The Oldman Reservoir is located outside of the RSA and LSA, as was illustrated in Figure 1 of EISs Surface Water Quality Assessment Report (CR#5, CEAR #42). Predicted exposures and subsequent risk for receptors located beyond the RSA would be lower than those locations assessed within the RSA. It is not necessary to conduct a detailed exposure and risk assessment for more distant receptors, such as the Oldman Reservoir, as receptor locations in closer proximity to the Project have a greater potential for exposure – the absence of a predicted risk at locations with a higher exposure potential is inherently predictive of an absence of risk at locations further away where potential for exposure is less.

b) Provide a revised HHRA that includes an assessment of the effects of the Project on the harvest and consumption of country foods and other resources of importance for each Indigenous group. The revised HHRA should examine the area within the LSA, RSA and an extended RSA that encompasses the Oldman Reservoir (including water,

fish, plants, ungulates and other resources used by Indigenous peoples). The assessment is to include:

i. an Indigenous-specific conceptual model which describes source-pathway linkages between the Project and Indigenous use of country foods (including water, coal dust, and incidental soil ingestion) and other resources of importance such as berries and medicinal plants;

ii. project specific mitigation measures aimed at reducing exposure to COPC via country foods during all Project phases;

iii. a revised risk characterization that goes beyond a contaminant-by-contaminant table of HQs and addresses the cumulative exposure to all COPC from all pathways (inhalation, ingestion, and absorption). Include an assessment of the end pit lake in the post-closure landscape and also of water, fish, plants, ungulates and other resources used by Indigenous peoples in the Oldman Reservoir area;

iv. a qualitative and quantitative description of the understanding of the overall implications of the Project with respect to toxicological risk to human health from Indigenous use of the LSA, RSA, the Crowsnest River, and the Oldman Reservoir and area; and

v. a description of any proposed mitigation which may include community-based monitoring and communication designed to support Indigenous confidence in the health of resources or community-based support to reinforce Indigenous harvest and intergenerational knowledge in the Project area.

Response:

The HHRA (Appendix 4.9-1) conservatively assumed an Indigenous receptor was located at all receptor locations (Section 5.1.2.1) and that within those receptor locations a person's diet was inclusive of country foods (including water, fruits, vegetables, valued resources such as Labrador tea, *etc.* (Section 5.1.2.1 – Table 5.1-3) as well as the effect of incidental ingestion of soil and fugitive dust (Section 5.1.3).

i) An updated indigenous-specific conceptual model (CSM) is not required. The current CSM developed for the HHRA was inclusive of all source-pathway linkages that would be expected of a person living in an area where their exposure includes a country food diet. Indigenous-specific food items and indigenous specific receptor characteristics were already incorporated into the HHRA (Section 5.1.2.2 – Table 5.1-4, Appendix 4.9-1).

ii) The HHRA did not indicate any risk to human health as a result of a country foods diet in relation to Project emissions. Project specific mitigations are not warranted.

iii) A cumulative exposure assessment had been included in the HHRA (see Sections 6.3.2 and 6.4 of the updated HHRA report provided in response to JRP IR-4.9a).

iv) Conclusions (both qualitative and quantitative) as provided in the HHRA were inherently inclusive of human health consideration for indigenous use of areas within the LSA, RSA, the Crowsnest River and the Oldman Reservoir. This is because exposure pathways were assumed operable at all receptor regardless of whether an actual pathway was present (*i.e.*, fish consumption was assumed to occur at locations where no fish habitable environment (*e.g.*, river or lake) existed – a conservative assumption. Hence, the absence of risk at a location considered to have a higher potential for exposure (within the RSA) would be inherently protective of any location outside of the RSA where the risk of exposure is less.

v) Benga has committed to implement an Indigenous Monitoring Program which will serve to build Indigenous community confidence in the environmental protections put in place for the Project. The Indigenous Monitoring Program will be directed by an Environmental Stewardship Committee comprised of Indigenous members appointed by the communities in proximity to the Project.

4.13 Information Request 4.13

Agreement to Establish a Joint Review Panel for the Grassy Mountain Coal Project Between the Minister of the Environment, Canada and the Alberta Energy Regulator, Alberta (Including Terms of Reference). (CEAR #80).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #12 - Human Health and Wildlife Screening Risk Assessment. (CEAR #42).

Comments from the Ktunaxa Nation Council. (CEAR #178).

Comments from JFK Law Corporation on Behalf of Káinai First Nation. (CEAR #184).

Comments from the Tsuut'ina Nation. (CEAR #192).

The Panel is mandated, under section 5(1) c of the *Canadian Environmental Assessment Act, 2012* to take into account any change that may be caused to the environment from the Project on the health of Aboriginal peoples. The Terms of Reference state that the Panel shall also take into account Information on the manner in which the Project may adversely impact asserted or established Aboriginal or Treaty rights and any measures that may reduce or avoid potential impacts to asserted or established Aboriginal or Treaty rights (CEAR #80).

The Human Health Risk Assessment (HHRA) presented in Consultant Report #12 (CEAR #42) does not consider the link between effects to health (both perceived and predicted) and access to, availability of, and quality of country foods and other resources

relied upon by Indigenous groups to meaningfully practice culture, traditional uses and exercise rights. As noted by Indigenous groups (CEAR #178, #184 and #192) the HHRA does not provide a robust discussion of the role of country foods and other resources with respect to ceremonial practices and the physical, mental, and spiritual health of Indigenous people.

Response:

The human health risk assessment (HHRA) conducted for the Project is a tool used to determine the potential risk of adverse health effects associated with exposure to chemical occurring or predicted to occur in environmental media (air, water, soil, food) (Health Canada 2017; US EPA on-line). As per Health Canada (2017) "*Human health risk assessment (HHRA) is an approach used by health agencies and risk assessment professionals to estimate the potential effects of chemicals on human health*."; thus, only the physical effect of potential chemical exposure is evaluated.

The HHRA did assess potential physical impacts on human health associated with predicted chemical exposure *via* consumption of traditional foods, the details of which have been described in the HHRA (see Sections 2.2, 5.1.2.2, 6.3.1.7, and 6.8 of the updated HHRA). However, HHRA methods do not have the capacity to evaluate potential health effects associated with other social determinants of health which describe potential impact on mental, or spiritual health, and food sovereignty and security.

The Project effects relative to spiritual health and ceremonial practices of Indigenous individuals and communities are addressed in the ***Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups*** (JRP IR 4.1, Appendix 4.1-1) which addresses valued components such as "Cultural and spiritual values" and "Indigenous Physical and Cultural Heritage".

The following is a summary of the information provided in Appendix 4.1-1 as it relates to this information request.

a) Describe the role and use of country foods and other resources valued by Indigenous groups from a holistic health perspective with respect to the physical, mental, spiritual health and ceremonial practices of Indigenous individuals and communities.

Benga understands that country foods have been important for subsistence and sustenance, and the practice of hunting, fishing and gathering has attached to it important cultural and spiritual considerations and knowledge. The research for the Project (JRP IR 4.1 – Appendix 4.1-1) found the following:

Hunting Perspective

Siksika Nation, Stoney Nakoda Nation, Tsuut'ina Nation and Ktunaxa traditionally focused their hunting on buffalo, which was consumed or traded. According to ethnographic information,

Ktunaxa Nation has hunted bison year-round in Crowsnest Pass. After the buffalo extirpation from the region in 1877, there was a shift in focus to hunt other large game animals such as elk and deer. Six Nations (Káínai, Piikani, Siksika, Stoney Nakoda, Tsuut'ina, Ktunaxa) indicated deer and elk as primary species within the Project area hunted for traditional, subsistence, ceremonial (*e.g.*, sacred bundle and Sundance ceremonies), spiritual, medicinal and clothing-making purposes. At least half of these Nations continue to primarily hunt deer and elk within their territories today. Current use for hunting around Grassy Mountain has been impeded since coal mining began in the 1900s. For example, Tsuut'ina Nation and Siksika Nation have reduced their level of hunting in the area and shifted to less disturbed areas. Ktunaxa Nation indicates that the area associated with the Project is a preferred subsistence harvest area, and it is reasonable to assume hunting might resume in the future. Other wildlife in and around the Project that are important for traditional use include: eagle, moose, big horn sheep, beaver, muskrat, rabbit, grouse, badger, mountain sheep, mountain goat, squirrel, black bear, grizzly bear, badger, owl, gopher, otter, wolf, wolverine, porcupine, ducks, geese, swan, prairie chicken, coyote, Sprague's pipit, skunk, cougar, lynx, mink, and marten.

Trapping Perspective

Fur bearers (*i.e.*, muskrat, beaver, mink, wolves, coyotes, black bear, lynx, squirrel, marten and foxes) were traditionally trapped by many Nations. By 1950s, industrial and land use pressures constrained these practices as eventually did the value of furs. Trapping in the Project area may occur today for subsistence and ceremonial purposes for at least one of the Nations (Káínai Nation). None of the Nations identified any current traplines or registered trapping areas in the Project's proposed mine permit boundary.

Fishing Perspective

Three Nations (Piikani, Siksika, and Tsuut'ina) do not heavily engage in fishing activities or fish are generally not eaten, except when necessary for subsistence (*e.g.*, a survival food when there is a decline in buffalo or other large game availability). Samson Cree Nation expressed an interest in fishing near the Project. Stoney Nakoda Nation and Ktunaxa Nation have always valued fish for subsistence as it was a staple of their diets. Ktunaxa Nation indicated that its members use fish for ecological, cultural, traditional and commercial purposes and fish for cutthroat trout and rainbow trout primarily in British Columbia. Káínai Nation members have indicated they fish for subsistence purposes in the watersheds north of the Project (*e.g.*, Livingston Range). In consultation meetings with the Káínai Nation, members have expressed concern that appropriate water quality and fisheries mitigations be in in place to ensure disturbance to fish habitat in Blairmore and Gold Creek is addressed as it could affect the availability of subsistence fish species and affect Káínai Nation rights to fish for subsistence purposes.

Plant Gathering Perspective

Seven of the Nations (Káínai, Piikani, Siksika, Stoney Nakoda, Ktunaxa, Tsuut'ina, Samson Cree) have historically valued gathering plants and foods for medicinal, cultural identity, ceremonial, spiritual, artisanal, healing, traditional teachings, subsistence purposes or for crafting tools, camps and canoes, and continue to gather plants for these purposes today. In addition, Stoney Nakoda Nation members use cedar branch needles, sweet grass and other plants for sweat lodges in preparation for vision quests and spruce bark for building shelters. The Project area is a valuable source of a variety of trees, shrubs and other plants used for these activities. The Káínai Nation sources some of the vegetation used for ceremonial (*e.g.*, Sundances) and medicinal purposes specifically in the Project area. During the TKUA site visit, Káínai Nation observed and continues to harvest over 27 important plant species for food, ceremonial and medicinal plants in the Project area. Siksika Nation, Tsuut'ina Nation, Samson Cree Nation and Stoney Nakoda Nation members also noted an abundance of subsistence, medicinal, healing, spiritual and ceremonial plants in and around the Project area. Samson Cree Nation notes there are important gathering and cultivation sites in proximity to the Project area for these types of plants. Tsuut'ina Nation commented that many of these important plants linked to ceremonial, healing, culture and spirituality are not found at lower elevations, plus at least 12 medicinal plants located near the Project area. Ktunaxa Nation identified the Project area as containing an array of ecological values and ties to cultural use and landscape stewardship.

Other Cultural Perspectives

Three Nations (Káínai, Tsuut'ina and Piikani) traditionally trap the golden eagle in their territory, and possibly including the Grassy Mountain area, for their feathers to use for ceremonial and war regalia purposes. The practice of trapping eagles was also considered a sacred and spiritual practice.

Four Nations (Káínai, Tsuut'ina, Stoney Nakoda and Piikani) indicated that lodgepole pine is gathered for tipi poles or log houses and is plentiful in the Project area. Tsuut'ina Nation has expressed an interest in harvesting lodgepole pine for tipi poles in the Project area. Samson Cree Nation notes that the Crowsnest Pass area is important for timber harvesting for ceremonial purposes.

While Benga cannot presume to understand from a holistic health perspective the role and use of country foods and other resources might have to Indigenous groups, it can draw some broad conclusions based on the statements made in Traditional Use Reports. Listed below are some well-being findings that can be linked to cultural activities and practices and country foods:

- Access to country food can help address concerns related to food insecurity. Food insecure individuals are at increased risk of chronic conditions and managing wellness. Food insecurity also negatively impacts social and mental well-being and may lead to obesity, depression, anxiety and social isolation. By contrast, procurement of country

food can have the opposite effect (Northern Health and the Provincial Health Services Authority. 2018).

- Food security is closely linked to availability of subsistence and store-bought foods, income, and housing costs in rural communities.
- Negative impacts of resource development on food security for First Nations in Canada include an increased sedentary lifestyle, poor access to nutritious foods
- Access to country food is part of cultural continuity to the Nations around the Project including links to norms, practices and beliefs, and traditional knowledge. Disrupted harvesting practices may have an impact on social relations and sharing, and ceremonial practices (Northern Health and the Provincial Health Services Authority. 2018).

b) Describe the role and use of country foods with respect to Indigenous food sovereignty (e.g. the re- connection to land-based food and political systems) as it relates to health, wellbeing, governance, and rights.

Indigenous Food Sovereignty (IFS) is a movement, a policy, or a political concept designed to facilitate access to healthy, culturally adapted Indigenous foods by addressing roadblocks. The approaches to address roadblocks can include:

- encouraging recognition of the importance of Indigenous foods and their cultural value;
- maintaining cultural harvesting strategies at the individual, family, community and regional levels;
- maximizing ability to make decisions over the amount and quality of food *i.e.*, reduced dependence on grocery foods; and
- adjusting policy frameworks to allow food sovereignty to be achieved[8].

Given the policy objectives of IFS, country food is a critical piece of achieving food sovereignty. As per the response in Part a), country foods can play an essential part of (re) establishing cultural connections because country food related activities allow for the exchange of songs and stories, relationship to ceremonies, and of course, language. Language facilitates the transfer of information in all of these things (Bell, Catherine, and Napoleon, Val. 2008a & 2008b).

c) Explain Benga's plan to provide clear and substantiated information on the benefits and risks of the consumption of country foods in order to mitigate the potential for avoidance of country foods due to perceived health risks.

Benga does not consider it appropriate for a Project proponent to provide information on the benefits and risks of the consumption of country foods in general. Benga does have an obligation to mitigate the potential for avoidance of country foods from areas adjacent to the

[8] https://www.indigenousfoodsystems.org/food-sovereignty

Project due to perceived health risks. With this objective, Benga has and will continue to act along three main axes:

- **Provision of Information** – Benga has been and will continue to be active in the nearby indigenous communities to provide information about the possible adverse health effects associated with country foods from areas adjacent to the project. The Human Health Risk Assessment (HHRA) did assess potential physical impacts on human health associated with predicted chemical exposure *via* consumption of traditional foods, the details of which have been described in the HHRA (see Sections 2.2, 5.1.2.2, 6.3.1.7, and 6.8 of the updated HHRA). No significant adverse health effect is predicted.
- **Environmental Stewardship Program** – Benga has proposed an environmental stewardship program led by indigenous representatives and responsible for development and implementation of a cultural monitoring plan. The intention of this program and the cultural monitoring is to encourage community member knowledge of the Project and to identify and discuss issues that are of concern from a cultural/community perspective.
- **Environmental Reporting** – Benga has committed to provide regular reports to nearby indigenous communities regarding the environmental performance of the project. The intent is to keep the communities informed of Benga's compliance with environmental performance parameters.

d) Describe how both actual and perceived effects of the Project on health can impact Indigenous current use and cultural heritage. Include a discussion of the potential impacts on access and use of preferred areas, opportunities to uphold stewardship, and practice of preferred cultural and spiritual activities (e.g. hunting, fishing, trapping, and gathering).

As already discussed, the HHRA did assess potential physical impacts on human health associated with predicted chemical exposure *via* consumption of traditional foods. The conclusion of the HHRA is that there will be no significant actual effect of the Project on health of Indigenous groups due to consumption. The remaining actual effects of the Project lie in impacts to access and use of preferred areas. Benga is working to mitigate these actual effects through implementation of an Access Management Plan that ensures access to areas adjacent to the Project for practice of traditional activities as well as providing access to Benga-owned private lands that are outside of the Project footprint. (See IR 4.5 for additional discussion of the AMP).

The Project can also impact on satisfactory enjoyment of the surrounding area due to a perception that country food hunted or gathered nearby may somehow be tainted or because of actual noise and other disturbance that impacts directly on the experience. As discussed in Part c) above, Benga has and will continue to make efforts to mitigate these perceptions through the three main axes described above.

References

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US EPA (United States Environmental Protection Agency). Human Health Risk Assessment. Basic Information. Web page accessed on-line May 23, 2019. https://www.epa.gov/risk/human-health-risk-assessment

4.14 Information Request 4.14

Eighth Addendum to the Environmental Impact Assessment. (CEAR #89).

Comments from the Government of Canada - Health Canada submission. (CEAR #167).

Country foods were identified as the main contributor for dietary manganese exposure by Benga in HC- R2-11, Addendum 8 (CEAR #89). Levels of manganese in Saskatoon berries from the Project area appear to be elevated relative to the range of background concentrations reported in other types of berries that are sold in Canada included in Health Canada's Total Diet Study, as well as data available for Saskatoon berries collected as part of the Canadian Food Inspection Agency's monitoring surveys (Lim 2012) [9].

[9] Reference in the comments from the Government of Canada - Health Canada submission. (CEAR #167). Available online: https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/canadian- total-diet-study.html

Health Canada (CEAR #167) noted that modelled manganese exposure for adults as a result of the Project exceeds the US EPA's no-observed-adverse-effect-level (NOAEL) and its equivalent to the NOAEL reported by Finley et al. (2003) [10]. In the case of toddlers, it appears a comparison was made to the NOAEL reported by Finley et al. (2003) which is specific to adults. A toxicological reference value (TRV) specific to toddlers could be derived by expressing the no-observed effect levels (NOELs) on a body weight basis for both toddlers and adults and comparing to estimated exposures on a body weight basis. This would allow for a more accurate determination of the potential health risks associated with manganese in country foods.

If the exposure estimates for Project and baseline conditions provided by the proponent are accurate, Health Canada indicated that contribution of manganese exposure from country foods as a result of project activities appears to be negligible. However, if the manganese concentrations in environmental media are found to significantly increase as a result of Project activities, Health Canada recommended that a monitoring program also be implemented for manganese in country foods, given the existing high apparent background levels of manganese in Saskatoon berries and background exposure estimates are already elevated (CEAR #167).

a) Derive a TRV specific to toddlers by expressing the NOELs on a body weight basis for both toddlers and adults and compare to estimated exposures on a body weight basis.

Response:

The TRV used in the assessment of manganese is based on the US EPA (1996) oral RfD of 0.140 mg/kg bw/d. An adjustment of the TRV is not considered appropriate as it is in line with Health Canada (2010) age adjusted TDI for toddlers (aged 7 month to 4 years) of 0.136 mg/kg bw/d.

The purpose of comparison to the NOAEL used in derivation of the US EPA RfD was intended as supporting evidence that the concentrations found in background are of low likelihood to cause adverse effect. The age adjusted NOAEL used in derivation of the toddler TRV used by Health Canada (2010) is 2 mg/day.

Table 4.14-1 Estimated Exposure *vs.* Age Adjusted

Life Stage	Estimated Daily Intake (EDI) mg/day		NOAEL (Health Canada 2010) mg/day
	Project	Background	
Toddler	3.0×10^{-7}	8	2
Adult	8.9×10^{-7}	21	11

[10] Reference in the comments from the Government of Canada - Health Canada submission (CEAR #167) and available from: https://link.springer.com/chapter/10.1007/978-94-007-4053-2_43

As shown in Table 4.14-1, the project contribution to elevated manganese is insignificant. The EDI based on background is greater than the no observable effect level (NOAEL) used by Health Canada (2010a). However, exceedance of a NOAEL value is not a direct indication of potential risk – it implies that it is higher than the concentration that was shown not to cause an effect. Provided exposure is a result of measured Baseline concentrations, the conservative nature of the multi-media model, the insignificance of Project contribution, and the modelled EDIs are marginally elevated as compared to NOAELs reported in literature, manganese is not considered to be a human health risk.

b) Where possible, provide additional consumption information from local Indigenous populations that may inform the consumption patterns of berries from the Project area. Consumption rates used in the EIA should be representative of Indigenous populations that harvest and consume foods from the area impacted by the Project.

Response:

Indigenous consumption rates were taken from Health Canada (2012) and are provided in Table 5.1-2 in Section 5.1.2 of the updated HHRA (JPR IR-4.9, Appendix 4.9-1). As provided in SIR response HC-R2-11 (CEAR #89) traditional food consumption rate for berries applied in the HHRA were compared with the mean and 95th percentile consumption rates reported in the First Nations Food, Nutrition and Environment Study (FNFNES). The FNFNES values are considered to be the most robust publicly available documentation by which to compare ingestion rates. In all cases, the Health Canada recommended values applied in the HHRA were considerably higher than the FNFNES data and were considered to over-estimate the potential for manganese exposure due to berry ingestion. Therefore, the HHRA is likely to be an over-estimate of local Indigenous population harvest and ingestion rates.

c) Indicate whether monitoring will be implemented for manganese in environmental media (including but not limited to soil, sediment and water). Should the monitoring results suggest a significant increase, indicate whether manganese will be monitored in country foods. If monitoring is not being considered, provide justification as to why it is not necessary.

Response:

There are no predicted risks associated with ingestion of manganese, contribution from the Project to background contributions is negligible and estimated ingestion (daily intake) is attributable to background (natural) levels. An environmental monitoring program for the measurement of manganese is currently not part of Project related monitoring plans.

4.15 Information Request 4.15

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Section A – Project Introduction (CEAR #42).

Grassy Mountain Coal Project – Updated Environmental Impact Assessment. Consultant Report #3 – Hydrogeology. (CEAR #42).

Sixth Addendum to the Environmental Impact Assessment. (CEAR #70).

Comments from the Government of Canada - Health Canada submission. (CEAR #167).

Benga states that municipal water wells are not predicted to have any groundwater quality impacts associated with mine spoil and mining activities (Section A, CEAR #42). However, in Consultant Report #3 (CEAR #42), Benga states that a field survey conducted in Fall 2014 verified that six water wells and two springs are used for domestic purposes.

In Consultant Report #3 (CEAR #42), Benga indicated that the Municipality of Crowsnest Pass obtains its water from groundwater, which is extracted from wells in the alluvial sand and gravel aquifers in the vicinity of the Crowsnest River. All water licences within the RSA are expected to extract groundwater from the alluvial aquifers and not from bedrock aquifers. Consultant Report #3 also noted that mapping of potential alluvial aquifers indicates that an alluvial aquifer may be associated with some portions of Blairmore Creek and Gold creek, and near the confluence with the Crowsnest River. Potential impacts to surface water on these creeks and river due to runoff from the mine could affect water quality in the Municipality of Crowsnest Pass.

A second possible pathway for contaminated groundwater to reach the existing wells is via groundwater transport of contamination in the bedrock aquifers beneath the mine, and beneath the alluvial aquifers. Bedrock groundwater will discharge upwards into the alluvial aquifers and streams.

Furthermore, Benga stated in the response to Health Canada's IR 15d (CEAR #70), that exposure through consumption of groundwater was included in the Human Health Risk Assessment (HHRA). However, groundwater does not appear to be included as a pathway in the HHRA (CEAR #167).

a) Clarify whether the consumption of groundwater was included in the HHRA as an exposure pathway.

Response:

The HHRA considered the potential for consumption of groundwater pathway in the problem formulation stage of the assessment. As the Project has been demonstrated to have no direct effect on water quality or aquatic health (Consultant Report (CR)#3 – Hydrogeology [CEAR #42], CR#5 – Surface Water Quality [CEAR #42] and CR#6 – Fisheries [CEAR #44]) this pathway was defined as inoperative with respect to potential human exposure and therefore does not require detailed quantitative assessment.

b) Provide and justify the concentrations used for selenium and other contaminants assumed to be present in the groundwater for the HHRA assessment.

Response:

Selenium concentrations were not modelled in groundwater as a part of the HHRA as the Project is not expected to have a direct effect on water quality (CR#3 – Hydrogeology, CR#5 – Surface Water Quality [CEAR #42] and CR#5 – Fisheries [CEAR #44]).

c) Indicate the likelihood that the six wells and two springs identified in Consultant Report #3 could be affected by the Project. Describe the proposed mitigation measures Benga will implement to ameliorate or replace the water supply if needed.

Response:

Potential effects to water wells, including the field surveyed locations, were assessed in CR #3 – Hydrogeology, Section 5.4.2.2.2 (CEAR #42). The assessment concluded that there was no effect to water wells from Project activities; as a result, no mitigation options are required.

d) Provide a revised or updated HHRA which includes groundwater consumption as an exposure pathway. Include both municipal sources and private wells influenced by surface water or bedrock.

Response:

The HHRA (JRP IR-4.9, Appendix 4.9-1) included an assessment of groundwater consumption as part of the Problem Formulation. The potential for impact to municipal sources and private water wells was already assessed as a component of the CR #3 – Hydrogeology (CEAR #42) and the potential of occurrence was considered low (unlikely). Neither a revision nor an update of the HHRA is required.

4.16 Information Request 4.16

Fourth Addendum to the Environmental Impact Assessment. Attachment 2. (CEAR #55).

Fifth Addendum to the Environmental Impact Assessment. (CEAR #69).

In response to IR #25 in Addendum 4 (CEAR #55), Benga examined the frequency and severity of wildfires that are expected to occur during the life of the Project and the resulting potential effects on Valued Components (VCs), mitigation, and reclamation. For the Aboriginal health VC, Benga noted that “reduced air quality during burns will be less frequent” and “air quality may be further reduced during larger fires”. Benga did not however propose changes to mitigation measures for air quality or human health as a result.

In Addendum 5 (CEAR #69), Benga considered potential changes to forest fire regime due to climate change in the assessment of other valued components, such as vegetation and wetlands. Benga stated that “though fire is largely a stochastic process, the modelled

changes in climate parameters are expected to increase the area burned each year and in many cases the frequency of fire as well."

With the increase of area burned each year, particulate matter released in the air will further reduce the air quality predicted for the Project area. Benga did not characterize "reduced air quality during burns" nor indicate whether conclusions with respect to air quality and human health may differ by taking into account the changes to wildfire frequency and severity as a result of climate change in combination with and fugitive dust emissions due to mining activities.

a) Qualify and characterize the potential adverse effects to air quality from potential project effects in combination with effects on air quality resulting from predicted changes in wildfire frequency and severity due to climate change. Use the modeled projections for future frequency and severity of wildfires provided in response to IR #25 in Addendum 4.

b) Describe any potential effects on human health resulting from the cumulative interaction of project effects and wildfire effects on air quality. Where data is available, provide information relating to reduced air quality as a result of forest fires in combination with air emissions from relevant metallurgical coal mining operations.

c) Provide any additional proposed measures to mitigate effects to human health. Provide a rationale if no additional mitigation measures are proposed.

Response:

Potential ADVERSE Effects to Air Quality Predicted for Project and Wildfires Combined

Project effects are substantially smaller in comparison to the impact of wildfire on air quality. Wildfires can release significant amounts of pollutants into the atmosphere, including particulate matter (PM), ammonia (NH_3), and ozone (O_3) precursors such as nitrogen oxides (NOx), volatile organic compounds (VOCs), and carbon monoxide (CO). Although many of these species are harmful to human health, population health impacts of wildfire smoke have been attributed mainly to short-term concentrations of PM less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$) (Munoz-Alpizar *et. al*., 2017). Additionally, of the contaminants associated with wildfire smoke, airborne $PM_{2.5}$ has been identified as the contaminants of potential concern (COPC) of greatest concern beyond the local vicinity of a fire (Hu *et al*., 2007; Liu *et al*., 2015); populations living within the vicinity of a wildfire would likely be evacuated. As such, $PM_{2.5}$ emissions will be used to discuss potential combined adverse effects to air quality from the Project and wildfires.

The response to IR #25 in Addendum 4 (Attachment #2, CEAR #55) indicated that fire frequency in the Project area is predicted to decrease by at least 25% to 33% over the lifetime of the Project and total burn area (severity) is projected to increase by 11% to 33% by 2040 and 200% to 300% by 2070. However, $PM_{2.5}$ emissions could not be directly predicted from this work.

During the 2016 Horse River wildfire in Northern Alberta (Fort McMurray), 24-hour $PM_{2.5}$ concentrations of up to 140 µg/m^3 were reported (Government of Alberta, 2017). A study by Navarro *et. al*. (2018) determined that wildfire events in the Pacific Northwest produced mean $PM_{2.5}$ concentrations up to 121 µg/m^3 over a 24 hr-averaging period (Navarro *et. al*., 2018). In comparison, project-related 99th percentile $PM_{2.5}$ concentrations were predicted to range between 0.2 and 6.7 µg/m^3 (Figure 4.16-1). For the Project Application Case, $PM_{2.5}$ concentrations were predicted to range between 0.2 and 12.0 µg/m^3. This demonstrates that present-day wildfire-specific $PM_{2.5}$ concentrations are expected to be several times greater in magnitude compared to predicted project related $PM_{2.5}$ emissions.

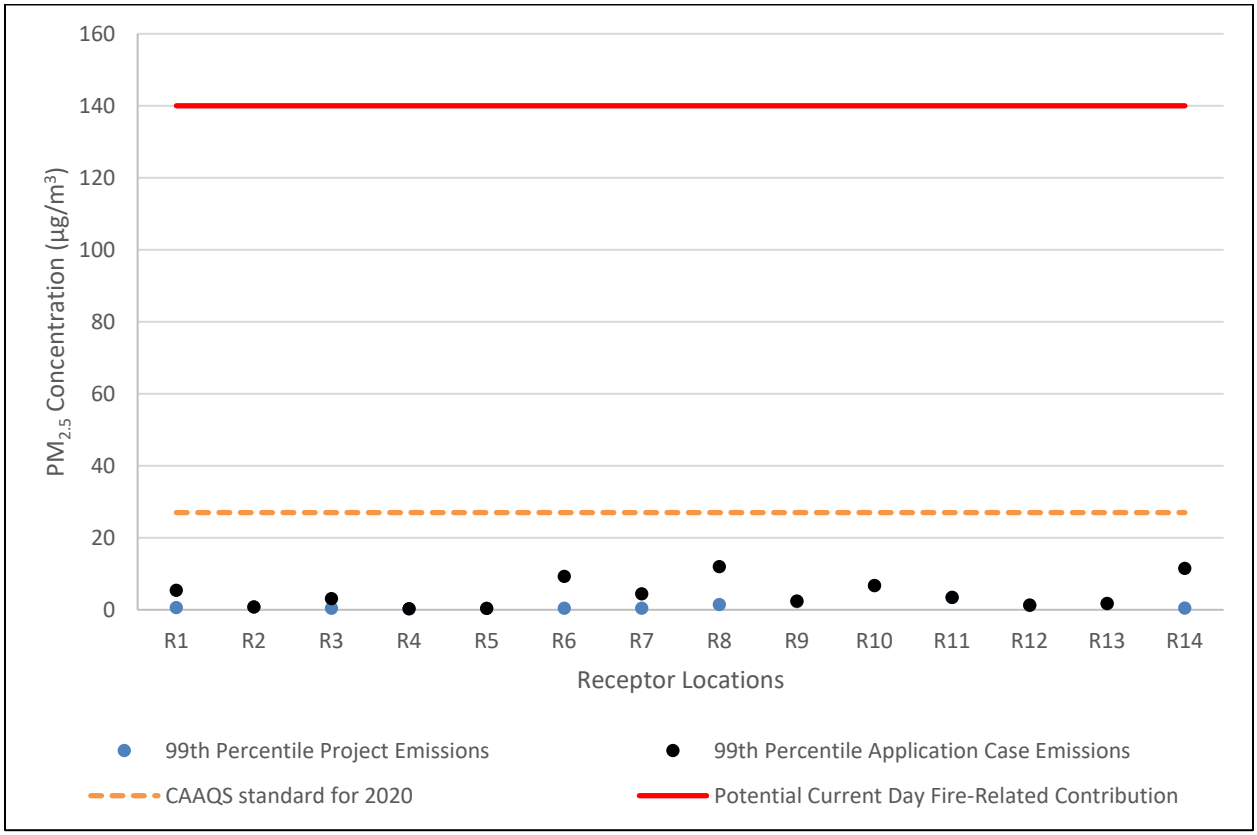

Figure 4.16-1. $PM_{2.5}$ Contribution to Air Quality from Various Sources.

A study by Liu *et al*. (2016) found that wildfires are a major contributor to ambient $PM_{2.5}$ levels in the western US, especially on days when ambient $PM_{2.5}$ levels exceeded the US National Ambient Air Quality Standard (NAAQS) (35 µg/m^3) or the World Health Organization (WHO) standard (25 µg/m^3). On days with total $PM_{2.5}$ exceeding the WHO 24-hour standard for $PM_{2.5}$, wildfire contributed approximately 64 % of total $PM_{2.5}$ from all sources. The study by Liu *et al*. (2016) also estimated the effect of climate change on wildfire-specific $PM_{2.5}$ in 561 western US counties during potential future (2046–2051) fire events. The study used a fire prediction model and GEOS-Chem, a 3-D global chemical transport model, under a scenario of

moderately increasing greenhouse gases by mid-century. The study estimated average wildfire-specific $PM_{2.5}$ levels for the years 2046–2051 will increase by approximately 160% (interpreted as increase in frequency) and the maximum wildfire-specific $PM_{2.5}$ levels will increase by more than 400% (interpreted as increase in intensity).

Predicted project related emissions outside of the mine site area are approximately 1% compared to $PM_{2.5}$ emissions measured during the Horse River Wildfire (Government of Alberta, 2017) and wildfire events in the Pacific Northwest (Navarro *et al*., 2018). Based on the predicted changes in wildfire-specific $PM_{2.5}$ concentrations due climate change (Liu *et al*., 2016), project related $PM_{2.5}$ emissions are predicted to be approximately 0.25%, compared to wildfire-specific $PM_{2.5}$ emissions, by 2046-2051. Benga's air quality monitoring and mitigation program and its goal of continuous improvement through reducing $PM_{2.5}$ emissions from combustion sources, reducing emissions of fugitive dust from mine operations and reducing fugitive dust emissions from rail loading and transport will further reduce the Project contribution to $PM_{2.5}$ (JRP IR-1.1, Appendix 1.1-3).

Potential Effects on Human Health Resulting from the Cumulative Interaction of the Project and Wildfires

As demonstrated above, the predicted health effects associated with Project emissions are substantially less than those associated with wildfire air quality events. The effects of urban $PM_{2.5}$ on human health has been linked to increased respiratory symptoms (*e.g.*, coughing and asthma symptoms), decreased lung functionality, and increased use of medical services (*i.e.*, emergency room visits and hospitalization) (Gouv. du Québec, 2014). Collective evidence from epidemiologic, controlled human exposure and toxicological studies indicates a causal relationship exists between short-term exposures to urban $PM_{2.5}$ and both cardiovascular effects and mortality (US EPA, 2009). The evidence suggests a causal relationship likely exists between short-term exposures to urban $PM_{2.5}$ and respiratory effects.

While mortality rates associated with cardiovascular illnesses have been studied in relation to urban PM levels due to air pollution (Garrett and Casimiro, 2011; Stölzel *et al.*, 2007; Zu *et al.*, 2016; Gouv. du Québec, 2014), few studies correlate PM to mortality after short term exposures during wildfire events. Variables such as climatic conditions, population sensitivity and psychological impacts due to stress from wildfire may further complicate the findings of such studies (Gouv. du Québec, 2014). A two-month study investigating the 2006-2007 wildfire episode in Victoria, Australia concluded that $PM_{2.5}$ exposure from wildfire smoke may be an important determinant of out-of-hospital cardiac arrest and ischemic heart disease (emergency department visits and hospital admissions) and that susceptible persons such as older adults may be at higher risk during extreme wildfire events (Haikerwal *et al.*, 2015). Health outcomes

known or suspected to be caused by wildfire smoke to susceptible populations include the following (BCCDC, 2014a, 2014b):

- asthma and COPD exacerbations;
- bronchitis and pneumonia;
- adverse cardiovascular outcomes;
- adverse birth outcomes;
- childhood respiratory disease;
- otitis media; and
- anxiety.

Wildfire events may produce $PM_{2.5}$ concentrations that are several times greater in magnitude compared to $PM_{2.5}$ standards (Figure 4.16-1). Studies specific to reduced air quality or human health effects as a result of both forest fires and air emissions from relevant metallurgical coal mining operations were not found. However, during periods of wildfire, the primary contribution to $PM_{2.5}$ is expected to be from wildfire emissions and Project emissions are not expected to drive human health concerns during this time.

Proposed Mitigation

Benga's air quality mitigation program (JRP IR-1.1, Appendix 1.1-3) will result in a further reduction of Project-specific $PM_{2.5}$ emissions. Mitigation measures to reduce PM, including $PM_{2.5}$, are as follows:

- Construction Phase:
  - Water (or other dust suppressant) will be systematically applied to access roads, to the plant access road, and to any haul roads under construction to minimize dust using a water truck dedicated to this purpose. An emission control efficiency of 80% during the summer months is targeted from this measure.
  - Gravel or crushed rock will be used as the underlay on the haul roads. Gravel is observed to produce less dust than clay and sandy surfaces.
  - A grader will be used to maintain the active surface of the access road. This procedure is expected to reduce the effective silt content of the portion of the road where the wheels of the haul trucks travel. The grader blade would tend to move the silt particles to the inactive portion (side) of the road or cover the active portion with coarser material.
  - Trees and bushes will be preserved around mines and plant, because they effectively trap dust emissions from construction activities.
  - To manage the formation of secondary particulate emissions from combustion emissions, Benga will use ultra-low sulphur diesel during construction.

- Operations Phase:
  - During operations, the primary sources of particulate emissions are dust from haul road activity and material handling. Benga has introduced mitigative measures to reduce particulate fugitive emissions along private haul roads and for pit activities. The following mitigation measures were incorporated into emission estimation and dispersion modelling and in the health impact assessment:
    - The mine fleet will be regularly upgraded and by Year 19, equipment will be newer and more efficient than assumed in emission estimation. Exhaust emissions from the U.S. EPA Tier 4 (2010) standards were used in Project emission estimates and it is likely that off-road standards will be more stringent by Year 19.
    - Water will be systematically applied to haul roads and to the plant access road to minimize dust using a water truck dedicated to this purpose. An emission control efficiency of 80% during the summer months is targeted from this measure.
    - Snow cover will be retained on the road as a mitigative measure during the winter months, unless the cover would compromise the safety of vehicle operations. Winter ground is frozen and, since the soil and overburden have elevated moisture contents, there is a reduction of dust emissions at that time.
    - Gravel or crushed rock will be used on the haul roads. Gravel is observed to produce less dust than clay and sandy surfaces.
    - A grader will be used to maintain the active surface of the road. This procedure is expected to reduce the effective silt content of the portion of the road where the wheels of the haul trucks travel. The grader blade would tend to move the silt particles to the inactive portion (side) of the road or cover the active portion with coarser material.
    - Speeds on mine roads will be limited to 50 km/h. Speed reduction does not eliminate total emissions but does reduce acute concentrations/exposure.
    - Trees and bushes will be preserved around mines and plant, because they effectively trap dust emissions from mining activities and reduce dust concentrations farther from mining activities.
    - The coal processing plant module will be contained within an enclosed area and all coal material handling will be *via* covered conveyors.
    - Dust generation from transferring coal from the conveyor to the stock pile will be minimized by the use of luffing stackers (those that can lower and raise their boom) which will minimize the drop height and drop time of the coal.
    - Fugitive dust generation will be minimized at the rail load-out, with full cladding on the sides of the load-out structure to create a wind shelter, and

with the movable discharge chute of the bin located as close as practical to the coal within the rail cars.

- DCT will be applied at the loadout to reduce wind blown emissions of coal dust from rail cars during transport.

- Decommissioning and Reclamation Phase:
  - During the decommissioning and reclamation phase, the following approaches will used to manage particulate emissions:
    - The mined areas will be reclaimed promptly and backfilled with overburden and soil from pre-stripped areas, and then covered by vegetation which reduces windblown fugitive dust emissions from exposed land.
    - Water (or other dust suppressant) will be systematically applied to all roads open during decommissioning and reclamation phases.
    - Gravel or crushed rock will be used as the underlay on the open access roads.
    - A grader will be used to maintain any remaining active surface of access roads.
    - Trees and bushes will be replanted as per the Project's Conservation and Reclamation Plan to effectively trap dust emissions from past mining activities.
    - To manage the formation of secondary particulate emissions from combustion emissions, Benga will use ultra-low sulphur diesel vehicles during the reclamation phase.

Benga also intends to monitor actual emissions from its operations to compare them to predicted emissions by installing ambient air quality monitors at two sites in the Project area (proposed near the eastern edge of the lease and in the community of Blairmore near the loadout). Both of these sites will measure $PM_{2.5}$ concentrations continuously, in addition to NO_x and PM_{10}.

Finally, Benga is committed to continuous improvement over the life of the Project. Benga expects advances to be made to the emission control technologies and to the monitoring approaches that are adopted. Based on the limited service life of several components, certain pieces of equipment will be scheduled for replacement (*e.g.*, haul truck engines and complete haul trucks). Benga plans to take advantage of future technologies to further reduce emissions when these scheduled maintenance activities take place. For combustion sources, although the ability to confirm emissions through continuous or intermittent monitoring is limited, estimation based on fuel consumption will allow appropriate and timely mitigation management to address any potential performance issues.

Benga's wildfire mitigation and prevention plan is outlined in Section C.7.7 of the Project Description (CEAR #42). This plan includes adapting best practices from the FireSmart

Guidebook for the Oil and Gas Industry for wildfire planning and mitigation (Government of Alberta, 2008), which include the following:

- **Structures**: coal handling and processing plant (CHPP) services buildings are constructed with non-combustible siding and roofing. These buildings have a minimum setback of 10 m from all forest vegetation, on-site vegetation, and hydrocarbon storage.
- **Mine Infrastructure Area (MIA**): vegetation will be removed away from all hydrocarbon storage tanks to a distance of 5 m.
- **All-Terrain Utility Vehicle (UTV) Activities**: UTVs are a key mode of transportation for employees and contractors at the Grassy Mountain Coal Mine. UTVs present a fire hazard due to the temperature of the exhaust system, which may ignite accumulated or nearby vegetation. UTV operators will not drive through forested vegetation (*i.e.*, off trail); During prolonged periods of extreme fire danger levels and forest closures, Benga will monitor (and as necessary restrict) the use UTVs; All UTVs are equipped with fire extinguishers.
- **Brush/Vegetation Management**: burning woody debris presents an increased risk for ignition of wildfire, especially if the piles are not properly extinguished. Benga does not intend to dispose of debris through burning. All non-salvageable timber and brush will be chipped or windrowed to promote vegetation growth on disturbed areas; Benga will ensure permanent structures in Zone 1 (MIA and CHPP) and Zone 2 (all areas within the disturbance footprint, except those included in Zone 1) are at least 10 m from any vegetation and at least 30 m from forested areas. Vegetation removal activities will be carried out along the border of forested areas that are adjacent to cleared Industrial Zone 1 areas containing permanent structures. Ground cover in Zone 1 areas will be maintained as bare mineral soil, gravel, or mowed grass. The majority of Industrial Zone 2 areas are free of vegetation and are either gravelled areas surrounding infrastructure within Industrial Zone 1, or areas where mining operations are being undertaken. In Zone 2 areas, vegetation management will depend on the values at risk. If values at risk warrant protection, areas will be maintained as vegetation-free zones or a mowed grass. If risk does not warrant this extreme level of management, vegetation reduction will be implemented if flammable coniferous forest vegetation is present.
- **Personnel Safety**: Benga provides mandatory annual safety inductions which review wildfire preparedness and emergency response plans, outlines evacuation staging areas and plans, evacuation and emergency alerts/sirens, evacuation routes for use during a wildfire event, methods of transportation for evacuation (air and ground) and communication requirements during an emergency.

Many local and provincial government agencies use the air quality index (AQI in the US or air quality health index [AQHI] in Canada) as a surrogate for $PM_{2.5}$ during wildfire response (BCCDC, 2017). The AQHI is a scale designed to help understand the impact of air quality on health. It is used to make decisions to reduce short-term exposure to diminished air quality by adjusting activity levels and time spent outdoors. Alberta has a number of government-run air monitoring stations that calculate an hourly AQHI; however, the Albertan air monitoring station

nearest to the Project area is located in Lethbridge, approximately 150 km from the Crowsnest Pass. Thus, an Albertan AQHI is not calculated for the Crowsnest Pass. An hourly AQI is available for the Crowsnest Pass on-line through the US WeatherBug (2019) site. The US AQI scale is slightly different from the Albertan scale since the US scale is based on the US National Ambient Air Quality Standard (NAAQS), whereas the Albertan AQHI is based on the Albertan AAQOs.

The US AQI scale is summarized in Table 4.16-1, along with health risk and health protective actions recommended during periods of diminishing air quality. The breakpoint from "Moderate" health risk (AQI of 51 to 100) to "Unhealthy for Sensitive People" (AQI of 101 to 150) is based on the US 24-hr average NAAQS (US EPA, 2012; Chen and Copes, 2013), which is 35 µg/m^3 for $PM_{2.5}$. The breakpoint from "Good" to "Moderate" is set at one-half the level of the annual standard or at one-half the level of the short-term standard if an annual standard is not available (Chen and Copes, 2013). The annual NAAQS for $PM_{2.5}$ is 12.0 µg/m^3 (US EPA, 2012). During periods of wildfire when $PM_{2.5}$ exceeds the NAAQS, the AQI would indicate moderate risk to hazardous conditions and trigger messaging for reducing or avoiding heavy exertion and time spent outdoors, as described in Table 4.16-1. During periods of wildfire, the AQI can be referenced on-line by all people living within the Project Area and other areas to determine health risk and appropriate health-protective actions.

Table 4.16-1 United States Air Quality Index

Health Risk	Air Quality Index	Sensitive Groups	General Population
Good	0 – 50	None	None
Moderate	51 – 100	Unusually sensitive people should consider reducing prolonged or heavy exertion. Respiratory symptoms possible in unusually sensitive individuals, possible aggravation of heart or lung disease in people with cardiopulmonary disease and older adults.	None
Unhealthy for Sensitive People	101 – 150	Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease, older adults, and people of lower SES. People with heart or lung disease, the elderly, children and pregnant women should limit prolonged or heavy exertion.	None
Unhealthy	151 – 200	Increased aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease, older adults, and people of lower SES; increased respiratory effects in general population.	Everyone should reduce prolonged or heavy exertion.

Table 4.16-1 United States Air Quality Index			
Health Risk	**Air Quality Index**	**Sensitive Groups**	**General Population**
Very Unhealthy	201 – 300	Significant aggravation of heart or lung disease and premature mortality in people with cardio-pulmonary disease, older adults, and people of lower SES.	Significant increase in respiratory effects in general population; everyone should avoid prolonged or heavy exertion.
Hazardous	301 – 500	Serious aggravation of heart or lung disease and premature mortality in people with cardiopulmonary disease, older adults, and people of lower SES. People with heart or lung disease, older adults, children, and people of lower SES should remain indoors and keep activity levels low.	Serious risk of respiratory effects in general population; everyone should avoid all physical activity outdoors.

Modified from US EPA (2014)

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FIGURES

R4 W5M

R3 W5M

T9

T8

T7

ACCESS TO BLAIRMORE CREEK

HWY 40

HISTORICAL SITES DjPo-98/130

ACCESS CONTROL POINT

PROJECT ACCESS ROAD

ALTERNATE ACCESS TO GOLD CREEK

Daisy Creek

Gold Creek

Cow Creek

Caudron Creek

Blairmore Creek

Nez Perce Creek

McGillivray Creek

Pellatier Creek

Morin Creek

Green Creek

Crowsnest River

Lyons Creek

York Creek

North York Creek

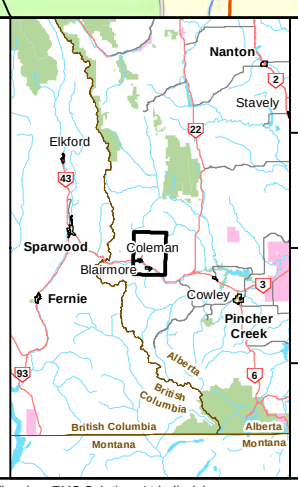
Frank Lake

LEGEND

- Existing Access Road
- Existing Powerline
- Mine Facilities
- Railway Loop
- Proposed Helipad Access
- Paved Road
- Gravel Road
- Trail\Unimproved
- Blairmore/Gold Creek
- Watercourse (Definite)
- Watercourse (Indefinite)
- Waterbody (Definite)
- Waterbody (Indefinite)
- Mine Permit Boundary
- Project Footprint

Land Ownership

- Crown
- Freehold - Benga
- Freehold - Benga 50%, Other 50%
- Freehold - Other



RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

GRASSY MOUNTAIN ACCESS ROUTES

AltaLIS, 2019; Deswik, 2016; Golder, 2016; MEMS, 2019; Riversdale, 2018

Coordinate System: NAD 1983 UTM Zone 11N

0 1 2 Kilometres

MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201

DRAWN BY: JLAMBERTS

CHECKED BY: GH

DATE: AUGUST 13, 2019

FIGURE 4.5-1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\Landuse\Resubmission\Information Request 3\Fig 4-5-1 Access Routes 14-00201.mxd

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APPENDIX 4.1-1: AN UPDATED ASSESSMENT OF THE POTENTIAL EFFECTS OF THE GRASSY MOUNTAIN PROJECT ON INDIGENOUS GROUPS

An
Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups

(Updated July 2019)
(Presented as Appendix 4.1-1 in Addendum 10)

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An Updated Assessment of the Potential Effects of the Grassy Mountain Project on Indigenous Groups

1.0 INTRODUCTION

Benga Mining Limited (Benga), a wholly owned subsidiary of Riversdale Resources Limited (Riversdale), is proposing to develop a nominal 4.5 million clean tonnes per year steelmaking coal mine, referred to as the Grassy Mountain Coal Project (the Project). The Project is located in southwest Alberta, approximately 150 km southwest of Calgary in the Crowsnest Pass. The proposed steelmaking coal processing facility is planned to be located approximately 7 km north of the community of Blairmore. Benga has been consulting and engaging with Indigenous groups that may be affected by the Project since June 2013.

On May 3, 2019, the Joint Review Panel (JRP) requested that Benga Mining provide additional information related to effects on Indigenous groups for the Grassy Mountain Coal Project. This information is required before the Project can proceed to the JRP hearing. This report provides information in response to Information Requests JRP IR-4.1 and JRP IR-4.2 regarding Indigenous Rights, Land Use and Culture.

For Information Requests JRP IR-4.1, this report provides an updated assessment of potential effects of the Project on Indigenous people using all shared traditional land use and related studies completed to date for the Project including any updated information contained in Addenda 1-9, traditional land use studies, cumulative effects assessments, consultation tables and submissions to the JRP directly from Indigenous groups. The following information is provided for each Indigenous group specified in the EIS Guidelines as well as Louis Bull Tribe, Montana First Nation and Ermineskin Cree Nation:

a) An updated assessment of the potential adverse effects to the environment for all biophysical Valued Components (VCs) including those identified by the Indigenous groups in traditional land or related studies. This includes ecological and social context, residual effects, conclusions and mitigation measures.
b) An assessment of the effects of the Project on lands and resources for traditional purposes focusing on resources, access, use and experience in accordance with the Agency's "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under *Canadian Environmental Assessment Act, 2012.*"

For Information Request JRP IR-4.2, this report provides an updated assessment of Project effects on Indigenous people using all shared traditional land use and related studies completed to date for the Project including traditional land use studies, cumulative effects assessments, consultation tables and

submissions directly from the Indigenous groups to the Panel. For each Indigenous group, a description and analysis is provided to show how Benga has assessed the connections to the land and the experiences embodied through both current use and physical and cultural heritage and how changes to the environment caused by the Project will directly or indirectly affect the tangible and intangible values of current use and the physical and cultural heritage of Indigenous peoples.

Indigenous groups that are potentially affected by the Project are defined in the *Terms of Reference for Environmental Impact Assessment Report* (Alberta Energy Regulator [AER], 2015); the *Guidelines for the Preparation of the Environmental Impact Statement* (Canadian Environmental Assessment Agency [CEAA], 2015a) and most recently, an email from CEAA to the Panel dated January 18, 2019 recommending the addition of three First Nations (CEAR #147). Indigenous groups identified as potentially affected by the Project are:

- Blood Tribe (Káínai Nation);
- Piikani Nation;
- Siksika Nation;
    - Stoney Nakoda Nation:
    - Bearspaw;
    - Chiniki; and
    - Wesley.
- Tsuut'ina Nation;
- Ktunaxa Nation:
- St. Mary's Indian Band;
    - Lower Kootenay Indian Band;
    - Tobacco Plains Indian Band; and
    - Akisq'nuk First Nation.
- Samson Cree Nation;
- Shuswap Indian Band;
- Foothills Ojibway First Nation;
- Métis Nation of Alberta;
- Métis Nation of British Columbia;
- Louis Bull Tribe;
- Montana First Nation; and
- Ermineskin Cree Nation.

This report is presented in the following sections:

Section 1 provides a Project background, a description of Information Requests JRP IR-4.1 and JRP IR-4.2 and lists Indigenous groups identified as potentially affected by the Project.

Section 2 provides a description on how Traditional Knowledge and Traditional Land Use is integrated into this report.

Section 3 provides an introduction with Project background and methods used to assess the Valued Components (VCs) with respect to Indigenous peoples. For Indigenous peoples, the assessment focuses on an effect of any change caused to the environment on physical and cultural heritage; the current use of lands and resources for traditional purposes; and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. The methods used in the assessment of potential effects of the Project on VCs are informed by the methods used in the assessment of potential effects on VCs in Section D of the EIA (CEAR #42) and CEAA guidance;

- *Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the Canadian Environmental Assessment Act, 2012;*
- *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archaeological, Paleontological or Architectural Significance under the Canadian Environmental Assessment Act, 2012;*
- *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project.*

Section 4 through Section 17 contain background information, potential effects of the Project, proposed mitigation measures, residual effects and significance determinations for each potentially affected Indigenous group.

Section 18 provides an assessment of cumulative effects, followed by Section 19 on follow up and monitoring.

2.0 INTEGRATING TRADITIONAL KNOWLEDGE AND TRADITIONAL LAND USE INFORMATION

Traditional Knowledge and Traditional Land Use (TK/TU) is interwoven into existing conditions and the assessment of potential effects to Indigenous groups. The objective of interweaving TK/TU with western science is to support or fill gaps in the assessment about species of importance, characteristics, behaviours, population trends, abundance, habitat, migration, and relationships with other species. Further, the incorporation of TK/TU brings cultural and spiritual elements to the

assessment that would otherwise be missing. In the words of Mi'kmaw Elder Albert Marshall (2005), the key principles guiding this *two-eyed seeing* into the assessment are:

- TK/TU is considered on par with scientific knowledge; and
- Indigenous groups are key contributors to the assessment of potential effects of the Project to the environment.

Based on the information provided in the TK/TU reports submitted to Benga, available information regarding important or valued components of the social and physical environment associated with Grassy Mountain was interwoven into the EIA. This information was used to ensure the identification and development of discipline-specific valued components (VCs) (*i.e.*, wildlife and vegetation), definition of assessment of spatial and temporal boundaries, collection of baseline information, identification of potential effects and the development of proposed mitigation and monitoring. This information was woven throughout this document as relevant to the assessment.

Throughout this assessment, reference to "the land" is often made when discussing the relationship between Indigenous peoples and the biophysical environment. It is important to note that "the land" has different meanings for Indigenous and non-Indigenous peoples. For Indigenous peoples, "the land" not only refers to the biophysical environment (land, water, air, plants, *etc.*), but also includes the interconnectedness cultural and spiritual elements embedded within the relationship of reciprocity and responsibility held between people and "the land." Further, "the land" has both a spirit and identity tied to the Creator often understood outside Indigenous cultures as "Mother Earth." Throughout the following sections, reference to "the land" includes this deeper and broader understanding.

3.0 ASSESSMENT METHODOLOGY

The following sections explain the approach for the updated assessment of Project effects on Indigenous groups. It follows the iterative 5-step process of the *Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under the Canadian Environmental Assessment Act, 2012*:

Step 1. Scoping including gathering information to identify valued components and potential effects and establishing spatial and temporal boundaries;

Step 2 and 3. Analysis of Potential effects and Mitigation - in this report, these steps are discussed together;

Step 4. Significance; and

Step 5. Follow-up.

3.1 Background Information and Scoping

Project setting and background information for each Indigenous group is provided in the background sections for each Indigenous group below. Each section includes a description of the presence and distribution of traditional resources and traditional land and resources use areas within the LSA and RSA, including historic, current and intended future uses; an explanation of the relative importance of identified resources, importance of access to these resources and preference for the use of these traditional land and resource areas; and a description of the physical and cultural importance of identified structures, sites or things to Indigenous heritage, including tangible and intangible context. The purpose of the background information is to inform the assessment of potential effects on VCs.

Background sections are drawn from information compiled in the EIA, relevant addenda and TK/TU studies provided to Benga from Indigenous groups. Several Indigenous groups undertook more fulsome TK/TU studies which were used for internal purposes and that not all information was shared in the summary TK/TU studies provided to Benga given issues around confidentiality, intellectual property, cultural sensitivity and more.

3.1.1 Spatial and Temporal Boundaries

3.1.1.1 Spatial Boundaries

The spatial boundaries for the assessment include a local study area (LSA) which is established based on the zone of influence of the Project beyond which the potential environmental, cultural and socio-economic effects of the Project are expected to be non-detectable. This includes the Project footprint which is the area of direct disturbance by mining activities such as the open pit mine, coal handling and processing plant, overland conveyor and train load-out facility and associated infrastructure (*e.g.*, rail system, equipment and explosives storage facilities, fueling station, water management structures, construction camp, coal conveyor and powerline, access roads). While the assessment of effects focuses on interactions occurring within the LSA, discussion of effects from associated VC Sections in the EIA are included in the assessment on Indigenous VCs.

The regional study area (RSA) for the Indigenous groups cumulative effects assessment was defined as the Project Wildlife - Grizzly Bear RSA, which is an area with a diameter of 50-60 km centered on the Project. This boundary was selected as the RSA as it is the broadest study area used in the EIA for environmental VCs that interact with Indigenous VCs.

The RSA comprises the area within which the VCs affected by the Project that could also be affected by past, present or future projects and captures impacts to Indigenous VCs that arise from environmental impacts (*e.g.*, reduced availability of wildlife that in turn might affect Indigenous hunting), as well as direct impacts to Indigenous VCs (*e.g.*, reduced access to harvesting locations due to a Project activity). Through the Project's ongoing consultation with Indigenous groups,

information provided has been more overarching and holistic, rather than location-specific, as some of the site-specific information is considered sacred and private to each of the Indigenous groups.

Benga is bound to "spatial boundaries" as defined by the EA process, but recognizes that these do not necessarily capture the intangible elements of a cultural landscape grounded in spirituality and the ethic of Indigenous peoples being in relationship with "the land."

3.1.1.2 Temporal Boundaries

The temporal boundaries for the assessment are:

- **Construction:**
- The overall construction phase of the Project is anticipated to be two years pending all necessary
  - approvals and permits;
- **Operation:**
- The Project is anticipated to operate for 23 years; and
- **Reclamation and closure:**
  - Progressive reclamation will commence in Year 5 and extend to end of mine (EOM). The final closure phase will commence at the EOM and could extend an additional 15 to 20 years until substantially all reclamation certificates are received.

3.1.2 Selection of Indigenous Valued Components and Potential Effects

VCs for the assessment of potential effects to Indigenous groups were identified based on guidance provided by the AER and CEAA; information provided by Indigenous groups during consultation; understanding of Indigenous interests as communicated by Indigenous groups; environmental assessments for similar projects; and publicly available sources. In response to JRP Information Requests JRP IR-4.1 and JRP IR-4.2, Benga has added the subcomponent "Cultural and Spiritual Values" and associated potential effects to the Current Use of Lands and Resources for the Traditional Resources VC. This subcomponent and the effects considered were based on the types of values considered in the TK/TU studies submitted by Indigenous groups and through the consultation process. The Indigenous Physical and Cultural Heritage VC includes consideration of any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. The latter are also considered in the cultural and spiritual values subcomponent, in recognition that there is overlap. The table below provides the list of the VCs and VC sub-components considered in response to JRP Information Requests JRP IR-4.1 and JRP IR-4.2.

Table 3.1.2-1 Indigenous Valued Components and Potential Effects

Indigenous Valued Components	Potential Effects to Indigenous Interests	Associated Valued Component[1]
Current Use of Lands and Resources for Traditional Purposes		
Hunting	Change in identified hunted species and habitat Change in use or access to identified hunting locations Change in preferred harvesting method	Wildlife Land and Resource Use Noise and Air
Trapping	Change in identified trapped species and habitat Change in use/access to identified trapping locations Change in preferred trapping method	Wildlife Land and Resource Use
Fishing	Change in identified fishing species and habitat Change in use or access to identified fishing locations Change in preferred fishing method	Aquatics/Fisheries Land and Resource Use
Plant Gathering	Change in use/access to identified vegetation species/habitat Change in use/access to identified plant gathering locations Change in preferred plant gathering method	Vegetation Land and Resource Use
Trails and Travelways	Change in use or access to identified trails and travelways Disturbance to features associated with trails and travelways	Land and Resource Use Historical Resources
Cultural and spiritual values (*e.g.*, sacred and ceremonial areas and activities, teaching areas, place names)	Disturbance to sacred and culturally or spiritually important sites and access to, or use, of those sites Changes to the experience of engaging with sites and landscape features that have cultural or spiritual value Changes to the cultural value and importance associated with the engagement with the sites/features of cultural or spiritual value (including inter-generational teaching of traditional practices)	Historical Resources
Indigenous Physical and Cultural Heritage (including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance)		
Indigenous Physical and Cultural Heritage	Disturbance to physical and cultural heritage Change in access to physical and cultural heritage Change to cultural value or importance associated with physical and cultural heritage Change in relationship with physical or cultural heritage	Historical Resource; Land and Resource Use

[1] Results of the assessments to other associated VCs in the Application including any relevant mitigation measures and discussion of potential residual and cumulative effects and follow-up programs will be referenced as appropriate.

3.2 Potential Effects on Indigenous Valued Components and related mitigation measures (Steps 2 and 3)

3.2.1 Pathways of Effects

Through review of information and knowledge provided in the Indigenous groups' TK/TU studies, Benga has gained insight into the tangible and intangible aspects of the cultural heritage of the Indigenous groups affected by the Project. Benga has considered these in responding to JRP Information Requests JRP IR-4.1 and JRP IR-4.2. It is understood that resources such as plants, fish and wildlife have always been important for food, subsistence and sustenance and that the gathering of these resources in specific areas has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, legends as well as resource use as medicine, food and more is shared while harvesting. The knowledge shared is often place-specific and relies on maintaining the integrity of the cultural landscapes such that they can continue to be used for teachings and quiet enjoyment of the land. In addition to this educational context, these intangible values are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

This report considers the information in the TK/TU studies, with a focus on tangible as well as intangible elements that are beyond changes to the lands and resources and a recognition that the cultural heritage of the Indigenous groups is embedded in the landscape.

The table below depicts the effects pathways that consider both tangible and intangible values.

Table 3.2.1-1 Pathways of Potential Effects on Indigenous Valued Components

Project Activity	Pathway of Effect	Potential Effect on the Environment	Link to Indigenous Valued Component
Site Preparation and Construction	Vegetation clearing	Change in wildlife habitat availability, mortality risk and population; Change in vegetation and wetlands	Use of or access to hunting, trapping, fishing, plant gathering, trails and travelways and cultural and spiritual practices
Road Use	Access road use	Change in wildlife mortality risk, movement, population; Change in land and resource use	Access to hunting, trapping, fishing, plant gathering, trails and travelways and cultural and spiritual practices

Table 3.2.1-1 Pathways of Potential Effects on Indigenous Valued Components

Project Activity	Pathway of Effect	Potential Effect on the Environment	Link to Indigenous Valued Component
Mine pit operations	Land use	Change in land and resources use	Use of or access to hunting, trapping, fishing, plant gathering, trails and travelways and cultural and spiritual practices
Mine pit operations	Indirect (sensory) disturbance	Increase in noise, odour and visual disturbance to wildlife and Indigenous groups	Use of or access to hunting, trapping, fishing, plant gathering, trails and travelways and cultural and spiritual practices
Mine pit operations	Sediment discharge and air emissions	Change in air quality; Change in water quality; Change in wildlife health	Use of or access to hunting, trapping, fishing, plant gathering and cultural and spiritual practices

3.2.2 Mitigation Measures

Proposed mitigation measures are identified to avoid or reduce potential effects to Indigenous VCs. Recommendations for mitigation measures made by Indigenous groups through TK/TU Studies and consultation are referenced and considered in each part of this assessment where they were provided. Recommendations and views expressed about the effectiveness of proposed mitigation measures are included, where available. Mitigation measures developed specifically to avoid or reduce potential effects to Indigenous groups are detailed in the Access Management Plan (Appendix 4.5-1 to JRP IR-4.5) and will also be included in the Cultural Site Discovery Contingency Plan.

Benga will continue to consult with Indigenous groups regarding mitigation and monitoring throughout the life of the Project in keeping with an adaptive management approach and a commitment to meaningful interweaving of TK into reclamation and closure (*e.g.*, monitoring) planning.

3.3 Characterization of Residual Effects and Determination of Significance (Step 4)

Residual effects are effects that are anticipated to remain after the implementation of mitigation measures. Residual effects on Indigenous VCs are characterized for each Indigenous group based on the criteria in the table below.

Table 3.3-1 Characterization of Residual Effects on Indigenous Valued Components

Residual Effects Characterization Criteria	Description	Definition
Magnitude	Magnitude describes the amount of change associated with the residual adverse effect to Indigenous Interests within the spatial boundaries.	Negligible – no change in the ability to exercise an Indigenous interest Low – a change in the ability to exercise an Indigenous Interest but within normal annual variability. Will not affect the ability to exercise an Indigenous interest in the RSA. Moderate – a change in the ability to exercise an Indigenous Interest outside a normal annual variability. Will not affect the ability to exercise the Indigenous interest in the RSA. High – a change in the ability to exercise an Indigenous interest outside of normal annual variability. May affect the ability to exercise the Indigenous Interest within the RSA.
Geographic extent	Geographic extent refers to the spatial scale within which a residual adverse effect is predicted.	Local = local study area Regional = regional study area
Duration	Duration is the length of time that the potential residual effect could last.	Short term – limited to the construction phase Medium term – construction to operation Long-term – beyond the Project lifespan
Frequency	Frequency is related to duration and it refers to how often the residual effect is expected to occur.	Once = occurs once Regular = occurs regularly Continuous = occurs continuously
Reversibility	Reversibility refers to whether the residual adverse effect can be reversed to baseline conditions.	Reversible Non reversible - permanent
Ecological and social context	Context refers to the sensitivity and resilience of the Indigenous Interest to change caused by the Project.	Sensitive – the Indigenous interest is sensitive or has low resiliency to disruption Resilient – the Indigenous interest is not sensitive or has high resiliency to disruption

The residual effects definitions above remain unchanged from the EIA definitions; however, they are interpreted in the characterization of residual effects with input received from Indigenous groups through their TK/TU studies and comments made during consultation.

The determination of significance of potential residual effects for the Current Use of Lands and Resources for Traditional Purposes and Indigenous Cultural and Physical Heritage VCs follows the process outlined in CEAA "Technical Guidance for Assessing Current Use of Lands and Resources for Traditional Purposes under the *Canadian Environmental Assessment Act*, 2012" (CEAA, 2015c) and the "Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the *Canadian Environmental Assessment Act*, 2012"(CEAA, 2015d2015c):

Stage 1: Determining whether the residual environmental effects are **adverse**;

Stage 2: Determining whether the residual adverse environmental effects are **significant**;

Stage 3: Determining whether the significant adverse environmental effects are **likely**.

Due to the qualitative and, at times, intangible nature of information provided by Indigenous groups, professional judgement is applied to the determination of significance in some cases. When a project is predicted to have adverse environmental effects, the EIA considers the significance of the adverse environmental effects after considering the implementation of mitigation measures, including a consideration of the level of effectiveness of mitigation measures and uncertainties. The determination of significance of effects to Indigenous VCs considers the following factors:

Significance	Significance refers to whether the Project is likely to cause significant adverse effects after considering the implementation of mitigation measures.	Not significant – effects are predicted to be within the range of natural variability and below guideline or threshold levels Significant – effects are predicted to cause irreversible changes to the sustainability or integrity of a population or resource

Additional elements are considered in determining significance:

- potential environmental effects of the Project and determination of significance described in the assessment of environmental biophysical VCs;
- the potential effect of the Project on the ability to continue to exercise Indigenous interests including treaty rights; and
- the extent to which mitigation measures can reasonably address potential effects.

Likelihood, or the probability of an environmental effect occurring, is considered only where it is established that a residual effect is significant.

3.3.1 Cumulative Effects Assessment

The cumulative effects assessment provides a qualitative discussion of potential cumulative effects on Indigenous VCs that have residual adverse effects (*i.e.,* those that have not been fully mitigated or accommodated based on the relevant Project effects identified for associated VCs). Establishing which other projects or activities may interact cumulatively with the effects of the Project is done in consideration of views of Indigenous groups and assessment as described in Cumulative Effects Assessment in Addendum 8.

Determining which VCs are included in the discussion of cumulative effects is based on input from Indigenous groups and the residual effects assessment for associated VCs. Identifying the spatial and temporal overlap of the residual effects with those of other projects or activities is focused on interactions with other projects and activities that are in proximity to the Project. These activities are described and shown in corresponding figures. The discussion of whether there is a reasonable expectation for the occurrence of a cumulative effect is based on a qualitative interpretation of how cumulative effects may affect Indigenous people. Cumulative effects may be minimized through the implementation of Project-specific mitigation measures and regional level management by government. Indigenous led community-based monitoring will likely play an additional role in cumulative effects monitoring, mitigation and adaptive management.

3.4 Follow-up and Monitoring Programs (Step 5)

The purpose of follow-up and monitoring programs is to verify the accuracy of the effects assessment, determine the effectiveness of mitigation measures identified for the Project and implement adaptive management as required. Follow-up and monitoring programs related to Indigenous VCs are described in Section 19 of this Information Request response. Residual effects are likely, and the effectiveness of proposed mitigation measures is uncertain. The focus of follow-up and monitoring programs is on VCs that are characterized as not resilient. In addition, views provided by Indigenous groups on monitoring and reclamation are presented and discussed.

4.0 KÁÍNAI NATION CONSULTATION AND ASSESSMENT

4.1 Káínai Nation Consultation Summary

Consultation and engagement activities with the Káínai Nation have included:

- ongoing and regular phone and e-mail communications;

- development of on-going field programs to:
  - assess and refine recommendations for mitigation of specific Traditional Use sites;
  - assess potential impacts of the Project on archaeological sites of cultural interest identified as part of the Historic Resources Impact Assessment (HRIA) and consider recommendations for mitigation as outlined in the HRIA;
- meetings to discuss project updates issues and concerns and to seek input on the Project and the environmental assessment; and
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - draft CEAA EIS guidelines;
  - final CEAA Project Description; and
  - information packages.

Benga initiated engagement with the Káinai Nation in June 2013 with a meeting at the Káinai Nation council chambers to introduce the company and team members and express Benga's interest in developing the Project in the Crowsnest Pass. In the meeting, the Káinai Nation, provided a background on the area, their Indigenous Interests, their administrative structure and expressed interest in continued engagement.

Benga and the Káinai Nation collaboratively developed a work plan and budget, based on the First Nations Consultation Plan, to outline the tasks and schedules associated with continued engagement and to identify the Káinai Nation's resource needs for continued participation as the Project progressed through the EA process. The consultation work plan and budget were revised, as necessary, to accommodate unanticipated changes to the Project or the regulatory process such as Project changes bringing it under CEAA purview and referral of the Project to a JRP.

In accordance with the First Nations Consultation Plan, Benga provided a copy of the PTOR to the Káinai Nation in December 2014 and followed-up with emails and in-person as well as teleconference meetings to discuss the PTOR in detail. In late January 2015, Benga provided the Káinai Nation's comments to the ACO and AER. Similarly, Benga provided information and reviewed the CEAA process starting in February 2014 and met with the Káinai Nation in April 2015 to discuss the CEAA Draft EIS Guidelines. In June 2015 Benga provided the final version of the EIS Guidelines to the Káinai Nation. In July 2015, Benga provided an information update on funding opportunities for participation in the CEAA review process. Between August 2015 and July 2016, Benga continued communications with the Káinai Nation regarding fieldwork, additional mapping, consultation protocols and terms of engagement.

Between August 2016 and April 2019, Benga and the Káínai Nation representatives maintained ongoing dialogue regarding the EIA mitigation measures and issues and concerns. The Káínai Nation engaged in a project review by submitting comments, participating in meetings, undertaking traditional use fieldwork and site visits and carrying out the following additional work for the Project:

- Cumulative effects assessment;
- TK/TU Assessment; and
- Assessment of archaeological sites of interest identified as part of the Historic Resources Impact Assessment (HRIA).

In December 2018, Benga received two reports from the Káínai Nation:

- Cumulative Effects Assessment for the Káínai Nation (Carlson *et al*., 2018a); and
- Blood Tribe/Káínai Nation Traditional Knowledge & Use Assessment Grassy Mountain Coal Project (O'Connor, 2018).

The documents referenced above and communications from the Káínai Nation use the following terms and spellings: Bloods, Blood Tribe, Káínai or Kainai First Nation. For the purpose of this report, Benga uses the Káínai Nation.

Information provided to Benga after the submission of this consultation update report will be considered by Benga and incorporated into the Project planning as appropriate.

4.2 Káínai Nation Traditional Use and Traditional Knowledge Studies

Káínai Nation has submitted the following two traditional use studies for the Project to Benga. Funding to undertake this work was provided by Benga:

- Public Report on Káínai Traditional Knowledge and Use of the Grassy Mountain Area (Káínai Nation, 2015); and
- Blood Tribe/ Káínai Nation Traditional Knowledge & Use Assessment (TKUA) for the Grassy Mountain Coal Project (O'Connor, 2018).

The first report was produced prior to the EIA submission and was fully integrated. Both reports were used to compile Addendum 9 (CEAR #185). A non-public and confidential version of the 2015 TKU report was produced and was not provided to Benga. It is more comprehensive than the public report, was developed for the Káínai Nation and is housed and controlled by the Káínai Nation.

The TKUA was completed in the summer of 2018 to "further access and refine recommendations for mitigation of specific Traditional Use sites and areas within the Grassy Mountain Project area identified by the Káínai Nation during their 2014 and 2015 Traditional Land Use Assessment

fieldwork" and to "assess potential impacts of the Project on archaeological sites of interest identified as part of the Historic Resources Impact Assessment" (O'Connor, 2018, p. 5). The report outlines the methodology of the TKUA; discusses general the Káinai Nation history; culture and traditional use patterns; provides a technical review of the EIA; and undertakes an assessment of the potential effects of the Project on traditional use, traditional resources and areas of ceremonial, spiritual, cultural, educational or historical value to the Káinai Nation.

Information about lands and resources of value to the Káinai Nation was also provided in the Káinai Nation Cumulative Effects Assessment (Carlson *et al*., 2018a).

The Káinai Nation's Traditional Knowledge and Use (TK/TU) of the Grassy Mountain Area served as an instrument for the Káinai Nation to record traditional knowledge and land uses, to identify potential effects of the proposed Project and to give the Káinai Nation knowledge holders an opportunity to provide ideas for mitigation of potential effects. This study is a vital component of the consultation process because TK/TU studies enhance the quality of an environmental assessment in terms of confidence in results, avoiding potential effects to the Káinai Nation and incorporating knowledge of the local environment

4.3 Current Use of Lands and Resources for the Káinai Nation Traditional Purposes

4.3.1 Background of Current Use of Lands and Resources for the Káinai Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Káinai Nation since the EIA (CEAR #42) was submitted, in the TKUA (O'Connor, 2018) and the Káinai Nation Cumulative Effects Assessment (Carlson *et al*., 2018a).

The Káinai Nation has long participated in and continues to practice, a seasonal round that involves travel throughout their territory for hunting and gathering resources based on an annual cycle. The Káinai Nation have close connections to the alpine part of their land, and they hunt large game while harvesting plant resources for spiritual and subsistence purposes throughout Crowsnest Pass. The Káinai Nation were nomadic and hunted in areas where they travelled and moved, including through neighboring territories (Káinai Nation, 2015). In the past, buffalo were available in Crowsnest Pass during the winter when they concentrated in the bottom of the valley at Crowsnest River. With the arrival of Euro-Canadian settlers, the once abundant buffalo herds became extinct in the late 1800s resulting in pervasive starvation among Blackfoot groups and forcing the Káinai Nation members to shift into ranching to sustain their livelihoods (Káinai Nation, 2015). Today, the Káinai Nation members continue to hunt for sustenance as well as for spiritual and ceremonial purposes.

4.3.1.1 Hunting

The Káínai Nation members hunt in their territory focusing mainly on deer and elk. The TKUA indicates that the Project LSA and RSA provide habitat for many important species hunted for traditional and subsistence purposes, including elk, mule deer, bighorn sheep, moose and bear (O'Connor, 2018). A key hunting location for the Káínai Nation is the timber limit (No 148A), located approximately 90 km southeast of the Project. The Káínai Nation hunters target several species in the timber limit including moose, elk, deer (mule and white-tailed), bear (grizzly and black) and cougar (Káínai Nation, 2015). Additional harvested species identified through consultation with the Káínai Nation include grouse (ruffed, sharp-tailed), eagle, hawk, osprey, Canada goose, ducks (mallard, merganser) and historically, bison (O'Connor, 2018; Káínai Nation, 2015).

The TKUA identifies that, while the Káínai Nation members do not use the Project LSA and RSA as extensively to hunt today as they did in the past, the area continues to be the source of wildlife hunted for use in ceremonies, sacred bundles and for subsistence purposes. The Káínai Nation indicates a preference for mule deer in the mountains over grain-fed deer on the prairies. Hunting practices today have been largely constrained by the fragmentation of biophysical and cultural landscapes, industrial development and the prohibitive monetary, temporal and social costs incurred to many individuals with employment obligations.

The Blood Tribe Hunting Concentration Map in the TKUA depicts the Káínai Nation's hunting areas, hunting camps and big game observations (O'Connor, 2018, p. 78). They hunt, or have hunted, in the following areas: Forestry Trunk Road which provides access to the western portion of the Project TLU RSA and LSA; Gold Creek Valley; and Blairmore Creek Valley (O'Connor, 2018). The TKUA describes the potential value of big game hunting within the LSA and observes occurrences of the following: bone fragments (potentially deer and elk), moose, bear and elk scat, bear claw marks, mule deer, suitable moose habitat, ducks and grouse (O'Connor, 2018).

The Káínai Nation indicated "they do not hunt or fish in national parks, provincial parks or ecological reserves, so these areas were deemed inaccessible for traditional land use" (Carlson *et al*., 2018a, p. 69). The Káínai Nation does not hunt in close proximity to well sites (approximately 500 m) and, as outlined in the Káínai Nation's Cumulative Effects Assessment, indicates they would not hunt near industrial sites, settlements, rural residence and other features used for non-TLU purposes due to concerns about contamination, safety and an overall negative experience on the land (Carlson *et al*., 2018a).

Historically, birds were not a primary source of food; however, ducks, geese, swan and prairie chicken were hunted during times when buffalo were not available (Dempsey, 2001). The TKUA report identified that the Káínai Nation hunt ruffed goose, sharp-tailed grouse, Canada goose,

mallard and merganser (O'Connor, 2018). Some birds are also harvested for traditional purposes such as eagles, hawks and osprey (O'Connor, 2018).

During the Grassy Mountain TK/TU Program, one Elder explained the Blackfoot ethos of hunting as well as species of importance, such as bighorn sheep:

> Hunting is part of a larger system. We do not hunt for trophies. This time of year (December), we are hunting sheep because they have the highest fat content now. Buffalo meat is lean. We make pemmican, which is dried meat mixed with Saskatoon berries. In fact, Saskatoon berries are a culturally important resource to the Káinai Nation. During seasonal rounds, we harvested bighorn sheep in their wintering grounds. – Káinai Elder (Workshop, December 2, 2014) (Káinai Nation, 2015, p. 31)

Other species were also used traditionally for clothing and tool making. The Káinai Nation reported a preference for making clothing from elk hide because it is thicker than deer hide and easier to process than bison hide (Káinai Nation, 2015). After contact with Euro-Canadian settlers, Káinai traded surplus goods from their territory including buffalo robes and meat as well as fox and wolf skins at Rocky Mountain House (approximately 300 km north of Grassy Mountain) (Parks Canada, 2008).

The bow and arrow were used in hunting among Blackfoot people. With the introduction of trade among newly arrived settlers, Blackfoot adapted their hunting practices to include horses and rifles. The Káinai Nation, like other Blackfoot groups, also used buffalo jumps to harvest large numbers of buffalo. These jumps were cliffs on the prairie near buffalo wintering grounds where herds were corralled into driving lanes lined with shrubs and driven off the cliffs (Dempsey, 2001).

4.3.1.2 Trapping

The TKUA indicates that trapping in the Project LSA and RSA may occur today likely for both subsistence and ceremonial purposes; it further describes traditional trapping practices for species such as the golden eagle and fur bearing animals that took place prior to industrial and land use constraints being imposed on these practices in the 1950's (O'Connor, 2018). The Káinai Nation Elders described the practice of trapping golden eagles for the use of their feathers on Bluff Mountain and possibly Grassy Mountain. Trapping eagles occurs in March during the northern migration from the southern nesting grounds. The Káinai Nation would construct mounds of earth with a hollow centre and lay wolf liver on top of the trap to lure eagles (Káinai Nation, 2015). Other species identified for trapping included muskrat, beaver and mink (Káinai Nation, 2015).

4.3.1.3 Fishing

The Káinai Nation members traditionally fished for trout in September each year due to ease of harvest (Káinai Nation, 2015). The methods of fishing include the use of sticks with wires to scoop trout out of the water (Káinai Nation, 2015).

The Káínai Nation Elders report that current methods of fishing are adaptations to western practices undertaken on reservoirs near communities. This includes fishing in the fall as well as ice fishing in the winter (Káínai Nation, 2015). During consultation, the Káínai Nation identified species of interest including Westslope Cutthroat trout, Rainbow trout, Bull trout, Suckers, Squaw fish, Pike, Whitefish and Walleye (Káínai Nation, 2015). In addition, the TKUA identifies the following species of importance to the Káínai Nation: Westslope Cutthroat trout, Rainbow trout, Bull trout and Rocky Mountain Whitefish (O'Connor, 2018). The TKUA indicates that the Káínai Nation members fish for subsistence purposes in the Crowsnest River watershed and the Old Man River watershed north of the Project RSA.

The TKUA summarizes information identified in EIA Volume 1 (EIA, CEAR #42), noting the importance of the habitat in the Crowsnest River, Blairmore Creek, Gold Creek and two upstream tributaries and the presence of Westslope Cutthroat trout, trout, Rainbow trout, Mountain whitefish and Bull trout in those waters. In addition, the Káínai Nation research team observed occurrences of fish in the Blairmore Creek and noted that Brook trout is not native to the area (O'Connor, 2018).

The Káínai Nation TKUA indicates that disturbances to fish habitat in the watershed, inclusive of TLU LSA streams Blairmore Creek and Gold Creek, could interfere with the availability of subsistence fish species such as Mountain whitefish or trout and impact the Káínai Nation rights to fish for food (O'Connor, 2018). The Blood Tribe Food & Medicinal Plant Gathering Areas, Fishing & Trapping Map in the TKUA depicts the areas where these fish were found (O'Connor, 2018, p. 86).

The Káínai Nation indicated "they do not hunt or fish in national parks, provincial parks and ecological reserves, so these areas were deemed inaccessible for traditional land use," (Carlson *et al*., 2018a, p. 69). Furthermore, the Káínai Nation does not fish in close proximity to well sites (approximately 500 m) and it was assumed in the Káínai Nation's Cumulative Effects Assessment that they would not fish near industrial sites, settlements, rural residence and other features used for non-TLU purposes due to concerns regarding contamination, safety and the overall negative experience on the land (Carlson *et al*., 2018a).

4.3.1.4 Plant Gathering

The TKUA indicates that the Káínai Nation uses plants and foods for medicinal, cultural and subsistence purposes, as well as for traditional building (*e.g.,* the use of lodgepole pine to make tipi poles). Harvesting food and plants is described as important to Blackfoot culture, medicine and subsistence (O'Connor, 2018). The TKUA notes that the Project LSA is a valuable source of a variety of trees, shrubs and other plants with traditional medicinal, subsistence and artisanal uses and that the vegetation available in the Project LSA is relatively unique compared to the vegetation on the prairie around the Káínai Nation reserve. Some of the vegetation is sourced specifically in the TLU LSA and RSA for ceremonial purposes.

In the past, plant harvesting was important among the Káínai Nation, including for alpine fir, juniper, fireweed, bearberry, spikemoss and lodgepole pines in the forests in the foothills of the Káínai Nation traditional territory (Galileo, 2014). They targeted a diverse range of 62 plants available throughout their territory in the spring and summer months (Galileo, 2014). The mountainous areas of their territory provided important medicinal and ceremonial plants that were not available on the plains, including sweet pine, yarrow, ochre and bearberry (Káínai Nation, 2015). According to Dempsey, "serviceberries and chokeberries were the most widely used, particularly for making pemmican. The dish consisted of a mixture of pulverized dried meat, pounded dried berries and hot marrow fat. It would keep for many months, stored in rawhide sacks…" (Dempsey, 2001, p. 620).

According to another secondary source, "the first thunderclap of spring tells us that the Thunder Medicine Bundle may be opened. Sweetgrass and sage are our most sacred healing herbs of mind and spirit grow here at the Belly Butte, our sacred Sundance site" (2014, cited in Section H, p. 27).

The Káínai Nation members have always followed cultural protocols associated with gathering plants for medicinal, ceremonial and consumption purposes. According to the seasonal round, plants are generally gathered in the spring except for lodgepole pine, which is harvested in the fall for making tipi poles. Five locations associated with plant gathering overlap the Project area on Crown land (Káínai Nation, 2015). Plants identified for gathering in the LSA are lodgepole pine, sweet pine, wild licorice, horsetail, thimbleberry and aspen. As indicated in eight areas of the Project footprint, the Káínai Nation technicians undertook active harvesting of these important plants during ground-truthing efforts in preparation for sundances as well as other cultural ceremonies and for medicinal purposes (O'Connor, 2018). The Káínai Nation members continue to harvest important plant resources including: spruce, poplar, aspen, black cottonwood, willow and balsam fir (Káínai Nation, 2015). Additional species identified by the Káínai Nation (2015) include yarrow, mushrooms, cottonwood, birch, Saskatoon berries, choke cherries, huckleberries, white bark pine, sweetgrass, red willow, willow berries, rose hip, Echinacea, husk, raspberry, bitter root and Kinnikinnick, strawberries and Labrador Tea.

During their field visit for their TKUA, the Káínai Nation observed occurrences of the following plants with food, ceremonial and medicinal use within the TLU LSA: Wild rose, Buffalo berries, Saskatoon berries, Yarrow, Prairie Crocus, Wild Strawberry, Labrador Tea, Arboreal mosses, Lodgepole pine, White spruce, Rocky Mountain alpine fur, Common juniper berry, Sweetgrass, Willow Trees, Paintbrush plants, Gooseberry, Horsetail, Wolfwillow, and Red cherry or currant (O'Connor, 2018, p. 87-88).

The TKUA identifies other plants with food, ceremonial and medicinal use within the TLU local study area: Indian rhubarb (likely cow parsnip or Heracleum maximum but also possibly Bear root bitterroot, wild licorice, wild onion, a sweet root and red tea (likely Red-osier dogwood). The Blood

Tribe Food & Medicinal Plant Gathering Areas, Fishing & Trapping Map in the TKUA depicts the areas where these plants were found (O'Connor, 2018, p. 86).

4.3.1.5 Trails and Travelways

Blackfoot moved freely through the Project area in pursuit of resources and defence of their territory (Káínai Nation, 2015). During the TK/TU program, the Káínai Nation members did not provide any specific information about traditional trails and travel corridors and spoke more generally about navigation methods through the mountains. The Káínai Nation members detailed natural phenomena and the night sky as navigational tools used for travel. According to one of the Elders, the Dipper is used among Blackfoot to assist with navigation and denotes the period of wildlife reproduction. The Dipper is used by Blackfoot members like a clock to tell the time of night and the season (Káínai Nation, 2015). The Káínai Nation also utilized other indicators for navigational purposes, such as sap on trees, which typically occurs on the north facing side. Another navigational technique is reading which way trees lean to determine prevailing winds (Káínai Nation, 2015).

The Blackfoot have used Crowsnest Pass as an east-west travel corridor to hunt buffalo and harvest plants in times of peace and to defend their territory against the Kootenay to the west in times of war (Káínai Nation, 2015). McClintock (1910) describes his travels through the Káínai Nation territory on his way to meet the Piikani Chief Brings-down-the-Sun and highlights the trail and travel between the Káínai Nation and Piikani group to the west in relation to the Rocky Mountains:

> We left the [Káínai] camp soon after sunrise, riding along the Okoan [Belly] River and through groves of large cottonwoods. After fording the river, we turned toward the mountains and the country of the North Piegans. Heavy clouds covered the plain, completely hiding the sun. But the snow-clad summits of the Rockies in the west, glowed in the rays that shone above the clouds. We followed an old Indian trail known to Kionama and Onesta, a short cut, that took us across a broad plain. (McClintock, 1910, p. 375).

Blackfoot traveled by horse and foot supported by travois and dogs. The Káínai Nation members would also travel in the spring and autumn to the north at Rocky Mountain House and Fort Edmonton for trading meat, robes made of buffalo, horses and a limited supply of furs (Dempsey, 2001).

The TKUA indicates that traditional Blackfoot trails and travelways into the Crowsnest Pass were roughly in line with Highway 3 and that the areas within the Project LSA and RSA were used as camping and hunting areas along the trade route (O'Connor, 2018). Sites within the Project TLU LSA and RSA, such as DjPo-63, could contain archaeological and historic resources that are associated with

Blackfoot use of trails in the area (O'Connor, 2018). The TKUA identifies the following key trails and travelways important for access today:

- Access roads into TLU LSA from Highway 3;
- Access into TLU LSA from Highway 40 *via* a gas lease road; and
- Daisy Creek Trail.

4.3.1.6 Cultural and Spiritual Values

As with all Nations in the Project area, the Káínai draw their culture from the area – the land, the landscape and the animals. There is a kinship with the animals which continues to provide lessons and teachings by which to live. The TKUA indicates that the Crowsnest Pass area is a "very sensitive area" and is central to Blackfoot culture, spirituality and culture (O'Connor, 2018, p. 63). The Káínai Nation maintain a strong and historically rooted cultural and spiritual connection to the land and animals surrounding the proposed mine site.

There are many well-known and documented sacred places and gathering areas throughout the Káínai Nation territory. These sacred sites are unifying symbols, provide evidence for cultural continuity and establish and reinforce national and personal connections to the landscape. The Káínai Nation noted Crowsnest Mountain (approximately 10 km west of the Grassy Mountain LSA) as an important landscape marker and associated with Blackfoot myths and traditional culture and is still referenced in ceremonial purposes (Káínai Nation, 2015).

While country foods have always been important for food, subsistence and sustenance, the practice of hunting has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

Likewise, fishing has always been important for food, subsistence and sustenance and the activity of fishing has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, legends as well as fish use as medicine, food and more is shared while fishing. In addition, to this educational context, the activity of fishing is typically linked to other intangible values with spiritual, artistic and aesthetic elements. For example, fishing typically provides for quiet enjoyment of the landscape or access to water for other uses.

Intergenerational knowledge provides instruction on cultural and spiritual practices such as gathering plants for food and subsistence, ceremonial procedures, legends, using plants as medicine and harvesting berries. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

4.3.2 Potential Effects and Mitigation Measures on Current Use of Lands and Resources for the Káinai Nation Traditional Purposes

This section describes the Project effects on current use of lands and resources for traditional purposes for the Káinai Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Káinai Nation.

4.3.2.1 Hunting

The Káinai Nation continues to hunt throughout their traditional territory and have indicated that they hunt or have hunted in the following areas: Forestry Trunk Road, which provides access to the western portion of the Project TLU RSA and LSA, Gold Creek Valley and Blairmore Creek Valley (O'Connor, 2018). The Project is bounded by Blairmore Creek to the west and Gold Creek to the east with Bluff Mountain to the south. Currently, areas to the west of Blairmore Creek and Crown lands to the north of the Site are primarily accessed from Highway 40 using a trail network. This is because the topography on both sides of Blairmore Creek is quite steep and there are few feasible crossing locations. Areas to the east of Gold Creek are accessed by using the existing Benga-owned Grassy Mountain Road and other trails through Benga-owned private land. Alternatively, lands to the east of Gold Creek can be accessed through a trail system from the south originating from the Frank Slide Interpretive Center, or from the purple trails at the north of the Project site.

The Project activities will intersect or be in proximity to habitat and species that are identified for hunting by the Káinai Nation. These species are moose, elk, deer (mule and white-tailed), bear (grizzly and black) and cougar, grouse (ruffed, sharp-tailed), eagle, hawk, osprey, Canada goose, ducks (mallard, merganser) and historically, bison (Káinai Nation, 2015).

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to the Káinai Nation hunting. CR #9 (EIA, CEAR #42) addresses direct and indirect effects on key wildlife species and their habitats of species that are hunted by the Káinai Nation; these include loss of habitat availability (through direct loss or indirect through sensory disturbance), disruption of wildlife movement (through habitat fragmentation and reduced connectivity), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, could affect the cultural and spiritual relationship between the Káinai Nation and wildlife.

CR #5 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. In summary, the Project is not expected to have direct adverse effects on water quality or aquatic health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as moose, elk, deer and bear hunted by the Káinai Nation members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Káinai Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Káinai Nation and wildlife.

CR #10 addresses potential effects to land use activities related to hunting. According to the TKUA, the primary adverse effect is loss of Crown land for hunting and loss of access to wildlife habitat (O'Connor, 2018). The consequence is loss of hunting opportunities and a likely decline in hunting in the TLU LSA and RSA. Likewise, these effects could affect the cultural and spiritual relationship between the Káinai Nation and wildlife.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect project infrastructure. This will limit the Káinai Nation access during construction and operation of the Project, which is approximately 25 years. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga has produced an Access Management Plan to facilitate access for traditional land use activities within the LSA.

To address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and by extension effects on hunters. Key features are:

- continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;

- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
    - commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover; and
    - establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation.
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- engage with the Káínai Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- retain vegetation adjacent to high-activity linear corridors (*e.g.,* access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- continue to work with the Káínai Nation to identify species of importance for harvesting prior to construction activities;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- store all toxic materials, including those used for blasting, in secure areas that are inaccessible to wildlife (*e.g.,* buildings, storage areas surrounded by wildlife-proof fencing). In addition,

proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and

- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

The Káinai Nation suggested the following in the TKUA:

- establishment of a network of provincial, national parks and sanctuaries where hunting is prohibited. These areas provide refugia for wildlife and act as source areas for repopulating adjacent areas where mortality rates may be higher (Carlson *et al*., 2018, p. C-14);
- road sanctuary buffers on selected roads. These buffers are generally applied to roads where hunting is prohibited within 365 m of the road right of way (Carlson *et al*., 2018, p. C-14); and
- Alberta's hunting "constraint" regulations (number of available tags, when and where one can harvest) reflect the basic understanding that hunters with extensive "access" to the regional landscape of a wildlife species can, if unregulated, create a combined mortality rate that is excessive relative to population objectives. The greater the extent to which the hunting community can access wildlife habitat with vehicles (including OHVs), the greater the need for regulatory constraints (Carlson *et al*., 2018, p. C-14).

Benga's response to the above suggestions is as follows:

- Benga has committed to meet with Káinai on a regular basis to review the environmental performance of the Project. Timing and frequency of such meetings will be determined on a consensual basis based on the information to be reviewed;
- The only road within the scope of the Project is the main access road which runs entirely within Benga privately owned land. Benga does not allow hunting on its privately-owned lands;
- Benga will support an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise; and
- Benga will support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of hunters. Benga has proposed mitigation for visual impacts and dust in CR #1 (EIA, CEAR #42) and for noise in CR #2 (EIA, CEAR #42). If the Káínai Nation has additional measures to suggest mitigating for hunting experience, Benga will continue to work with the Nation on mitigation measures.

4.3.2.2 Trapping

The TKUA states that potential effects to the Káínai Nation trapping are similar to the potential effects on the Káínai Nation hunting. Adverse Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution, or change in animal behaviour for furbearers important to the Káínai Nation such as marten, lynx, wolf, beaver and rabbits. These effects could result in reduced trapping opportunities and reduced success to trapping sites for the Káínai Nation. In addition, the TKUA identifies interference with traditional practice of trapping eagles and harvesting eagle feathers as an effect to the Káínai Nation. The TKUA states "the Project could reduce the availability of nesting areas for bald eagles and golden eagles and Project-related noise, dust and pollution and other sensory disturbances could displace eagles from the Project footprint" (O'Connor, 2018, p. 105).

The TKUA re-states Benga's proposed mitigation and provides their analysis and comments (O'Connor, 2018). A specific mitigation measure that will be taken by Benga is to conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to mitigate effects on nesting eagles.

4.3.2.3 Fishing

The Káínai Nation advised they have a fishing interest in the Project area and identified species including Westslope Cutthroat trout, Rainbow trout, Bull trout, Suckers, Squaw fish, Pike, Whitefish and Walleye (Káínai Nation, 2015).

Land and Resource Use addresses potential effects to land use activities including accessibility to the Project area. Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and Blairmore Creek can be assessed from Highway 40 using existing trails. CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and

riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: Detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred fishing method.

In their TKUA, the Káinai Nation indicate that the Project will impact water flows, sedimentation, fish mortality and morbidity in Blairmore Creek, Gold Creek and Crowsnest River and that the following valued components would be affected: Blairmore Creek and tributaries; Gold Creek and Tributaries; Crowsnest River, Westslope Cutthroat trout, Brook trout, Rainbow trout, Mountain Whitefish Bull trout. These effects would result in the loss of availability and quality of fish and would ultimately cause a decline in the Káinai Nation fishing opportunities, and a loss of access to fishing areas (O'Connor, 2018).

Mitigation measures Benga has planned to avoid or minimize potential effects to the availability of fishing areas include:

- a Detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan have been proposed (Appendices B1 and B2, Addendum 8, CEAR #89) that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek;
- Benga will continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Káinai Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- engage with the Káinai Nation prior to and during mine construction to allow for opportunities for species of interest to be harvested, re-located or otherwise utilized;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Káinai Nation has additional measures to suggest mitigating for fishing experience, Benga will continue to work with the Nation on mitigation measures.

4.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Káínai Nation. These include lodgepole pine, sweet pine, wild licorice, horsetail, thimbleberry, aspen, yarrow, mushrooms, cottonwood, birch, Saskatoon berries, choke cherries, huckleberries, white bark pine, sweetgrass, red willow, willow berries, rose hip, Echinacea, husk, raspberry, bitter root and Kinnikinnick (Káínai Nation, 2015). Spruce, poplar, black cottonwood, willow and balsam fir are also important species to the Káínai Nation. Plant gathering activities typically take place in the spring.

CR #8 (EIA, CEAR #42) addresses potential effects on key vegetation species and habitat including the species identified by the Káínai Nation. Further, a summary of species identified by the Káínai Nation with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure.

The potential effects described in these sections of the EIA could result in a change in identified plant species and habitat, change in use or access to identified plant gathering locations, or change in preferred harvesting method. These effects, in turn, could affect the cultural and spiritual relationship between the Káínai Nation and plants. Input provided by the Káínai Nation during consultation is considered in the identification of potential effects and proposed mitigation measures.

Strawberries, Labrador tea and cow parsnip were not identified by the Káínai Nation prior to submission of the EIA; however, these plants and berries were identified by other Indigenous groups and were considered in the overall vegetation VC. Tamarack and blueberries were identified in the EIA.

No information was provided to Benga regarding preferred plant harvesting methods.

The TKUA identifies the following effects to the Káínai Nation plant gathering: loss of ecosites supporting a wide variety of traditional use plants; disturbance to 1,502.7 ha of land that could support vegetation; and loss of availability of plants. According to the TKUA, the following species would be affected: lodgepole pine, sweet pine, cottonwood, birch, aspen, spruce, wild licorice, horsetail, juniper, bearberry, dry tree moss, moist ground moss, yarrow, rose hip, raspberries, thimbleberries and mushrooms, buffalo berries, goose berries, gooseberries, moss, prairie crocus, strawberry, Labrador tea, sweet grass, wolfwillow, paintbrush plants, cow parsnip, red-osier dogwood, wild onion and bear-root, lay-down root. The Project would reduce the availability and abundance of traditional use plants, reduce space to harvest and harvesting areas, cause a decline in use and enjoyment of plants of cultural and ceremonial significance (O'Connor, 2018).

The EIA details the mitigation measures relating to Vegetation and Wetlands (CR #8, EIA, CEAR #42) and Land and Resource Use (CR #10, EIA, CEAR #42). Reclamation specific mitigation is detailed in the Updated Conceptual Conservation and Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to JRP IR-2.6). In addition, vegetation species identified during the consultation process, including TU species (vascular and non-vascular) observed in the vegetation LSA vegetation field surveys are included in the updated C&R Plan (Table F.1.9-1). Key plant gathering mitigation includes:

- on-going consultation with the Káinai Nation in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants will be made available for harvesting by the Káinai Nation potentially affected by the Project; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will consult with the Káinai Nation on updates to the Conservation and Reclamation (C&R) plan. The C&R Plan will include the use of native species wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Káinai Nation Traditional land use opportunities will be integrated;
- Benga will support an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise; and
- Benga will support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes;
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation; and
- Benga will consider mitigation suggestions proposed by the Káinai Nation regarding traditional and medicinal plants.

- The Káinai Nation suggested the following in the TKUA:
  - Funding support prior to construction and vegetation clearing for the Káinai Nation cultural camp within the Project footprint (O'Connor, 2018); and
  - Quarterly reports provided to the Káinai Nation on the environmental impacts of the Project (O'Connor, 2018).

Benga responded to the above suggestions with the following:

- Benga has committed to meet with Káinai on a regular basis to review the environmental performance of the Project. Timing and frequency of such meetings will be determined on a consensual basis based on the information to be reviewed.

4.3.2.5 Trails and Travelways

The Project will intersect or be in proximity to territory that is identified as trails or travelways by the Káinai Nation. For example, the Káinai Nation identified historical site DjPo-63 to be associated with the trails and travelways in the LSA. It is anticipated that the Project may affect access and use of trails and travelways and associated features, especially those within the LSA. It is assumed that trails and travelways connect these sites.

Section E.13 (EIA, CEAR #42) addresses potential effects to sites defined as any work of nature, or humans, that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or esthetic interest including a palaeontological, archaeological, prehistoric, historic, or natural site, structure, or object. There are 32 recorded archaeological or historic era resources located in the Project area including sites that are valued as cultural heritage sites to the Káinai Nation. Of the 32 sites, there are 10 that are overlapping the Project footprint. The Káinai Nation identified sites associated with trails and travelways that are fully or partially within the mine permit boundary; however, specific locations have not been provided to Benga. Direct effects to historical resources are anticipated for sites within the mine permit area as a result of Project construction.

In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the Access Management Plan that will include the following:
  - access points and roads to be clearly labelled and documented;
  - notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
  - identified sensitive features (*e.g.*, species of management concern, important habitat features) to be flagged or fenced ahead of clearing; and
  - signage to be used for identifying areas that are not open for public use.

- share information about construction timing; and
- will continue to improve the Cultural Site Discovery Contingency Plan for culturally important sites identified during construction and operations.

The Káinai Nation suggested the following in the TKUA:

- Binding commitment prior to Project approval to turn over privately owned lands within the Mine Permit Area to the Káinai Nation or the Blackfoot Confederacy upon final mine closure and reclamation (O'Connor, 2018);
- Quarterly reports provided to the Káinai Nation on the environmental impacts of the Project (O'Connor, 2018);
- Prohibition of some forms of transportation (such as OHVs) along selected linear features (roads, seismic lines) during defined times of the day or week (Carlson *et al*., 2018, p. C-14); and
- Integrated landscape management strategies that seek to reduce the quantity of linear footprint that is needed to extract natural resources (Carlson *et al*., 2018, p. C-14).

Benga's responses are as follows:

- Disposition of privately-owned lands at the end of the Project is a commercial matter not appropriately dealt with in a regulatory process;
- Benga has committed to share the environmental performance of the Project with Káinai on a regular basis through the life of the Project.
- Timing and frequency of such meetings will be determined on a consensual basis based on the information to be reviewed;
- Access and use of OHVs on Benga - owned lands and the Project footprint will be controlled through the AMP; and
- The only linear footprint of the Project is along the main access road which will also incorporate the covered conveyor and the power line for supplying electricity to the mine. Benga considers that it has minimized linear footprint for the Project by combining all these features in one alignment.

In addition to a direct change to trails and travelways and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the cultural and spiritual relationship between the Káinai Nation and their trails and travelways.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Káinai Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

The TKUA analysis of the Project's potential effects to the Káinai Nation trails and travelways is outlined in the following (O'Connor, 2018, p. 102): access restrictions to southern portion of LSA and access changes to northern portion of LSA. According to the TKUA, the following related valued components would be affected: Crowsnest Pass historic travel corridor; access roads into LSA from south; access into LSA from Highway 40; and Daisy Creek Trail.

4.3.2.6 Cultural and Spiritual Values

Changes resulting from the Project may interfere with the Káinai Nation's ability to pass on cultural teachings to the next generation in the Project LSA. For example, the loss of a harvesting area means there is one fewer place to teach harvesting practices or share a language unique to the area.

The Káinai Nation has stated the Project footprint would destroy documented and undocumented sites of cultural and spiritual significance (O'Connor, 2018, p. 94). The Káinai Nation stated that sites hold intrinsic cultural and heritage value to the Blackfoot Nation and potential disturbance and, or destruction of these sites would result in negative effects on the physiological wellness of the Káinai Nation members and their connection to their traditional territory within the LSA (O'Connor, 2018). Further, the Káinai Nation's cultural sustainability and continued use would be impacted negatively from changes to these cultural and spiritual sites (O'Connor, 2018).

In addition to a direct change to cultural and spiritual values and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the relationship between the Káinai Nation and their cultural and spiritual values.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Káinai Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

Specific sites that interact with the Project footprint are (O'Connor, 2018, p. 104):

- DjPo-38;
- DjPo-63;
- DjPo-98;
- DjPo-101;
- DjPo-116;

- DjPo-124;
- DjPo-130;
- DjPo-184;
- DjPo-7;
- DjPo-41; and,
- DjPo-112.

Benga has proposed mitigation measures relevant to sites of cultural and spiritual importance and committed to the following measures to mitigate effects related to cultural and spiritual values:

- Benga will continue to work with the Káínai Nation to improve the Access Management Plan (AMP) to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Káínai Nation where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- Where identified by the Káínai Nation, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;
- If avoidance of any TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Káínai Nation to develop and plan for mitigation of the site;
- Benga will continue to work with the Káínai Nation to identify ways in which TK can be considered during Project activities and in the development of environmental management plans;
- Benga will continue to work with the Káínai Nation to interweave TK in the development of Project management and monitoring plans and in Project activities;
- Benga will support a cultural competency program for its employees and contractors;
- Benga has and will continue to support local and Indigenous cultural events and ceremonies through its Indigenous engagement and initiatives such as its community sponsorship program;
- Benga will fund and will arrange a ceremony with the Káínai Nation in advance of ground disturbance for Project Construction;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction or operations.
- An Indigenous Environmental Stewardship Committee will be established, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and

- An Indigenous monitoring program will be implemented, which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

4.3.3 Residual Effects to Current Use of Lands and Resources for the Káinai Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects on the current use of lands and resources valued by the Káinai Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Káinai Nation and surrounding lands and resources.

4.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects (CR #9, EIA, CEAR #42) and input provided by the Káinai Nation. Changes to wildlife may have an effect on the hunting activities and therefore, wildlife mitigation measures are directly relevant to the interest of the Káinai Nation. These effects affect the cultural and spiritual relationship between the Káinai Nation and wildlife.

The Project will affect the ten wildlife VCs, including moose, elk and bear, through changes in habitat availability, habitat fragmentation/connectivity, mortality risk and abundance all of which will affect local populations to some degree. With successful application of mitigation measures, the residual effects of the Project on habitat availability, habitat fragmentation/connectivity, mortality risk and abundance within the Wildlife LSA (WLSA) were deemed not significant (CR #9, EIA, CEAR #42).

Just as with wildlife, Project effects to land and resource use: hunting and trapping and access (CR #10, EIA, CEAR #42) have been characterized as local in geographic extent, extended in duration, continuous (access) or occasional (hunting) in frequency, reversible in the long-term and low in magnitude and not significant.

In summary then, the Project is not expected to have measurable effects on species hunted by the Káinai Nation. Similarly, with the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

Measures to be implemented to mitigate these effects are outlined in Section 4.3.2.1 of this Information Request. After implementation of mitigation, residual effects to hunting are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to hunting by the Káinai Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. Further, the implementation of an Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will function to address issues related to traditional use, wildlife and hunting throughout the life of the Project. It will also provide a mechanism by which community members can actively contribute to and participate in on-going reclamation and conservation planning.

4.3.3.2 Trapping

Given the relationship between hunting and trapping in use and access to wildlife, Benga considered the residual effects the same.

4.3.3.3 Fishing

The characterization of residual effects to fishing includes consideration of residual effects and input provided by Káinai Nation. Changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Káinai Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Káinai Nation and fish.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Káinai Nation. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience and enjoyment of fishing can be managed through

noise and visual impact management as discussed in CR #1 and CR #2 (EIA, CEAR #42). Nonetheless, the Káínai Nation may avoid fishing in visual and auditory range of Project activities.

As a result, residual effects to fishing are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The Project residual effects to fishing by the Káínai Nation are not considered significant. In totality, the changes to fishing are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

4.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of residual effects described in CR #8 (EIA, CEAR #42) and input provided by the Káínai Nation. Changes to plant habitat may have an effect on the plant gathering activities and therefore plant gathering measures are directly relevant to the interest of the Káínai Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Káínai Nation and plants.

The Project is expected to remove traditional use plants within the Project LSA. Beyond the Project area, habitats are expected to remain intact. Therefore, the overall availability of habitat is not anticipated to be substantially affected by the Project.

Vegetation in CR #8 and Land use in CR #10 (EIA, CEAR #42) characterize residual effects to vegetation as local in geographic extent, long-term in duration, continuous in frequency, reversible and high magnitude. The mitigation proposes reclaiming the land that will support a range of communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. The residual effects for vegetation are not considered significant.

As described in CR #10 (EIA, CEAR #42) while the Project will result in some loss of traditional use of vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. The Project-specific residual effects are not likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment.

With the mitigation measures summarized above especially those related to access and experience and pleasure of plant gathering, the Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Káínai Nation. As a result, residual effects to plant gathering are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the residual effects to plant gathering by the Káínai Nation are not considered significant.

Although residual effects to plant gathering are not considered significant in this context, the Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will include vegetation identification and monitoring of reclamation success. Benga has committed to continued community engagement with the Káínai Nation and will obtain input from the Káínai Nation into the Environmental Management Plans, including the Conservation and Reclamation Plan; this input may be facilitated *via* the Environmental Stewardship Committee, the Indigenous monitoring program or another process determined in collaboration with the Káínai Nation.

4.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary.

The Project footprint will be reclaimed to land use capability equivalent to pre-mining; however, it will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area west of Blairmore Creek and Crown Land north of the Project and from either the north or the south along the Gold Creek. With the implementation of the AMP, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Káínai Nation and trails and travelways.

Therefore, the residual effects are:

- moderate magnitude;
- local geographic extent;

- long-term duration;
- continuous frequency;
- non-reversible where trails and travelways are lost; and
- resilient in ecological and social context.

The changes to trails and travelways used by the Káinai Nation are not considered significant. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

In totality, the changes to trails and travelways used by the Káinai Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

4.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by the Káinai Nation in their traditional knowledge and traditional use assessment report and cumulative effects assessment.

The Káinai Nation TKUA report defines magnitude as follows:

> amount of change compared to baseline conditions, whether the effect is small, medium or large. Small magnitude would affect only a small amount of resources or land, medium magnitude would impact a moderate amount of resources or land and would therefore have a medium level of impact; large magnitude effects would impact large amounts of traditional resources or land. (O'Connor, 2018, p. 127).

The Káinai Nation TKUA report indicates that "the Project area remains a highly significant, culturally important and environmentally sensitive area," (O'Connor, 2018, p. 139). Further, the Project will "disturb and destroy evidence of human occupation and material culture and heritage artifacts that have remained on the land for thousands of years," (O'Connor, 2018, p. 139).

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project would still affect the Káinai Nation cultural and spiritual values and

interests. The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts.

Benga agrees with the Káinai Nation's characterization of frequency, duration and reversibility and, using the residual effects definitions in Table 3.3-1, characterizes the adverse residual effects as follows:

- long-term in duration;
- continuous;
- not reversible (permanent);
- moderate magnitude;
- local in geographic extent; and
- sensitive in ecological and social context.

With respect to magnitude and, using the residual effects definitions in Table 3.3-1, Benga characterizes the magnitude of the effect as moderate given that the Project effects would not affect the ability of the Káinai Nation's to practice its culture and traditions in the RSA.

Benga characterizes geographic extent as local, that is, within the Project LSA.

In totality, the residual effects of changes to physical and cultural heritage of the Káinai Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance

4.3.4 Significance Determination of Current Use of Lands and Resources for the Káinai Nation Traditional Purposes

No adverse significant effects post-mitigation were identified for Current Use of Lands and Resources for the Káinai Nation Traditional Purposes. Overall, the Project is not anticipated to measurably change the Káinai Nation's ability to continue traditional practices. It is predicted that the effect of the Project on access to hunting and gathering areas will not be significant as a large portion of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability and

Benga will continue to consult with the Káinai Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

4.4 Káinai Nation Physical and Cultural Heritage

4.4.1 Background of Káinai Nation Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Káinai Nation since the EIA was submitted, in the TKUA (O'Connor, 2018) and the Káinai Nation Cumulative Effects Assessment (Carlson *et al*., 2018a).

As noted above, the Crowsnest Pass is central to Blackfoot culture, spirituality and culture (O'Connor, 2018, p. 63). The TKUA specifies sites within the Project TLU LSA and RSA are significant for traditional material culture, such as material for knives and arrowheads (O'Connor, 2018).

The Káinai Nation field team visited thirteen (13) sites that relate to Indigenous physical and cultural heritage. The Blood Tribe Sites of Cultural, Historical, Ceremonial or Archaeological Significance and the Blood Tribe Traditional Occupancy (Pre-Contact) & Archaeological Sites Map in the TKUA depicts the areas where these sites are located (O'Connor, 2018, p. 61-62). Of these sites, nine (9) out of thirteen (13) were included in the ea. The TKUA indicates the following four (4) have not been included in the EIA:

- DjPo-216;
- DjPo-219;
- DjPo-214; and
- DjPo-37.

These sites are described and assessed in the HRIA. Fieldwork has been completed and a report filed with Alberta Culture for the Project (Ng *et al*., 2016). Alberta Culture has responded indicating that additional studies at sites 214, 216 and 219 are required if avoidance is not possible while no additional studies are required at site 37.

The TKUA indicated the following are sites or areas of current use for ceremonial, spiritual, cultural, educational or historical value, or unique ecological characteristics of interest to the Káinai Nation (O'Connor, 2018, p. 41):

- Ancient camps and associated archaeological features along Blairmore Creek;
- Tipi rings and stone cairns in proposed South Dump;
- Ancient camps and battle grounds in South Dump and related features;
- Bison jump site and archaeological and heritage resources in South Dump;

- Tipi rings and iniskim along ridge above rail load-out area;
- Crowsnest River Valley pre-contact travel and trade route;
- Wetlands (Tall Grass Lakes) as nesting grounds and migratory bird habitat; and
- Natural spring features.

The discovery of tipi rings and glacial erratics during fieldwork suggested the potential for additional archaeological or historical resources significant to the Káínai Nation culture. Additional features of interest indicated within the LSA are fire broken rocks, pottery, medicine wheels, vision quest sites, artifact scatters or deposits, arrowheads, pipes or carvings, bone piles, human remains, stone effigies and a healing sulphur spring.

The TKUA indicates that cumulative loss of access to lands has altered traditional occupancy patterns and states that access to areas of physical and cultural heritage has been diminished by logging, oil and gas facilities, pipelines and powerlines and cut lines. The TKUA further explains that while most land in the southern and eastern portion of the LSA is private and therefore restricted for traditional harvesters, land in the northern and western portions of the LSA is mainly Crown land. Camping areas within the TLU RSA are still in use today (O'Connor, 2018). The Blood Tribe Current Occupancy & Cumulative Effects Map in the TKUA depicts the areas where these sites are located (O'Connor, 2018, p. 71).

There are many well-known and documented sacred places and gathering areas throughout the Káínai Nation territory. According to the Káínai Nation, these sacred sites are unifying symbols and provide evidence for cultural continuity and establish and reinforce national and personal connections to the landscape (Káínai Nation, 2015). The Káínai Nation noted Crowsnest Mountain (approximately 10 km west of the Grassy Mountain LSA, as an important landscape marker and associated with Blackfoot myths and traditional culture and is still referenced in ceremonial purposes. Another important sacred site, Chief Mountain (approximately 100 km southwest of the Project LSA), is known as the home of Thunder (Glenbow Museum, 2015).

Vision quests in the mountains are an important element of the Blackfoot culture. A vision quest is a spiritual undertaking where the Káínai Nation went to isolated high ground with a view to a sacred mountain (Káínai Nation, 2015). The seeker usually remained several days waiting and praying for the vision (Káínai Nation, 2015). Crowsnest Pass is known to have numerous remains of former vision questing areas and these locations have both historic and religious significance (Káínai Nation,

2015). During the Káinai Nation TK/TU Program in 2014, one of the Káinai Elders shared the importance of the Grassy Mountain area and the effects of historical mining on these sites:

> There are stories about eagles and vision quest sites. These sites were probably destroyed at Grassy Mountain during historic mining in the 1940s and 50s. My ancestors occupied that area, especially during the winter. - Káinai Elder (Káinai Nation, 2015, p. 16)

Blackfoot members used tipis as shelters, consisting of "12-14 buffalo skins and between 20-30 poles," (Dempsey, 2001, p. 610). Lodgepole pine was used primarily in the construction of the tipis. This type of shelter supported the semi-nomadic ways of the Blackfoot members, which was easily transported by travois to the next camp. After contact with Euro-Canadian settlers and the signing of Treaty 7, "most [Blackfoot] selected reserves near favourite wintering places: … the Blackfoot at the Blackfoot Crossing of the Bow River, the [Káinai] on the Belly River, the North Piegan near the Porcupine Hills and the Sarcee – part of the confederacy – west of Fort Calgary" (Dempsey, 2001, p. 619).

Other secondary sources indicate the Káinai Nation movement between two main areas, including hunting grounds in the east around Sweetgrass Hills and wintering grounds in the west, especially around Highwood River (the most proximate to the Grassy Mountain Project is approximately 75 km north of the Project). The Káinai Nation members lived in south and southeast Alberta (Treaty 7 Management Corporation, 2015). Important hunting locations included the region of Hand hills near Drumheller, Sweetgrass regions and the present Lethbridge (Treaty 7 Management Corporation, 2015). During winter, they would stay along the Belly River, Highwood River and the Battle River (Treaty 7 Management Corporation, 2015).

Given the history of the travel pass system which restricted movement of Indigenous peoples off of reserves, one the Káinai Nation Elders spoke about mixed emotions regarding current and regained access to the Project area:

> We also need to acknowledge that there are a lot of emotions and feelings that come up when we talk about these areas. We say to ourselves: 'Look at what we lost.' There is a lot of anger and sadness when we finally get to see these areas again. We get to follow in the footsteps of our ancestors. - Káinai Elder (Káinai Nation, 2015, p. 13)

During the TK/TU program, the Káinai Nation Consultation Team spoke extensively about their strong and historically rooted cultural and spiritual connection to the land and animals surrounding the proposed mine site. One of the Káinai Nation Elders articulated the Káinai Nation spiritual connection to the land by indicating the location of rock art in two caves, one 15 km west of the proposed Project and another 8 km east of Grassy Mountain (Káinai Nation, 2015).

4.4.2 Potential Effects and Mitigations on Káinai Nation Physical and Cultural Heritage

The Project will intersect or be in proximity to sacred, gathering and habitation sites identified by the Káinai Nation. The Grassy Mountain area is used for ceremonies and there are three sacred sites identified by the Káinai Nation as fully or partially overlapping the Project LSA (although specific locations were not provided to Benga). Several VC Sections are relevant to the assessment on sacred, gathering and habitation sites such as the assessment sections for land and resource use and historical resources.

Section E.13 (EIA, CEAR #42) addresses potential effects to sites as defined as any work of nature or humans that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic interest. There are 32 recorded archaeological or historic resources located in the Project area including sites that are valued as cultural heritage sites to Indigenous group (O'Connor, 2018, p. 33). Of the 32 sites, 10 overlap the Project footprint. The Káinai Nation identified three sacred sites in their TU/TK study that are within the Project LSA however specific locations have not been provided to Benga. Direct effects to historical resources are anticipated for sites within the Project footprint as a result of Project construction. If avoidance is not possible, the Project may damage or disturb sites that are identified by the Káinai Nation as sacred sites (Káinai Nation, 2015).

The potential effects described in the sections listed above could result in a change in use or access or disturbance to features associated with sacred, gathering, or habitation sites. Together, these changes will change the cultural value or importance to the value.

The TKUA analysis of the Project's potential effects to the Káinai Nation sites of archaeological, historical, cultural or spiritual importance and occupancy is outlined by O'Connor (2018) as the following:

Project-Impact	Related Valued Components	Effects to the Káinai Nation TKU
Disturbance or destruction of sites of archaeological, historical, cultural importance including both documented and previously undocumented archaeological site	Pre-contact camps, tipi rings, stone cairns, artifacts, hearths, tools, lithics, ceremonial sites, historic occupancy areas, bones, traditional ceremonial vegetation	Disturbance or destruction of sites would have negative effects to the Káinai Nation members' psychological well-being, cultural sustainability and use and sense of connection to the portions of their traditional territory within the TLU LSA.
Access Restrictions to LSA and RSA	Sites of archaeological, historical, or cultural importance, traditional camps, aquatic resources, vegetation, building materials, wildlife	Loss of access and use of traditionally occupied crown lands in the northern portion of the LSA; continued and ongoing restrictions on access to privately owned land in southern portion of the LSA.

In their TKUA, the Káínai Nation recommends the following measures:

- Quarterly reports provided to the Káínai Nation on the environmental impacts of the Project;
- Binding commitment prior to Project approval to turn over privately owned lands within the Mine Permit Area to the Káínai Nation or the Blackfoot Confederacy upon final mine closure and reclamation;
- Funding support prior to construction and vegetation clearing for a Káínai Nation cultural camp within the Project footprint (O'Connor, 2018);
- In the TLU local study area: A buffer zone of 100 meters be established around the rocky hill associated with DkPo-7, tipi rings and erratics located during the TKUA fieldwork;
- DjPo-219, DjPo-184, DjPo-217, DjPo-216, DjPo-214, DjPo-116, DjPo-98;
- Further information provided to the Káínai Nation by Benga on the status of DjPo-130 and the findings of any additional archaeological field research completed at the site;
- Further information provided to the Káínai Nation by Benga about additional excavations and mitigation measures that Benga plans to implement for DjPo-63, DjPo-52and DjPo-32 prior to disturbance;
- Protection from future development for DjPo-37; and
- Map rock art sites within the TLU RSA on Bluff Mountain and submit a request to Alberta Culture and Tourism to have the site designated or otherwise protected from future development (O'Connor, 2018).

In response to the Káínai Nation's proposed measures listed above, Benga has committed to the following:

- Benga will continue to work with the Káínai Nation to avoid and protect cultural heritage sites or if unavoidable to support other mitigation measures such as ceremonies and site documentation. Benga has committed to the Káínai Nation that site DjPo-98 will not be disturbed by the Project;
- Benga has provided support to the Káínai Nation to:
  - further assess pre-contact archaeological sites, identified as part of the HRIA;
  - consider recommendations for mitigation, such as site excavation, as outlined in the HRIA; and
  - develop culturally based recommendations for the mitigation of sites that will be impacted by the Project.
- Benga has provided the completed HRIA report concerning site DjPo - 130 to Káínai. Benga has committed that site DjPo-130 will not be disturbed by the Project;

- Benga has discussed the additional excavations required at these sites with the Káínai Nation and has offered to support ceremonies and other mitigation measures if the sites are to be disturbed by the Project;
- DjPo-37 is recorded as Blairmore Dairy which is not an Indigenous site. The site is already largely disturbed, and no further action is intended to preserve the site. Benga has committed to continue to work with Káínai to avoid and protect cultural heritage sites or if unavoidable to support other mitigation measures such as ceremonies and site documentation; and
- With respect to rock art, no rock art has been recorded within the Project footprint. This mitigation measure is outside the scope of the Project. If rock art were to be found, Benga would engage in mitigation discussions with the Káínai Nation.

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of any unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;
- If avoidance of any identified TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Káínai Nation to develop and plan for mitigation of the site;
- Consultation will include sharing information with the Káínai Nation about construction timing;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations;
- Benga and the Káínai Nation will continue to meet to discuss management of culturally important and sacred sites;
- Benga will work with the Káínai Nation to design and implement an Indigenous Monitoring Program that will include consideration of cultural heritage impacts and monitoring for cultural sites; and
- Benga will continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate land use locations.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) present that noise, dust and visual impact mitigation measures are being adopted by Benga to minimize any adverse effects. The mitigation measures proposed for physical and cultural heritage resources are consistent with provincial requirements and measures proposed by the Káínai Nation.

Where the Káínai Nation has identified additional mitigation measures, these will be discussed with the Káínai Nation in follow-up meetings.

4.4.3 Residual Effects on Káinai Nation Physical and Cultural Heritage

The characterization of residual effects to sacred, gathering and habitation sites includes consideration of residual effects and input provided by the Káinai Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project could still have measurable effects on sacred sites used by the Káinai Nation and the Káinai Nation's use of these sites would be disturbed. After mitigation, residual effects to sacred, gathering and habitation sites are characterized as:

- moderate magnitude;
- local in geographic extent;
- long-term duration;
- regular frequency;
- not reversible; and
- sensitive in ecological and social context.

4.4.4 Significance Determination of Physical and Cultural Heritage for the Káinai Nation

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Káinai Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Káinai Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Káinai Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

In summary, the residual effects of the Project on the Káinai Nation are determined to be not significant and shown in Table 4.4.4-1.

Table 4.4.4-1 Summary of Residual Adverse Effects to the Káinai Nation

Valued Component	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting/ Trapping	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Plant Gathering	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Fishing	Moderate	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Trails and travelways	Moderate	Local	Long-term	Continuous	Not reversible where trails and travelways are lost	Resilient	Not significant
Cultural and Spiritual Values	Moderate	Local	Long-term	Continuous	Not reversible	Sensitive	Not Significant
Indigenous Physical and Cultural Heritage	Moderate	Local	Long-term	Regular	Not reversible	Sensitive	Not significant

5.0 PIIKANI NATION CONSULTATION AND ASSESSMENT

5.1 Piikani Nation Consultation Summary

Benga has been consulting with Piikani Nation regarding the Project since 2013. As a result of this engagement, Piikani Nation have indicated by letter to ACO and the JRP that they have no objections to the Project (CEAR #200).

Consultation and engagement activities with the Piikani Nation have included:

- ongoing and regular phone and e-mail communications;
- development of on-going field programs to assess and refine recommendations for mitigations of specific Traditional Use sites;
- meetings and open houses to discuss project updates issues and concerns and to seek input on the Project and the environmental assessment;
- review of provincial and federal environmental assessment processes and role of traditional studies in the assessment; and,
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - draft CEAA guidelines;
  - Project Description; and
  - information packages.

Benga initiated engagement with the Piikani Nation in June 2013 with a meeting at the Piikani Nation TK Services offices to introduce the Project, describe the Environmental Assessment process and discuss economic opportunities related to the Project. In this meeting, the Piikani Nation provided background on their Indigenous interests expressed interest in continued engagement on the Project. Throughout 2013 and early 2014, Benga provided periodic updates and at the Piikani Nation's invitation, returned in March 2014 to provide a Project update and an overview of upcoming environmental studies to the Piikani Nation Chief and Council. At that time, the parties agreed to develop a framework for continued consultation.

Benga and the Piikani Nation continued to discuss employment opportunities for fieldwork and establish a framework for continued consultation. This framework was drafted into a First Nations Consultation Plan which the Piikani Nation reviewed before it was finalized for submission to the Alberta government. The consultation work plan and budget were revised, as necessary, to accommodate unanticipated changes to the Project or the regulatory process such as Project changes bringing it under CEAA purview and referral of the Project to a JRP. In

accordance with the First Nations Consultation Plan, Benga provided a copy of the PTOR to Piikani Nation in December 2014. Benga followed-up with emails and an in-person meeting to discuss the PTOR in detail and then advised Piikani Nation when the AER finalized the TOR in March 2015. To ensure that Piikani Nation remained informed about the Project's status in the federal regulatory process, Benga provided information by email, letters, and in-person meetings with Piikani Nation. These updates included reference to funding opportunities for participation in the federal review process.

In late February 2015, Benga and Piikani Nation Chief, Council, and department managers began the process of developing a plan for the Piikani Socio-economic and Community Wellbeing Study (Socio-economic Study). This study, conducted by independent consultants funded by Benga, employed workshops and interviews with Piikani managers and community members to gather information for planning purposes related to the Project. The findings of this report, along with environmental and economic considerations related to the Project, were presented at an open house for Piikani Nation community members in August 2015.

A third-party technical review was led by Piikani Nation and funded through the CEAA contribution agreement on the Project and by Benga (Schaldemose & Associates, 2016). The review was completed by a team of consultants who thoroughly analyzed the EIA and gathered information from Piikani Nation members. The purpose of the review is to identify issues or concerns related to the Project and to provide recommendations to address issues. The technical review provides a summary of Project-specific issues and recommendations some of which are addressed in this report. The issues described in the technical review will continue to be addressed *via* ongoing consultation throughout the EA process. As part of the review process and ongoing consultation, community meetings and discussions have been part of the ongoing consultation strategy with Piikani Nation with the intent of addressing all concerns at the community level.

Between August 2016 and April 2019, Benga and the Piikani Nation representatives maintained ongoing dialogue regarding the EIA mitigation measures and issues and concerns. The Piikani Nation engaged in Project review by submitting comments, participating in meetings, undertaking traditional land use studies and carrying out technical reviews. Benga received the following studies from Piikani:

- Updated Review of Riversdale Resources Riversdale Limited Grassy Mountain (Ksiistsiiko'om oomoiyyi) Coal Project Environmental Impact Study (Schaldemose & Associates, July 2016);
- Piikani Nation Socio-economic Study (Confidential); and

- Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area (Scott & Thorpe, 2015).

Benga does not expect additional reporting from the Piikani Nation. Information provided to Benga after the submission of this consultation update report will be considered by Benga and incorporated into the Project planning as appropriate.

5.2 Piikani Nation Traditional Use and Traditional Knowledge Studies

The Piikani Nation has submitted on traditional use study for the Project to Benga:

- Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area (Scott & Thorpe, 2015)

The Piikani Nation Traditional Knowledge and Use (TKU) report is a summary of outcomes of fieldwork and information related to the Project and was approved by the Piikani Nation for use in the environmental assessment process. This report is the basis upon which the following sections are presented. No other traditional use or traditional knowledge study has been submitted to Benga from the Piikani Nation.

A non-public and confidential version of the TKU report was produced and was not provided to Benga. It is more comprehensive than the public report, was developed for the Piikani Nation and is housed and controlled by the Piikani Nation. Benga provided the funding to undertake the work.

The Piikani Nation's Traditional Knowledge and Use (TK/TU) of the Grassy Mountain Area served as an instrument for the Piikani Nation to record traditional knowledge and land uses, to identify potential effects of the proposed Project and to give the Piikani Nation knowledge holders an opportunity to provide ideas for mitigation of potential effects. This study is a vital component of the consultation process because TK/TU studies enhance the quality of an environmental assessment in terms of confidence in results, avoiding potential effects to the Piikani Nation and incorporating knowledge of the local environment

5.3 Current Use of Lands and Resources for Piikani Nation Traditional Purposes

5.3.1 Background of Current Use of Lands and Resources for the Piikani Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Piikani Nation to date.

Piikani Nation members were nomadic and hunted in areas where they travelled and moved through including neighboring territories (Piikani Nation, 2015b). In the past, buffalo were available in Crowsnest Pass during the winter where they concentrated in the bottom of the valley at Crowsnest River. Traditionally, Piikani members hunted deer and elk for spiritual, ceremonial, and subsistence purposes. Past hunting methods included bow and arrow followed by a later use of horses and rifles due to trade and contact with Euro-Canadian settlers. A common hunting technique was the use of buffalo jumps comprised of cliffs near buffalo wintering grounds with herds systematically corralled using V-shaped lanes lined with shrubs and driven off the cliffs by hunting parties (Dempsey, 2001, p. 606). The most famous of these are the Head Smashed in and Old Woman's Buffalo Jumps north and east of the Porcupine Hills. Buffalo hunting occurred primarily in the fall and winter months. The Piikani Nation members considered fish to be survival food compared to their preferred diet of buffalo. In comparison to buffalo, fish were rarely harvested and considered to be less substantial (Crowsnest Highway, 2004). However, buffalo went extinct in the late 1800s with extensive starvation, forcing Piikani members to shift into farming and eventually ranching for a livelihood (Piikani Nation, 2015b).

Trapping among Blackfoot members has been for the primary purpose of obtaining eagle feathers that are important for ceremonial and war regalia. The method of trapping entailed building a mound of earth with a hollow centre covered by branches on a high point, typically in the foothills. Using bison or coyote bait, young Blackfoot men would lure eagles to the mound and pull the eagle into the centre and kill it. One recorded location of a permanent eagle trapping site is in the southwest part of the Piikani Timber Limit 147B that was last used in the 1960s. Trapping of furbearers was limited to wolves and foxes. Blackfoot taboo prevented trapping of beaver due to its role in the bison hunt (Colpitts 2014, p. 64). Other secondary sources indicate that Blackfoot members primarily hunted bison but during the early 1800s there was a period of intensive trapping for beaver that played a role in the success of the Rocky Mountain House posts (Parks Canada, 2008).

In the past, plant harvesting was an important undertaking among the Piikani members. They targeted a variety of plants available in different parts of their territory. "Aspen, poplar, and birch were the main trees that managed to survive in the coulees. …[T]o the west, the tree-covered foothills of the Rocky Mountains were a primary source of lodge pole pine [for constructing tipis]" (Dempsey, 2001, p. 604). The mountainous areas also provided important medicinal and ceremonial plants that were not available on the plains, including sweet pine, yarrow, ochre, and bearberry (Piikani Nation, 2015b). Serviceberries and chokeberries were the most widely used, particularly for making pemmican (Dempsey, 2001, p. 607). According to Piikani Elders, Crowsnest Pass was an important east-west travel corridor for Blackfoot members both for harvesting of buffalo and plants in times of peace and to defend their

territory in times of war. Methods of travel were by horse and foot with the support of travois and dogs. After introduction of the horse in the early 1700s, there was an increase in warfare with groups west of the Rocky Mountains (Dempsey, 2001, p. 608). Another reason for travel in the spring and autumn was to trade to the north at Rocky Mountain House and Fort Edmonton with goods such as meat, robes made of buffalo, horses, and a limited supply of furs (Dempsey, 2001). More specifically in Crowsnest Pass, Piikani Nation Elders noted that the Blackfoot trail steered north to avoid the area that is currently covered by the Frank Slide because they knew the instability of the mountains in this area. There were also smaller trails throughout the Grassy Mountain area connecting lookout or scouting sites on top of rock outcrop occupied for brief periods of time by men who sent messages between ridges. Along these trails were rocks cairns used for navigational purposes. During consultation, Piikani Nation identified specific locations of rock cairns and smaller trails connecting scouting sites in relation to the Project; however, this information was identified as confidential and cannot be used in this assessment.

5.3.1.1 Hunting

The Piikani Nation were nomadic and hunted in areas where they travelled and moved through including neighboring territories (Scott & Thorpe, 2015). In the past, buffalo were available in Crowsnest Pass during the winter where they concentrated in the bottom of the valley at Crowsnest River. With the arrival of Euro-Canadian settlers, the once abundant buffalo herds became extinct in the late 1800s resulting in pervasive starvation among Blackfoot groups. The Piikani Nation hunted deer and elk for spiritual, ceremonial and subsistence purposes. Past hunting methods included bow and arrow followed by a later use of horses and rifles as trade and contact with Euro-Canadian settlers expanded.

A common hunting technique was the use of buffalo jumps comprised of cliffs near buffalo wintering grounds with herds systematically corralled using V-shaped lanes lined with shrubs and driven off the cliffs by hunting parties (Dempsey, 2001, p. 606). The most famous of these are the Head-Smashed-In and Old Woman's Buffalo Jumps north and east of the Porcupine Hills. Buffalo hunting occurred primarily in the fall and winter months.

The Piikani Nation members continue to hunt in their territory with a focus on deer and elk. Other species of importance to the Piikani Nation are moose, grouse, badger, mountain sheep, mountain goat, rabbit, squirrel, black bear, grizzly bear, beaver, badger, owl, elk, gopher, otter, wolf and porcupine. Hunting occurs for subsistence as well as for medicinal and ceremonial purposes such as for use in bundle and Sundance ceremonies (Piikani Nation, 2015b; Dempsey, 2001).

The Piikani Nation identified wildlife in the Project area including golden eagles and grouse (Scott & Thorpe, 2015). During consultation, the Piikani Nation identified eight wildlife sites

used for hunting and four harvest sites used for plant gathering that partially or fully overlap the LSA. However, the specific locations are identified as confidential by the Piikani Nation.

5.3.1.2 Trapping

Trapping among Blackfoot members has been for the primary purpose of obtaining eagle feathers that are important for ceremonial and war regalia. The method of trapping entailed building a mound of earth with a hollow centre covered by branches on a high point, typically in the foothills. Using bison or coyote bait, young Blackfoot men would lure eagles to the mound and pull the eagle into the centre and kill it. One recorded location of a permanent eagle trapping site is in the southwest part of the Piikani Nation Timber Limit 147B that was last used in the 1960s.

Today, the practice of eagle trapping has declined among the Piikani Nation:

> Eagle trapping is not a thriving practice among the Piikani Nation today. The fact that eagle trapping survived into the reserve era, until the 1960s, speaks to the loyalty of Piikani Nation people to their traditions despite the pressure to conform to Canadian life. The end of eagle trapping coincides with the removal of medicine bundles from the Piikani Nation community. (Hannis, 2006, p. 41)

Trapping of furbearers was limited to wolves and foxes. Blackfoot taboo prevented trapping of beaver due to its role in the bison hunt (Colpitts 2014, p. 64). Other secondary sources indicate that Blackfoot members primarily hunted bison but during the early 1800s there was a period of intensive trapping for beaver that played a role in the success of the Rocky Mountain House posts (Parks Canada, 2008).

Based on information provided by the Piikani Nation, there are no traplines currently in use by the Piikani Nation within the LSA.

5.3.1.3 Fishing

The Piikani Nation considered fish to be survival food *versus* their preferred staple diet of buffalo. In comparison to buffalo, fish were rarely harvested and considered to be less substantial (Crowsnest Highway, 2004). However, buffalo went extinct in the late 1800s with extensive starvation forcing the Piikani Nation members to shift into farming and eventually ranching for a livelihood (Scott & Thorpe, 2015).

Current fishing among the Piikani Nation members occurs in streams and lakes near the reserve and is primarily for sport (*i.e.*, catch and release) due to concerns about water quality, especially near the Old Man River dam (Figure H.4.1-1). These areas are outside of the Project LSA. The Piikani Nation identified species of interest including Westslope Cutthroat trout, Rainbow

trout, Mountain Whitefish, Bull trout, Brown trout, Brook trout and Lake trout (Piikani Nation, 2016).

5.3.1.4 Plant Gathering

In the past, plant gathering was an important undertaking among the Piikani members. They targeted a variety of plants available in different parts of their territory.

> Aspen, poplar and birch were the main trees that managed to survive in the coulees. …[T]o the west, the tree-covered foothills of the Rocky Mountains were a primary source of lodgepole pine [for constructing tipis]. (Dempsey, 2001, p. 604).
>
> The mountainous areas also provided important medicinal and ceremonial plants that were not available on the plains, including sweet pine, yarrow, ochre and bearberry. (Scott & Thorpe, 2015).
>
> Serviceberries and chokeberries were the most widely used, particularly for making pemmican. (Dempsey, 2001, p. 607).

A variety of plants continue to be gathered for medicinal and ceremonial uses governed by important cultural protocols. According to the seasonal round, plants are generally gathered in the spring. In the fall, lodgepole pine is gathered for constructing tipis. Plants identified during ground-truthing and currently harvested by the Piikani Nation members include sweet pine, poplar, bearberry, juniper, yarrow, tree lichen, willow, cottonwood and birch (Scott & Thorpe, 2015). The Piikani Nation also identified stonecrop and aster as important plants. Sweet pine was a consistent focus of harvest during site tours and ground-truthing efforts (Scott & Thorpe, 2015). The importance of plants is not isolated to members; they are also considered by the Piikani Nation as vital for the survival of wildlife.

During ground-truthing, the Piikani Nation field crew members recorded four harvest sites for plant gathering and hunting that partially or fully overlap the LSA (EIA Figure H.4.1-1). However, they did not disclose the specific locations or uses in the public report.

5.3.1.5 Trails and Travelways

According to the Piikani Nation Elders, Crowsnest Pass was an important east-west travel corridor for the Blackfoot both for harvesting of buffalo and plants in times of peace and to defend their territory in times of war. Methods of travel were by horse and foot with the support of travois and dogs. After introduction of the horse in the early 1700s, there was an increase in warfare with groups west of the Rocky Mountains (Dempsey, 2001, p. 608).

Another reason for travel in the spring and autumn was to trade to the north at Rocky Mountain House and Fort Edmonton with goods such as meat, buffalo robes, horses and a limited supply of furs (Dempsey, 2001). More specifically in Crowsnest Pass, the Piikani Nation Elders noted that the Blackfoot trail steered north to avoid the area that is currently covered by the Frank Slide because they knew the instability of the mountains in this area. There were also smaller trails throughout the Grassy Mountain area connecting lookout or scouting sites on top of rock outcrops occupied for brief periods of time by men who sent messages between ridges. Along these trails were rocks cairns used for navigational purposes.

During consultation, the Piikani Nation identified specific locations of rock cairns and smaller trails connecting scouting sites in relation to the Project, however this information was identified as confidential and cannot be used in this assessment.

Trails and travelways were identified for current use during consultation. Four features associated with travel that overlap the LSA were identified by the Piikani Nation (EIA) however, the specific locations of these features were not disclosed in the public report.

5.3.1.6 Cultural and Spiritual Values

As with all Nations in the Project area, the Piikani draw their culture from the area – the land, the landscape and the animals. There is a kinship with the animals which continues to provide lessons and teachings by which to live. For example, beavers provided lessons in etiquette, pain, industry and work, seasonal cycles and vegetation. Other animals were symbols of prestige or had strict restrictions when it comes to sharing (Piikani Nation, 2015a).

> I wanted to talk about our old history and current history. When we go and see these sites and go on these field visits, it is like a double-edged sword. You go out there and you're lucky enough to be on this team. Since the settlement of these lands, we are the first Natives to be back. But it puts a big onus on us guys. We have to go out there and all the history before us before we went out there, those sites have not been dealt with. Then it's up to us how to figure out how, what we should do with them, document them as much as we can and bring them back to the Elders to see to get some insight what there is. It is a heavy burden to carry to go out and do these. It's an honour and on other side, it's a heavy burden to carry. - Piikani Technician (Workshop 2014, cited in Piikani Nation 2015a)

The Piikani Nation say that stories are connected with Grassy Mountain, but also all the mountains. The Piikani Nation's creation story is linked to the mountains which is one reason why they had camps sites and sacred spaces in the flat places in the mountains. Warrior societies at one time protected these places (Piikani Nation, 2015a). The land is understood as a storybook.

The Piikani have not forgotten their connection to the land and their animals. They are deeply aware of the connection and the relationship. Elders have placed great pressure on themselves to make sure that cultural and spiritual values are not lost even when they can no long access these sites or harvest the animals (Piikani Nation, 2015a).

The Piikani continue with their traditional practices today and share what they know with their youth. It was acknowledged in a series of workshops that sharing cultural and spiritual knowledge is not without its challenges. Frequently, they cannot access areas in their traditional territory and must exercise their traditional practices elsewhere (Piikani Nation, 2015a).

Among the critical cultural and spiritual knowledge that is passed along is information on the seasonal round, animal behaviour in each season and what it says about seasonal conditions and ecological functioning, plants especially medicinal plants, harvesting skills, knowledge of symbology and the meaning behind symbology, travel and navigation and ceremonies (Piikani Nation, 2015a). Cultural, spiritual and ceremonial teachings are inextricably bound.

> The Piikani Nation's social and cultural fabric is based on access to traditional land and resources and the loss of traditional land even small amounts, continues to erode the already fragile cultural fabric of the Piikani Nation. (Academese & Associates of Piikani Nation, 2016, p. 109).
>
> Piikani Nation culture includes both physical features (such as high elevations as places that are spiritually powerful), plants (such as their use in ceremonies) and animals (as guides and teachers). (Schaldemose & Associates of Piikani Nation, 2016, p. 166).

While country foods have always been important for subsistence and sustenance, the practice of hunting has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

Likewise, fishing has always been important for food, subsistence and sustenance and the activity of fishing has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, legends as well as fish use as medicine, food and more is shared while fishing. In addition, to this educational context, the activity of fishing is typically linked to other intangible values with spiritual, artistic and aesthetic elements. For example, fishing typically provides for quiet enjoyment of the landscape or access to water for other uses.

The practice of gathering plants has important cultural and spiritual considerations as well as for food, subsistence and sustenance. Intergenerational knowledge about ceremonies, legends

as well as plant use as medicine, food and more is shared while harvesting berries and plants. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

5.3.2 Potential Effects and Mitigation Measures on Current Use of Lands and Resources for the Piikani Nation Traditional Purposes

This section describes the Project effects on current use of lands and resources for traditional purposes for the Piikani Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Piikani Nation.

5.3.2.1 Hunting

The Piikani Nation continues to hunt throughout their traditional territory. There are no specific hunting sites identified by the Piikani Nation in the Project LSA. However, Project activities will intersect or be in proximity to habitat and species that are identified for hunting by the Piikani Nation. These species are deer, elk, moose, grouse, badger, bighorn sheep, mountain goat, rabbit, squirrel, black bear, grizzly bear, beaver and porcupine. Particular concerns are changes that may result in hunted species and habitat, hunting locations and how harvesting is accomplished. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and wildlife.

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to the Piikani Nation hunting. The direct and indirect effects on wildlife species and habitats hunted by the Piikani Nation including the loss of habitat availability (through direct loss, sensory disturbance and fragmentation), disruption of wildlife movement (through habitat fragmentation, reduced connectivity and creation of barriers), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and wildlife.

CR #5 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the

same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as moose, elk, deer and bear hunted by the Piikani Nation members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Piikani Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and wildlife.

The potential effects to land use activities related to hunting are identified in CR #10 (EIA, CEAR #42). The primary adverse effect is loss of Crown land for hunting and loss of access to wildlife habitat (O'Connor, 2018). The consequence is loss of hunting opportunities and a likely decline in hunting in the TLU LSA and RSA. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and wildlife.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect project infrastructure. This will limit the Piikani Nation access during construction and operation of the Project, which is approximately 25 years or one generation. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga will continue to consult with the Piikani Nation about the Access Management Plan (AMP) to facilitate access for traditional land use activities where they may be affected by the Project.

Adverse Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in animal behaviour. The indirect effect on the Piikani Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and reduced food quality, which could therefore, affect how and if the Piikani Nation will hunt these animals. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and wildlife.

The Piikani Nation understood that the Project will have adverse effect on wildlife and wildlife habitat. They were concerned about what the Project would do to wildlife as part of their cultural heritage. They wanted to ensure that mitigation would be sufficient to ensure that animal rights were protected. In addition, they wanted to ensure the Project had a small

footprint by developing on previously disturbed sites. Finally, they wanted to ensure that the site was reclaimed: not reclaiming would not be acceptable (Piikani Nation, 2015a).

> The Project may also interfere with access to areas where hunting takes place. The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will have a policy that controls access to reduce risk to public safety and to protect Project infrastructure. This will limit Piikani Nation access during construction and operation of the Project, which is approximately 25 years or one generation. This potential effect is expected to be reduced at mine closure following reclamation. This potential effect is expected to be reduced at mine closure following reclamation. The wildlife will use that mountain. Everything has equal rights. How is it going to affect the elk, cougar, bear? They have every right to access that area, we are all equal. They have equal rights. How is it going to be compensated for them? -Piikani Technician (Plenary Session 2014, cited in Piikani Nation, 2015a)

> Power lines at the top of mountain, the prairie chickens (*i.e.*, grouse) use the top of mountains for a ritual, mating dance. The grouse will never come back to a spot, once it is disturbed. Disturbance wrecks their way of life, their children. -Piikani Technician (Plenary Session 2014, cited in Piikani Nation, 2015a)

The Piikani in their TK/TLU work confirmed that they had concerns for hunting access today and into the future. They want to make sure that hunting rights continue and that long-term impacts are considered. They want to make sure that they continue to have access for themselves and their children (Piikani Nation, 2015a).

To address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and, by extension, effects on Piikani hunters. Key features are:

- continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;

  - commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover; and
  - establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation.
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- engage with the Piikani Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- retain vegetation adjacent to high-activity linear corridors (*e.g.*, access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- continue to work with the Piikani Nation to identify species of importance for harvesting prior to construction activities;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- store all toxic materials, including those used for blasting in secure areas that are inaccessible to wildlife (*e.g.*, buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by

seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the sensory and visual experience of hunters. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) where measures to minimize effects are discussed.

5.3.2.2 Trapping

The Piikani Consultation Team has not identified an interest in trapping in the Project area. It is not anticipated that the Project will have adverse effects to trapping activities for the Piikani Nation, however, if they do trap, the mitigations above in the hunting section will apply.

5.3.2.3 Fishing

The Piikani Nation identified through consultation that that they have a fishing interest in the Project area and identified species including Westslope, Cutthroat trout, Rainbow trout, Mountain Whitefish, Bull trout, Brown trout, Brook trout and Lake trout. They are particularly concerned with changes that may result in changes to fish species and habitat, fishing locations and how harvesting is accomplished. They acknowledge that they switched to fish after the bison disappeared and the fish initially was not a preferred food (Piikani Nation, 2015a).

Land and Resource Use addresses potential effects to land use activities including accessibility to the Project area. Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and Blairmore Creek can be assessed from Highway 40 using existing trails. CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: Detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred fishing method. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and fish

Mitigation measures to avoid or minimize potential effects to the availability of fishing areas include the following:

- a Detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan have been proposed (Appendices B1 and B2, Addendum 8, CEAR #89) that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek;
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Piikani Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- engage with the Piikani Nation prior to and during mine construction to allow for opportunities for species of interest to be harvested, re-located or otherwise utilized;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the sensory and visual experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) where measures to minimize effects are discussed. If the Piikani Nation has additional suggested measures to mitigate for fishing experience, Benga will continue to work with the Nation on these.

5.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Piikani Nation in the Project LSA. These include sweet pine, poplar, bearberry, sweet pine, juniper, yarrow, tree lichen, lodgepole pine, willow, poplar, cottonwood and birch. No information was provided to Benga regarding preferred plant harvesting methods.

The assessments for vegetation (CR #8, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the assessment on plant gathering. The potential effects on key species and habitat including the species identified by the Piikani Nation and a summary of species identified by the Piikani Nation for the Project with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure.

In addition, air emissions released into the atmosphere during construction and operations may result in potential direct and indirect effects on vegetation.

Therefore, potential effects are a change in identified plant species and habitat, change in use or access to identified plant gathering locations and change in preferred gathering method. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and plants.

The mitigation measures relating to Vegetation and Wetlands Land and Resource Use and as measures described in the Conservation & Reclamation Plan are part of the reclamation program, especially for returning of wildlife habitat. In addition, vegetation species identified during consultation process including TK species observed in the vegetation LSA vegetation field surveys are included in the reclamation plan. Key plant gathering mitigation includes:

- on-going consultation with the Piikani Nation in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants will be made available to the Piikani Nation potentially affected by the Project for harvesting; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering location;
- Benga will consider mitigation suggestions proposed by the Piikani Nation regarding traditional and medicinal plants;
- Benga will consult with the Piikani Nation on the Conservation and Reclamation plan and vegetation management program. The C&R plan will include the use of native species and wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Piikani Nation Traditional land use opportunities will be integrated;

- An Indigenous environmental stewardship committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation.

5.3.2.5 Trails and Travelways

The Project will intersect or be in proximity to territory that is identified for trails and travelways by the Piikani Nation. Associated with the trails and travelways in the LSA, the Piikani Nation identified four cultural heritage sites however, the specific locations of these sites were not provided to Benga. Therefore, it is anticipated that the Project may affect access and use of trails and travelways and associated features, especially those within the LSA. It is assumed that trails and travelways connect these sites.

In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the Access Management Plan (AMP) that will include the following:
  - access points and roads to be clearly labelled and documented;
  - notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
  - identified sensitive features (*e.g.*, species of management concern, important habitat features) to be flagged or fenced ahead of clearing; and
  - signage to be used for identifying areas that are not open for public use.
- share information about construction timing; and
- Benga will continue to improve the Cultural Site Discovery Contingency Plan for culturally important sites identified during construction and operations.

The Piikani Nation did not provide any specific, additional recommendations.

In addition to a direct change to trails and travelways and associated features, it is expected that the sensory and visual experience of visiting these locations will also change. The Project will cause noise, dust and a visual impact. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and their trails and travelways. Benga is not proposing any additional mitigation measures other than those already identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42).

5.3.2.6 Cultural and Spiritual Values

Changes resulting from the Project may interfere with the Piikani Nation's ability to pass on cultural teachings to the next generation in the Project LSA. For example, the loss of a harvesting area means there is one fewer place to teach harvesting practices or share a language unique to the area.

The Piikani included loss of culture, now and for future generations among their concerns. They want to make sure that there would be continued access to culturally and spiritually important sites, that the cultural experience in the landscape would not be lost and the value continues, not only for themselves, but also for others.

> If the program proceeds, it will impact our younger generation. It will be part of our culture, our history, our storytelling. From what I heard when I grew up, I used to hear stories from up here from my Elders, from my grandfather (*naahsa*), Wolf Tail (*aapi'sosoyis*), Small Legs, they used to sit around and talk about the old days, about the mountains, about history. We were just young kids; we had to sit around and listen. You [Riversdale] will impact our future, our storytelling will change. The sites that we have seen so far that is just a fraction of what's up there and what's going to be disturbed. It is against our culture. - Piikani Elder (Workshop, September 2014)

In addition to a direct change to cultural and spiritual values and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the relationship between the Piikani Nation and their cultural and spiritual values. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Piikani Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

In their recommendations, they would like Benga to do the following:

- Conduct a ceremony with Piikani Elders and youth before any disturbance occurs;
- Provide lodgepole pine cleared from the site to Piikani members;
- Support orientation on Piikani cultural practices (including ceremonies), history and sacred sites for Riversdale employees and contractors. Blackfoot ceremonies are an important part of traditional safety protocols as they provide protection for members and healing for the land;
- Conduct ceremonies for protection of the land and the workers;
- Adopt Blackfoot frame of mind when doing fieldwork;

- Members of the Brave Dog Society have traditional played a role in security and delivery of messages. They could be employed at the proposed Project in a similar capacity as a recognition of and respect for their traditional skills; and
- Allow more time to conduct additional ground-truthing.

In response, Benga has put forward the following mitigations regarding cultural and spiritual values:

- Benga will continue to work with the Piikani Nation to improve the AMP to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Piikani Nation, where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- Where identified by the Piikani Nation, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;
- If avoidance of any TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Piikani Nation to develop and plan for culturally appropriate mitigation; and
- Benga will continue to work with the Piikani Nation to integrate TK in the development of Project management and monitoring plans and in Project activities.

5.3.3 Residual Effects to Current Use of Lands and Resources to the Piikani Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects to current use of lands and resource valued by the Piikani Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and surrounding lands and resources.

5.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects input provided by the Piikani Nation (CR #9, EIA, CEAR #42). Changes to wildlife may have an effect on the hunting activities and therefore, wildlife mitigation measures are directly relevant to the interest of the Piikani Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and wildlife.

The Project will affect the ten wildlife VCs including moose, elk, bear and special status wildlife species such as mountain goat and eagles through changes in habitat availability, habitat fragmentation/connectivity, mortality risk, all of which will affect local populations to some degree. Most of the Project-related effects on wildlife will be confined primarily to the Project footprint and sensory disturbances associated with mine construction and operations will be largely limited to the WLSA (CR #9, EIA, CEAR #42).

Just as with wildlife, effects to land and resource use has been characterized as local in geographic extent, extended in duration, continuous in frequency, reversible to long-term and negligible in magnitude (no change in the ability to exercise an Indigenous Interest).

In summary, the Project is not expected to have significant effects on species hunted by the Piikani Nation. Similarly, with the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns. As a result, residual effects to hunting are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to hunting by the Piikani Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. Further, the implementation of an Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will function to address issues related to traditional use, wildlife and hunting throughout the life of the Project. It will also provide a mechanism by which community members can actively contribute to and participate in on-going reclamation and conservation planning.

5.3.3.2 Trapping

Given the relationship between hunting and trapping in use and access to wildlife, Benga considered the residual effects the same.

5.3.3.3 Fishing

The characterization of residual effects to fishing included consideration of residual effects and input provided by the Piikani Nation. Changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Piikani Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and fish.

The residual effects to fish and fish habitat were characterized as local in geographic extent, extended in duration, continuous in frequency, reversible in the long-term and nil in magnitude. In other words, the Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Piikani Nation. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is also not expected to affect current access patterns.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience of and enjoyment of fishing can be managed through noise and visual impact management as discussed in CR #1 and CR #2 (EIA, CEAR #42). Nonetheless, the Piikani Nation may avoid fishing in visual and auditory range of Project activities.

In summary, the Project is not expected to affect current fishing patterns. As a result, residual effects to fishing are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to fishing by the Piikani Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

5.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of the residual effects conclusions and input provided by the Piikani Nation. Changes to plant habitat may

have an effect on the plant gathering activities and therefore plant gathering measures are directly relevant to the interest of the Piikani Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Piikani Nation and plants.

The Project is expected to remove traditional use plants within the Project LSA. Beyond the Project area, habitats are expected to remain intact. Therefore, the overall availability of habitat is not anticipated to be substantially affected by the Project.CR #8 (Vegetation) and CR #10 (Land Use) (EIA, CEAR #42) characterizes residual effects to vegetation as local in geographic extent, long-term in duration, continuous in frequency, reversible and high magnitude. The majority of the land to be developed is privately owned and the lands will be reclaimed to an equivalent capability. The mitigation proposes reclaiming the land that will support a range of communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. The residual effects for vegetation are not considered significant.

As described in CR #10 (EIA, CEAR #42) while the Project will result in some loss of traditional use of vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. The Project-specific residual effects are not likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Piikani Nation. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns. As a result, residual effects to plant gathering are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and,
- sensitive in ecological and social context.

In totality, the changes to plant gathering by the Piikani Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

Although residual effects to plant gathering are not considered significant in this context, the Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will include vegetation identification and monitoring of reclamation success. Benga has committed to continued community engagement with the Piikani Nation and will obtain input from the Piikani Nation into the Environmental Management Plans, including the Conservation and Reclamation Plan; this input may be facilitated *via* the Environmental Stewardship Committee, the Indigenous monitoring program or another process determined in collaboration with the Piikani Nation.

5.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary.

The Project footprint will be reclaimed to land use capability equivalent to pre-mining; however, it will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area west of Blairmore Creek and Crown Land to the north of the Project and from either the north or the south along the Gold Creek. With the implementation of the Access Management Plan, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Piikani Nation and trails and travelways.

Therefore, the residual effects are:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- non-reversible where trails and travelways are lost; and
- resilient in ecological and social context.

The changes to trails and travelways used by the Piikani Nation are not considered significant. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and

- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

In totality, the changes to trails and travelways used by the Piikani Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful

5.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by the Piikani Nation in their TK/TLU report.

The residual effects to hunting, trapping, fishing, plant gathering and trails and travelways were deemed to be primarily,

- moderate in magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and,
- sensitive in ecological and social context.

The implementation of mitigation measures including access management planning and ongoing consultation, the Project would still affect Piikani cultural and spiritual values and interests. The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts. As a result, residual effects are characterized as:

- moderate in magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the residual effects of changes to physical and cultural heritage of the Piikani Nation are not considered significant providing mitigation measures are implemented and successful.

Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

5.3.4 Significance Determination of Current Use of Lands and Resources for the Piikani Nation Traditional Purposes

No significant adverse effects post-mitigation were identified for Current Use of Lands and Resources for the Piikani Nation Traditional Purposes. Overall, the Project is expected to change traditional practices, at least for the duration of the Project. The Piikani Nation has recommended measures that would mitigate for the worst of these effects especially as it relates to continuing with spiritual and cultural values. Benga will continue to consult with the Piikani Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

5.4 Piikani Nation Physical and Cultural Heritage

5.4.1 Background of Piikani Nation Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Piikani Nation since the EIA was submitted.

Traditionally, the Piikani Nation habitation sites such as camps were located along Crowlodge or Oldman River, Crowfoot and Blackfoot Crossing on the plains east of Crowsnest Pass (Piikani Nation, 2015). Typical Blackfoot shelters consisted of tipis, including 12-14 buffalo skins and between 20-30 poles (Dempsey, 2001). A winter camp was located along the Old North Trail at Maycroft where there was also a sacred place and a Sundance Lodge. The Old Women's Buffalo Jump is a significant archeological location in Alberta as its identification matches Blackfoot mythology used for a place for marriages between men and women to be held (Piikani Nation, 2015; Dempsey, 2001). The valley where Crowlodge Creek flows into the Oldman River was an important wintering area and became a permanent habitation area for the Piikani Nation.

After contact with Euro-Canadian settlers and the signing of Treaty 7, "most [Blackfoot] selected reserves near favourite wintering places: … the North Piegan near the Porcupine

Hills," (Dempsey, 2001, p. 619). Many of the traditional sites and habitation areas continue to have importance to the Piikani Nation, including Oldman River, Crowsnest Mountain, Napi's Playground, Crowlodge Mountain and Creek, Chief Mountain, Little Bow River, Sweetgrass Hill and Porcupine Hills. They are located throughout the Piikani Nation traditional territory, interconnected through patterns of use and travel and associated with stories and harvesting (Scott & Thorpe, 2015).

Crowsnest Mountain is a sacred site used for ceremonial and religious purposes and is part of Blackfoot myths and tradition (Scott & Thorpe, 2015). Crowlodge Mountain is a location used as a vision quest site and red ochre is gathered there, which is described as a sacred activity by the Piikani Nation (Scott & Thorpe, 2015). Vision quest sites are defined by the Piikani Nation as sacred places to stay for an extended period for spiritual purposes often in an isolated environment with a view at a higher elevation such as a mountain (Scott & Thorpe, 2015). Crowsnest Pass is known for vision quest areas that are significant in a historical and spiritual way. During consultation, four sacred sites and three habitation sites were identified as partially or fully overlapping the LSA. One sacred site is identified near Blairmore in the Piikani Nation's TKU report (Scott & Thorpe, 2015).

5.4.2 Potential Effects and Mitigations on Piikani Nation Physical and Cultural Heritage

The Project will intersect or be in proximity to sacred, gathering and habitation sites identified by the Piikani Nation. The Grassy Mountain area is used for ceremonies and there are additional sites in proximity of the Project LSA.

The Historical Resources Impact Assessment (Section E.13, EIA, CEAR #42) addresses potential effects to sites as defined as any work of nature or humans that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic interest. Several VC Sections are relevant to the assessment of sacred, gathering and habitation sites such as the assessment sections for Land and Resource Use and Historical Resources. Specifically, these sections refer to physical changes to features of cultural heritage, disturbance to the features (*e.g.*, noise and visual disturbance) and change in the cultural value and importance because of the changes to the heritage sites.

The implementation of the Project could result in a change in use or access or disturbance to features associated with sacred, gathering, or habitation sites for the Piikani Nation. Together, these changes will change the cultural value or importance to the value.

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of any unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;
- If avoidance of any identified TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Piikani Nation depending on the circumstances to develop and plan for mitigation of the site;
- Consultation will include sharing information about construction timing;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations; and
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate land use locations.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. Air Quality (CR #1, EIA, CEAR #42) and Noise (CR #2, EIA, CEAR #42) present the dust and visual impact mitigation measures that are being adopted by Benga to minimize any adverse effects.

The mitigation measures proposed for physical and cultural heritage resources are consistent with provincial requirements and measures proposed by the Piikani Nation. Mitigation measures for effects on physical and cultural heritage are also summarized in the Indigenous Cumulative Effects Assessment and management plans.

Where the Piikani Nation has identified additional mitigation measures, these will be discussed with the Piikani Nation in follow-up meetings.

5.4.3 Residual Effects on Piikani Nation Physical and Cultural Heritage

The characterization of residual effects to Indigenous physical and cultural heritage includes consideration of residual effects and input provided by the Piikani Nation.

Benga will continue to consult with the Piikani Nation to address concerns, implement additional mitigation measures or identify offsetting measures by enabling access to Benga owned lands outside of the Project footprint. If avoidance of Indigenous physical and cultural heritage sites is not possible, the Project may damage or disturb sites that are identified by the Piikani Nation for trails and travelways and sacred sites (Scott & Thorpe, 2015). With the

implementation of mitigation measures, potential residual effects may be reduced but not fully mitigated if sites are physically disturbed.

The Project could result in measurable effects on sacred, gathering and habitation sites used by the Piikani Nation. With the implementation of mitigation measures including access management planning, site reclamation and ongoing consultation, the Project would still affect current. As a result, residual effects to sacred, gathering and habitation sites are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- regular frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the changes to Physical and Cultural Heritage of the Piikani Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

5.4.4 Significance Determination of Physical and Cultural Heritage for the Piikani Nation

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Piikani Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Piikani Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Piikani Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

Table 5.4.4-1 Summary of Residual Effects to the Piikani Nation

Valued Component	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting and Trapping	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Fishing	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Plant Gathering	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Trails and Travelways	Moderate	Local	Long-term	Continuous	Not reversible	Resilient	Not significant
Cultural and Spiritual Values	Moderate	Local	Long-term	Continuous	Not Reversible	Sensitive	Not significant
Indigenous Physical and Cultural Heritage	Moderate	Local	Long-term	Regular	Not reversible	Sensitive	Not significant

6.0 SIKSIKA NATION CONSULTATION AND ASSESSMENT

6.1 Siksika Nation Consultation Summary

Consultation and engagement activities with the Siksika Nation have included:

- ongoing and regular phone and e-mail communications;
- review of provincial and federal environmental assessment processes and role of traditional studies in the assessment;
- meetings to discuss Project updates and seek input on the Project and the environmental assessment;
- an open house on the Siksika Nation reserve; and
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - draft CEAA guidelines;
  - Project description for the environmental assessment process; and
  - information packages.
- development of on-going field programs to:
  - assess and refine recommendations for mitigation of specific Traditional Use sites; and,
  - assess potential impacts of the Project on archaeological sites of cultural interest identified as part of the Historic Resources Impact Assessment (HRIA) and consider recommendations for mitigation as outlined in the HRIA.

Benga initiated engagement with the Siksika Nation in June 2013 with a meeting at the Siksika Nation Resource Development offices to introduce the company, key members of its team and express Benga's interest in developing a project in the Crowsnest Pass. In this meeting, the Siksika Nation provided a background on the area, their Aboriginal interests and expressed interest in economic opportunities related to the Project.

Benga worked with the Siksika Nation to develop a First Nations Consultation Plan. The Siksika Nation reviewed the Plan before it was finalized for submission to the Alberta government. Benga and the Siksika Nation then developed a work plan and budget for the Siksika Nation's continued participation in the environmental assessment process. Benga provided funding for the Siksika Nation's participation in the Project environmental assessment process. The consultation work plan and budget were revised, as necessary, to accommodate

unanticipated changes to the Project or the regulatory process such as Project changes bringing it under CEAA purview and referral of the Project to a JRP.

In accordance with the First Nations Consultation Plan, Benga provided a copy of the PTOR to the Siksika Nation in December 2014. Benga followed-up with emails and an in-person meeting to discuss the PTOR in detail and advised the Siksika Nation when the AER finalized the TOR in March 2015. To ensure that the Siksika Nation remained informed about the Project's status in the federal regulatory process, Benga provided regular updates by email, letters and in-person meetings. These updates included reference to funding opportunities for participation in the federal review process.

Between August 2016 and April 2019, Benga and the Siksika Nation representatives engaged in ongoing dialogue regarding the EIS mitigation measures and issues and concerns. The Siksika Nation has engaged actively in Project review, submitting comments, participating in meetings, traditional land use fieldwork and site visits and conducting the following additional work related to the Project:

- Traditional land use studies;
- Cumulative Effects Assessment; and
- Assessment of HRIA sites.

Information provided to Benga after the submission of this consultation update report will be considered by Benga and incorporated into the Project planning as appropriate.

6.2 Siksika Nation Traditional Use and Traditional Knowledge Studies

The Siksika Nation has submitted the following traditional use studies for the Project to Benga:

- Riversdale Grassy Mountain Proposed Metallurgical Coal Mine Final TUS Assessment and Report (Siksika Nation, 2015); and
- Siksika Nation Traditional Use Study Report #4 Grassy Mountain Coal Mine (Siksika Nation Consultation Office, 2018).

Benga provided funding to the Siksika Nation to undertake the TK/TU and the Cumulative Effects Assessment (Carlson, 2018). Given that information gathered in all stages of TK/TU research with the Siksika Nation is the intellectual property of the Siksika Nation, a non-public and confidential version of the 2015 TKU report was produced but was not provided to Benga. The confidential report is more comprehensive than the public report, was developed for the Siksika Nation and is housed and controlled by the Siksika Nation.

Non-confidential outcomes of the fieldwork and information related to the Project are provided in the reports listed above. The fieldwork focused on key areas in the Project's original footprint where 46 TK/TU sites were recorded.

The Siksika Nation's Traditional Knowledge and Use (TK/TU) of the Grassy Mountain Area served as an instrument for the Siksika Nation to record traditional knowledge and land uses, to identify potential effects of the proposed Project and to give the Siksika Nation knowledge holders an opportunity to provide ideas for mitigation of potential effects. This study is a vital component of the consultation process because TK/TU studies enhance the quality of an environmental assessment in terms of confidence in results, avoiding potential effects to the Siksika Nation and incorporating knowledge of the local environment.

6.3 Current Use of Lands and Resources for the Siksika Nation Traditional Purposes

6.3.1 Background of Current Use of Lands and Resources for the Siksika Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Siksika Nation to date, in the TUS Assessment and Report (Siksika Nation, 2015) and the TUS Report (Siksika Nation Consultation Office, 2018).

6.3.1.1 Hunting

The Siksika Nation and Blackfoot culture and history developed around the life cycle of the buffalo (Blackfoot Crossing, 2015). Traditionally, the Siksika Nation relied primarily on buffalo which followed an annual migration where buffalo would locate on the prairies in summer and move to the foothills in winter. Members travelled to various hunting grounds using jumps and runs to trap and harvest buffalo (Dempsey, 2005). Buffalo jumps were used primarily in the fall and winter seasons around the Rocky Mountains such as at Head-Smashed-In Buffalo Jump (Alberta Culture and Tourism, 2015). The Head-Smashed-In Buffalo Jump Museum provides more detail about the wintering grounds of the buffalo in the foothills compared to their spring movement in the prairies:

> The Blackfoot bands were nomadic. The structure of their movements was dictated by the location of the bison herds, the weather and the season. Bison wintered in treed areas where snow is less deep. Brushing snow aside with winter's thick facial hair, grazing in shadow of forests, they did not move quickly in deep drifting snow and made easier targets for hunters. In spring the bison moved out onto the Plains where the new spring grasses provided forage. (Government of Alberta, 2019).

The Siksika Nation, like other Blackfoot members, hunted other wildlife species for food and clothing, including elk, deer, antelope and mountain sheep (Blackfoot Crossing, 2015). Ducks, geese, swans and prairie chickens were hunted for food when buffalo was not available although birds were generally not a primary source of subsistence (Dempsey, 2001). Buffalo meat and wolf skins were used for trade at locations such as Rocky Mountain House and key hunting grounds were located in the mountains approximately 175 km northwest of Grassy Mountain (Parks Canada, 2008). Preferred hunting tools included the bow and arrow; however, upon introduction of trade with Euro-Canadian settlers, hunting practices adapted to the use of horses and rifles (Dempsey, 2001).

Wildlife within the Project area that are important for traditional use and are of interest to the Siksika Nation include eagle, moose, elk, black tail deer, mule deer, white tail deer, big horn sheep, beaver, muskrat and rabbit (Siksika Nation, 2015). The Siksika Nation recommends that wildlife located in the Project area have time to re-locate to new habitat by developing the Project in appropriate timeframes (Siksika Nation, 2015). The Siksika Nation indicate that all animals living on the mountain are important. The Siksika Nation members report having used the Project area and mule deer, elk and moose are identified as valued species (Siksika Nation Consultation Office, 2018; Carlson *et al*., 2018).

The TUS reports identify that, while the Siksika Nation members do not use the Project LSA and RSA as extensively to hunt today as they did in the past, the area continues to be the source of wildlife hunted for use in ceremonies, sacred bundles and for subsistence purposes. Hunting practices today have been largely constrained by the fragmentation of biophysical and cultural landscapes, industrial development and the prohibitive monetary, temporal and social costs incurred to many individuals with employment obligations.

The Siksika Nation indicates there is a sacred agreement between humans and animals and that the Blackfoot members are stewards of the animals within their traditional territory (Siksika Nation, 2015).

6.3.1.2 Trapping

Secondary sources reported various levels of participation by the Siksika Nation in trapping activities (Kidd, 1986). Dempsey (2008) describes that because of the Siksika Nation's geographic location, it is possible that the Siksika Nation were the first of the Blackfoot tribes to be involved in trapping with the arrival of Euro-Canadian settlers.

The Siksika Nation did not identify an interest in trapping within the LSA or in the Project area and the TLUS Report did not include any information on trapping. The Siksika Nation did not

provide information about current trapping practices nor is site-specific information available in the literature.

6.3.1.3 Fishing

The Siksika Nation Interim TUS Assessment and Report (Siksika Nation, 2015) did not provide information about current fishing practices among the Siksika Nation members nor is site-specific information available in the literature. However, during consultation meetings, the Siksika Nation identified an interest in fishing Rainbow trout, Whitefish, Pike and Bull trout (Siksika Nation, 2015). Secondary sources report that the Blackfoot members generally viewed fish as an unclean source of food (Kidd, 1986).

The Siksika Nation raised concerns regarding potential contamination of the Gold and Blairmore Creeks water systems and microclimate as it would affect fish and the Siksika Nation's traditional use of the creek bottoms (Siksika Nation Consultation Office, 2018). No fish species or fishing areas are specified in the report.

6.3.1.4 Plant Gathering

Plants have always been highly important to the Siksika Nation and would be gathered traditionally during all seasons for subsistence, ceremonial and medicinal purposes. A variety of plants were important such as chokecherry, Saskatoon berry, wild turnip, sweetgrass, sage and bearberry (Blackfoot Crossing, 2015).

During site visits, the Siksika Nation noted "medicinal and ceremonial plants were found in several locations on the Project site [Grassy Mountain], particularly in fertile micro-systems and other sunny slopes" which affirms current plant gathering among the Siksika Nation members (Siksika Nation, 2015, p. 83). Further, sweet pine is culturally important and located in the Project area around Gold Creek (Siksika Nation, 2015). Additional species are identified including lodgepole pine, bear's power root, bull berries, angelica, prairie fern parsley, aspen, rose hip, wolf willow, white willow, red willow, sage, pipe stone, yellow paint, camas root, bearberry, cow parsnip, willow, Saskatoon berries, choke cherries, arrow leaf balsamroot, bitter root, blue elderberry, wild licorice, blue eyed grass, blue flax, old man's whiskers, creeping Oregon grape, fireweed, golden current, nodding onion, creeping juniper, glacier lily, serviceberry, thimbleberry, wild strawberry and woods rose (Siksika Nation, 2015).

6.3.1.5 Trails and Travelways

The Siksika Nation did not identify any trails or travelways or features associated with navigation within the Project LSA.

6.3.1.6 Cultural and Spiritual Values

As with all Nations in the Project area, the Siksika draw their culture from the area – the land, the landscape and the animals. There is a kinship with the animals which continues to provide lessons and teachings by which to live. The Siksika Nation do not view their spirituality as centralized in one physical location. Rather, they view their spirituality as expressed in sites that are part of a complex that is roughly crescent shaped from Gold Creek and Blairmore Creek valleys and benches and the saddle of land connecting those between Grassy Mountain and Grassy Mountain South (Siksika Nation Consultation Office, 2018). It is at Grassy Mountain that the Siksika received the Thunder Pipe from Thunder before he was forced by Crow to live at Chief Mountain. For millennia, the Thunder Pipe ceremony was held at Grassy Mountain when the first thunder was heard each year. The Siksika have used the area for over 9,000 years. With the coming of non-Blackfoot settlers, the Siksika lost access to many of their sacred sites. They equate Grassy Mountain as being analogous to Lourdes (Siksika Nation, 2018). The Siksika Nation considers yellow ochre sites to be sacred and indicated that such sites are present in the LSA.

The Siksika Nation remains connected to the land. There are many well-known and documented sacred places and gathering areas throughout the Siksika Nation territory. These sacred sites are unifying symbols, provide evidence for cultural continuity and establish and reinforce national and personal connections to the landscape. Elders have placed great pressure on themselves to make sure that cultural and spiritual values are not lost even when they can no longer access these sites or harvest the animals (Siksika Nation, 2015).

Among the critical cultural and spiritual knowledge that is passed along is information on the seasonal round, animal behaviour in each season and what it says about seasonal conditions and ecological functioning, plants, especially medicinal plants, harvesting skills, knowledge of symbology and the meaning behind symbology, travel and navigation and ceremonies (Siksika Nation, 2015). Cultural, spiritual and ceremonial teachings are inextricably bound.

While country foods have always been important for food, subsistence and sustenance, the practice of hunting has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

Likewise, fishing has always been important for food, subsistence and sustenance, the activity of fishing has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, legends as well as fish use as medicine, food and more is shared while

fishing. In addition, to this educational context, the activity of fishing is typically linked to other intangible values with spiritual, artistic and aesthetic elements. For example, fishing typically provides for quiet enjoyment of the landscape or access to water for other uses.

The practice of gathering plants has important cultural and spiritual considerations above. While plants for food, subsistence and sustenance. Intergenerational knowledge about ceremonies, legends as well as plant use as medicine, food and more is shared while harvesting berries and plants. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

6.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for the Siksika Nation Traditional Purposes

This section describes the Project effects on current use of lands and resources for traditional purposes for the Siksika Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Siksika Nation.

6.3.2.1 Hunting

The Siksika Nation continues to hunt throughout their traditional territory. There are no specific hunting sites identified by the Siksika Nation in the Project LSA. However, Project activities will intersect or be in proximity to habitat and species that are identified for hunting by the Siksika Nation. Adverse Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in animal behaviour. The indirect effect on the Siksika Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and reduced food quality. The Siksika Nation's own research anticipated a continuing decline in elk and mule deer populations largely due to on-going habitat conversion and fragmentation (Carlson *et al*., 2018a). The Siksika Nation also identified that this Project would continue reducing access to hunting locations; thereby, decreasing existing hunting opportunities. These effects, in turn, affect the cultural and spiritual relationship between the Siksika Nation and wildlife.

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to the Siksika Nation hunting. Direct and indirect effects on key wildlife species and their habitats of species that are hunted by the Siksika Nation include: loss of habitat availability (through direct loss, sensory disturbance and fragmentation), disruption of wildlife movement (through habitat fragmentation, reduced connectivity and creation of barriers), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, affect the cultural and spiritual relationship between the Siksika Nation and wildlife.

CR #1 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions (CR #12, EIA, CEAR #42) addresses potential effects on wildlife health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with the Project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as moose, elk, deer and bear hunted by the Siksika Nation members.

According to the Siksika Nation, the primary adverse effect is loss of Crown land for hunting and loss of access to wildlife habitat. This could result in loss of hunting opportunities and a likely decline in hunting in the LSA and RSA. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and wildlife.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Siksika Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and wildlife.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect Project infrastructure. This will limit the Siksika Nation access during construction and operation of the Project. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga will continue to consult with the Siksika Nation in developing an Access Management Plan (AMP) to facilitate access for traditional land use activities where they may be affected by the Project.

In order to address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and

activities aimed at mitigating impacts to wildlife and, by extension, effects on Siksika hunters. Key mitigation measures are:

- continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared to determine the occurrence of any important wildlife habitat features; these surveys will be used to inform the development and implementation of site-specific mitigation measures;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant establishment and cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
    - commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover; and
    - establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation.
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- vegetation adjacent to high-activity linear corridors (*e.g.,* access roads, coal conveyor) will be retained to reduce the extent of noise and visual sensory disturbances to the extent possible;
- consider compensation for loss of wildlife habitat features, as appropriate, for species important to the Siksika Nation, such as provision of alternative eagle nest sites;

- provide clearing plans to the Siksika Nation at least one year in advance to allow identification of sacred plants that could be impacted by the Project; Wildlife crossing signs will be put up to minimize wildlife-vehicle collisions;
- continue to work with the Siksika Nation to identify species of importance for harvesting prior to construction activities;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the *Migratory Bird Convention Act* to ensure no nesting eagles are affected;
- store all toxic materials, including those used for blasting in secure areas that are inaccessible to wildlife (*e.g.*, buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and Gold Creek. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

Noise, dust and visual impacts of the Project may alter the quality of the sensory and visual experience of hunters. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) where measures to minimize effects are discussed.

Benga will continue to work with the Siksika Nation to develop mitigation measures. The Siksika Nation has contributed suggested refinements to proposed mitigation measures. They wanted to ensure that animals had time to relocate safely and securely. They had special comments regarding eagles given that these sacred birds require special treatment and habitat creation:

> The animals that live on the property must be allowed time to find a new home meaning that the Project must be developed slowly and their access to water managed to be always available.
>
> There is an abundance of eagles - sacred in Blackfoot culture - that live and nest seasonally on the property since the site in on a major eagle migratory flyway (see Figure 2). The Project should include the establishment of appropriate, alternative nesting locations off the site but nearby for those eagles that will be impacted by the Project. - Siksika Interim TUS Assessment Report. (Siksika Nation, 2015d, p. 12)

Benga will take into consideration additional suggestions from the Siksika Nation on mitigation measures for hunting experience.

6.3.2.2 Trapping

Siksika has not identified an interest in trapping in the Project area, even though it was historically a traditional activity. The Siksika TUS assessment report highlights the importance of eagles to Blackfoot culture. It is not anticipated that the Project will have adverse effects to trapping activities for the Siksika Nation, however, if they do trap, the mitigations above in the hunting section will apply.

6.3.2.3 Fishing

During consultation, the Siksika Nation identified that they have a fishing interest in the Project area and identified species including Rainbow trout, Pike, Whitefish and Bull trout (Siksika Nation, 2018).

Land and Resource Use addresses potential effects to land use activities including accessibility to the Project area. Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and Blairmore Creek can be assessed from Highway 40 using existing trails.

CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred fishing method. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and fish.

The Siksika Nation, in a cumulative effects study, anticipated a continuing decline in fish populations largely due to on-going habitat conversion and fragmentation (Carlson *et al.*, 2018a). The Siksika Nation also identified that this Project would continue reducing access to fishing locations thereby decreasing existing fishing opportunities.

To address concerns related to fishing, Benga has planned to avoid or minimize potential effects to the availability of fishing areas through the following:

- a detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan have been proposed (Appendices B1 and B2, Addendum 8, CEAR #89) that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek;
- continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Siksika Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- engage with the Siksika Nation prior to and during mine construction to allow for opportunities for species of interest to be harvested, re-located or otherwise utilized;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the sensory and visual experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42). If the Siksika Nation has additional measures to suggest mitigating for fishing experience, Benga will continue to work with the Siksika Nation on mitigation measures.

6.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Siksika Nation in the LSA.

The Siksika Nation expressed concern for their sacred plants and traditional use medicines growing on the Grassy Mountain Project site, explaining that these plants must be protected (Siksika Nation Consultation Office, 2018). The Siksika Nation indicated the mitigation plan should protect the medicinal and ceremonial plants found in the Project site, including present harvesting, near term green housing and eventual replanting of important species during remediation (Siksika Nation, 2015).

CR #8 (EIA, CEAR #42) addresses potential effects on key species and habitat including the species identified by the Siksika Nation and a summary for the Project with the occurrence of species within the LSA. Potential effects of the Project on vegetation resources are

predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure. In addition, air emissions released into the atmosphere during Project construction and operations may result in direct and indirect effects on vegetation.

The potential effects described in these sections could result in a change in identified plant species and habitat, change in use or access to identified plant gathering locations and change in preferred gathering method. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and plants.

The EIA details the mitigation measures relating to Vegetation and Wetlands (CR #8, EIA, CEAR #42) and Land and Resource Use (CR #10, EIA, CEAR #42). Reclamation specific mitigation is detailed in the Updated Conceptual Conservation and Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to JRP IR-2.6). In addition, vegetation species identified during the consultation process, including TU species (vascular and non-vascular) observed in the vegetation LSA vegetation field surveys are included in the updated C&R Plan (Table F.1.9-1). Key plant gathering mitigation carried out by Benga will include:

- on-going consultation with the Siksika Nation in designing mitigation measures for plant gathering including sharing information about construction timing;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants potentially affected by the Project will be made available to the Siksika Nation for harvesting; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will support an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise;

- Benga will support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes;
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation; and
- Benga will consider mitigation suggestions proposed by the Káínai Nation regarding traditional and medicinal plants.

The Siksika Nation had very specific comments regarding their sacred plants. They did not want the area disturbed until the plants were located and protected through a formal consultation process as described below:

> There are a number of sacred, medicinal and ceremonial plants growing in the microclimate of Gold Creek and elsewhere at Grassy Mountain which need protection from the Project but were omitted from the Project Environmental Impact Assessment (EIA). We are aware they grow there but have not located them yet, because they only bloom at certain times of the year. Once located, a plan for their protection can be developed through a formal consultation process with the company. (Siksika Nation, 2015, p. 7).

6.3.2.5 Trails and Travelways

The Siksika Nation identified sites associated with trails and travelways that are fully or partially within the mine permit boundary; however, specific locations have not been provided. Direct effects to historical resources are anticipated for sites within the mine permit area as a result of Project construction.

The Historical Resources Impact Assessment (Section E.13, EIA, CEAR #42) addresses potential effects to sites defined as any work of nature or humans that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic interest including a palaeontological, archaeological, prehistoric, historic, or natural site, structure, or object. There are 32 recorded archaeological or historic era resources located in the Project area including sites that are valued as cultural heritage sites to the Siksika Nation. Of the 32 sites, there are 10 that are overlapping the Project footprint. It is assumed that trails and travelways connect these sites.

In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the Access Management Plan (AMP) that will include the following:
  - access points and roads to be clearly labelled and documented;

- notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
- identified sensitive features (*e.g.*, species of management concern, important habitat features) to be flagged or fenced ahead of clearing; and
- signage to be used for identifying areas that are not open for public use.

- share information about construction timing; and
- will continue to improve the Cultural Site Discovery Contingency Plan for culturally important sites identified during construction and operations.

In addition to a direct change to trails and travelways and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and their trails and travelways.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Siksika Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

6.3.2.6 Cultural and Spiritual Values

The Siksika Nation is concerned for the on-going loss of access to their cultural and spiritual sites on Grassy Mountain and for the visual impacts of any changes (Siksika Nation Consultation Office, 2018). The Siksika Nation is also concerned that they may lose a source of yellow ochre which is critical to ceremonial practices. The Siksika Nation has proposed that more traditional use research and documentation is needed to more specifically identify ways to avoid and/or mitigate impacts to Siksika traditional use sites and rights and measures to accommodate and/or compensate for unavoidable impacts, while ensuring the future use by Siksika members of the ceremonial and spiritual complex at Grassy Mountain (Siksika Nation Consultation Office, 2018). This is being discussed as part of the IBA negotiations.

The Siksika Nation proposes cultural awareness (competency) training for non-Indigenous employees on the sacred nature of the Southern Gate and Crowsnest Mountain as well as Benga-sponsored ceremonial events, including opening of the pipe (Siksika Nation, 2015).

The Siksika Nation also wants to ensure that the two bodies of water (Gold and Blairmore Creeks) they consider most important to maintaining cultural activities are not contaminated. Overall, as their cultural and spiritual values are tied to the land, they want to be assured that the mitigation measures will be effective.

Benga has proposed mitigation measures relevant to sites of cultural and spiritual importance and committed to the following measures to mitigate effects related to cultural and spiritual values:

- Benga will continue to work with the Siksika Nation to improve the AMP to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Siksika Nation where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- Where identified by the Siksika Nation, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;
- If avoidance of any TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Siksika Nation to develop and plan for mitigation of the site;
- Benga will continue to work with the Siksika Nation to identify ways in which TK can be considered during Project activities and in the development of environmental management plans;
- Benga will continue to work with the Siksika Nation to interweave TK in the development of Project management and monitoring plans and in Project activities;
- Benga will support a cultural competency program for its employees and contractors;
- Benga has and will continue to support local and Indigenous cultural events and ceremonies through its Indigenous engagement and initiatives such as its community sponsorship program;
- Benga will fund and will arrange a ceremony with the Siksika Nation in advance of ground disturbance for Project Construction;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction or operations;
- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program will be implemented, which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

In addition to a direct change to cultural and spiritual values and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The

Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the relationship between the Siksika Nation and their cultural and spiritual values.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Siksika Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

6.3.3 Residual Effects to Current Use of Lands and Resources for the Siksika Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects on the current use of lands and resources valued by the Siksika Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and surrounding lands and resources.

6.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects (CR #9, EIA, CEAR #42) and input provided by the Siksika Nation. Changes to wildlife may have an effect on hunting activities and therefore, wildlife mitigation measures are directly relevant to the interest of the Siksika Nation. Further, these effects in turn could affect the cultural and spiritual relationship between the Siksika Nation and wildlife.

The Project will affect the wildlife VCs hunted by the Siksika Nation (*e.g.*, moose, elk, bear, eagles) through changes in habitat availability, habitat fragmentation/connectivity and mortality risk. With successful application of mitigation measures, the residual effects of the Project on habitat availability, habitat fragmentation/connectivity, mortality risk and abundance within the Wildlife LSA (WLSA) were deemed not significant (CR #9, EIA, CEAR #42).

Most of the Project-related effects on wildlife will be confined primarily to the Project footprint and sensory disturbances associated with mine construction and operations will be largely limited to the WLSA.

In summary, the Project is not expected to have measurable effects on species hunted by the Siksika Nation. Similarly, with the implementation of mitigation measures including an AMP and ongoing consultation, the Project is not expected to affect current access patterns.

After implementation of mitigation, residual effects to hunting are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to hunting by the Siksika Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. Further, the implementation of an Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will function to address issues related to traditional use, wildlife and hunting throughout the life of the Project. It will also provide a mechanism by which community members can actively contribute to and participate in on-going reclamation and conservation planning.

6.3.3.2 Trapping

Given the relationship between hunting and trapping in use and access to wildlife, Benga considered the residual effects the same.

6.3.3.3 Fishing

The characterization of residual effects to fishing includes consideration of residual effects and input provided by Siksika Nation. Changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Siksika Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Siksika Nation and fish.

The Siksika Nation is particularly concerned with habitat loss and erosion. The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Siksika Nation. With the implementation of mitigation measures including an AMP and ongoing consultation, the Project is not expected to affect current access patterns.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience and enjoyment of fishing can be managed through noise and visual impact management as discussed in CR #1 and CR #2 (EIA,

CEAR #42). Nonetheless, the Siksika Nation may avoid fishing in visual and auditory range of Project activities.

As a result, residual effects to fishing are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

The Project residual effects to fishing by the Siksika Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

6.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of the residual effect the conclusions in CR #8 (EIA, CEAR #42) and input provided by the Siksika Nation. Changes to plant habitat may influence the plant gathering activities and therefore plant gathering measures are directly relevant to the interest of the Siksika Nation. These effects, could in turn, could affect the cultural and spiritual relationship between the Siksika Nation and plants.

As described in CR #8 (EIA, CEAR #42), while the Project will result in some loss of traditional use vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. The Project-specific residual effects are not likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Siksika Nation. Benga expects that Project reclamation will support a range of plant communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. As a result, residual effects to plant gathering are characterized as:

- moderate magnitude;
- local geographic extent;

- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the residual effects to plant gathering by the Siksika Nation are not considered significant. An Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will include vegetation identification and monitoring of reclamation success. Benga has committed to share the environmental performance of the Project with the Siksika Nation regularly for the life of the Project.

6.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary. Siksika did not identify specific trails or travelways within the Project area.

The project footprint will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the are west of Blairmore Creek and Crown land to the north of the Project and from either the north or the south along the Gold Creek. With the implementation of the AMP, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Siksika Nation and trails and travelways.

Therefore, the residual effects are:

- moderate in magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- resilient in ecological and social context.

Monitoring and implementing adaptive management techniques will be part of ensuring mitigation measures are effective. With the implementation of mitigation measures, including an AMP, the Project is expected to have a residual effect on the Siksika Nation trails and travelways; however, the effect is predicted to be not significant.

In totality, the changes to trails and travelways used by the Siksika Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

6.3.3.6 Cultural and Spiritual Values

The Siksika Nation has expressed concern for continuing loss of cultural and spiritual values not only through hunting, trapping, fishing and plant gathering, but also through changes to the landscape and sacred and ceremonial sites (Carlson *et al*., 2018). The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts. Benga understands that the Siksika will desire additional consultation to confirm the most appropriate mitigation measures. Providing that satisfactory mitigation measures can be reached and expecting measures similar to those already proposed, Benga anticipates the residual effects to be characterized as:

- moderate magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the changes to cultural and spiritual values of the Siksika Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

6.3.4 Significance Determination of Current Use of Lands and Resources for the Siksika Nation Traditional Purposes

No adverse significant effects post-mitigation were identified for Current Use of Lands and Resources for the Siksika Nation Traditional Purposes. Overall, the Project is not anticipated to measurably change the Siksika Nation's ability to continue traditional practices. It is predicted that the effect of the Project on access to hunting and gathering areas will not be significant as a

large portion of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability and Benga will continue to consult with the Siksika Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

The Siksika Nation has recommended that additional consultation will be needed to confirm mitigation measures would be sufficient to reduce adverse effects on traditional land and resource use, especially concerning spiritual and cultural values. Benga is committed to working with the Siksika Nation to assure mitigation measures are met and their feedback is incorporated into design and planning.

6.4 Siksika Nation Physical and Cultural Heritage

6.4.1 Background of the Siksika Nation Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Siksika Nation since the EIA (CEAR #42) was submitted, in the TUS Assessment and Report (Siksika Nation, 2015) and the TUS Report (Siksika Nation Consultation Office, 2018).

The Siksika Nation continues to have physical and cultural heritage sites in the Crowsnest area. For example, the Siksika Nation Interim TUS Assessment and Report (Siksika Nation, 2015) provides archival photos of camps east of Crowsnest Mountain in the pass. The Siksika Nation Consultation Team further notes that:

> The previous owners [of Grassy Mountain Project] paid little attention to remediation of the property desecrating a sacred site of the Blackfoot people proximate to Crowsnest Mountain, with little regard to our rights, interests and heritage sites protected by the Constitution of Canada. (Siksika Nation, 2015, p. 1).

According to secondary sources, many of the Siksika Nation sacred sites are located in the Oldman River Valley which flows from the Rocky Mountains north of the Grassy Mountain Project (Parks Canada, 2008). Dempsey (2005) notes the location of the Siksika Nation habitation sites north of the Grassy Mountain area around the Battle, North Saskatchewan and Red Deer Rivers. Grinnell (1892) reports Blackfoot members originally occupied forested areas of the foothills prior to 1800 and in the autumn would move to forested areas and remain through the winter season.

After contact with Euro-Canadian settlers and the signing of Treaty 7, Blackfoot chose reserves near their winter places (Dempsey, 2001). Exhibits at the Head-Smashed-in Buffalo Jump

Museum describe Blackfoot winter camps in the woods of the foothills much like the area in and around Grassy Mountain:

> For almost half the year, the Blackfoot bands lived in winter camps. Bands located along a wooded river valley, perhaps a day's march apart; in areas with adequate wood and game resources, some bands might camp together all winter. From about November to March, the people would not move camp unless food supplies, firewood or pasture for the horses became depleted. (Alberta Culture and Tourism, 2015 cited in Section H, p. 115-116).

Blackfoot members used tipis as shelters, consisting of buffalo skins and lodgepole pine (Dempsey, 2001). Lodgepole pine was used primarily in the construction of the tipis. This type of shelter supported the semi-nomadic ways of the Blackfoot members, which was easily transported by travois to the next camp.

The Siksika Nation Interim TUS Assessment and Report (Siksika Nation, 2015) did not provide site-specific information about current sacred sites, gathering sites and habitation areas in and around Grassy Mountain. The Siksika Nation provided an update to the TUS report which identified eagles as a culturally important species to Blackfoot culture (Siksika Nation, 2015). The Siksika Nation identify that there is an abundance of eagles in the Project area including nesting areas and seasonal use. The Siksika Nation provided a migratory fly-way map in their TUS part 2 follow-up report and recommended mitigation measures which are included in the following assessment of potential effects to Indigenous physical and cultural heritage (Siksika Nation, 2015).

The Siksika Nation Consultation Office (2018) raises concerns regarding the continued taking up of land, its potential impact on traditional use rights and traditional use sites and any associated impact on the Siksika Nation traditional culture. The Report indicates the need for further work to be done to locate other burial sites with one kilometre of the cairn found in the proposed south pit area (DkPo-07). The Siksika Nation calls for continued consultation to identify measures to avoid and/or mitigate impacts to the Siksika Nation's traditional sites, use of the ceremonial and spiritual complex at Grassy Mountain and the Siksika Nation rights. Where impacts cannot be avoided, the Siksika Nation calls for accommodation or compensation.

6.4.2 Potential Effects and Mitigations on the Siksika Nation Physical and Cultural Heritage

The Project will intersect or be in proximity to sacred, gathering and habitation sites identified by the Siksika Nation. The Siksika Nation identified four sacred sites and three habitation sites in their TK study that are fully or partially within the Project LSA however specific locations have not been provided. Several VC Sections are relevant to the assessment on sacred,

gathering and habitation sites such as the assessment sections for land and resource use and historical resources.

The Historical Resources Impact Assessment (Section E.13, EIA, CEAR #42) addresses potential effects to sites as defined as any work of nature or humans that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic interest. There are 32 recorded archaeological or historic resources located in the Project area including sites that are valued as cultural heritage sites to Indigenous group (O'Connor, 2018, p. 33). Of the 32 sites, 10 overlap the Project footprint. The Siksika Nation identified three sacred sites in their TU/TK study that are within the Project LSA however specific locations have not been provided to Benga. Direct effects to historical resources are anticipated for sites within the Project footprint as a result of Project construction. If avoidance is not possible, the Project may damage or disturb sites that are identified by the Siksika Nation as sacred sites (Siksika Nation, 2015).

The Siksika have expressed concern for possibly losing sacred site experience within the range of the Project owing to visual and sensory effects such as noise. As a result, the value and importance of physical and cultural heritage sites to the Siksika Nation may be affected.

The potential effects described in the sections listed above could result in a change in use or access or disturbance to features associated with sacred, gathering, or habitation sites. Together, these changes will change the cultural value or importance to the value.

To address the concerns raised by the Siksika Nation, Benga responded with the following:

- Benga will continue to discuss with the Siksika Nation regarding the mitigation measures for site DkPo – 07, which will be buried under the proposed South Rock Dump. Additional fieldwork is proposed for summer 2019; and
- Benga has committed to continue to work with the Siksika Nation to avoid and protect traditional use sites or, if unavoidable, to support other mitigation measures such as ceremonies and site documentation.

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of any unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;

- If avoidance of any identified TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Siksika Nation to develop and plan for mitigation of the site;
- Consultation will include sharing information with the Siksika Nation about construction timing;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations;
- Benga and the Siksika Nation will continue to meet to discuss management of culturally important and sacred sites;
- Benga will work with the Siksika Nation to design and implement an Indigenous Monitoring Program that will include consideration of cultural heritage impacts and monitoring for cultural sites; and
- Benga will continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate land use locations.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) present that noise, dust and visual impact mitigation measures are being adopted by Benga to minimize any adverse effects.

The mitigation measures proposed for physical and cultural heritage resources are consistent with provincial requirements and measures proposed by the Siksika Nation. Where the Siksika Nation has identified additional mitigation measures, these will be discussed with the Siksika Nation in follow-up meetings.

6.4.3 Residual Effects on Siksika Nation Physical and Cultural Heritage

The characterization of residual effects to sacred, gathering and habitation sites includes consideration of residual effects and input provided by the Siksika Nation.

With the implementation of mitigation measures including an AMP and ongoing consultation, the Project could still have measurable effects on sacred sites used by the Siksika Nation and the

Siksika Nation's use of these sites would be disturbed. After mitigation, residual effects to sacred, gathering and habitation sites are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- regular frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the residual effects of changes to physical and cultural heritage of the Siksika Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

6.4.4 Significance Determination of Physical and Cultural Heritage for Siksika Nation

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Siksika Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Siksika Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Siksika Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

In summary, the residual effects of the Project on the Siksika Nation are determined to be not significant and shown in Table 6.4.4-1.

Table 6.4.4-1 Summary of Residual Effects to the Siksika Nation

Valued Components	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting and Trapping	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Fishing	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Plant Gathering	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Trails and Travelways	Moderate	Local	Long-term	Continuous	Not Reversible where trails and travelways are lost	Resilient	Not significant
Cultural and Spiritual Values	Moderate	Local	Long-term	Continuous	Not Reversible	Sensitive	Not significant
Physical and Cultural Heritage	Moderate	Local	Long-term	Regular	Not Reversible	Sensitive	Not significant

7.0 STONEY NAKODA NATION CONSULTATION AND ASSESSMENT

7.1 Stoney Nakoda Nation Consultation Summary

Benga has been consulting with Stoney Nakoda Nation regarding the Project since 2013. As a result of this engagement, Stoney Nakoda Nation have indicated by letter to ACO and the JRP that they have no objections to the Project (CEAR #207).

Consultation and engagement activities with the Stoney Nakoda Nation include:

- ongoing and regular phone and e-mail communications;
- development of on-going field programs to:
  - assess and refine recommendations for mitigations of specific TU sites;
  - assess potential impacts of the Project on archeological sites of cultural interest identified as part of the HRIA and consider recommendations for mitigation as outlined in the HRIA;
- meetings and open houses to discuss the Project updates issues and concerns and to seek input on the Project and the environmental assessment;
- review of provincial and federal environmental assessment processes and role of traditional studies in the assessment; and
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - draft CEAA guidelines;
  - the Project description for the Environmental Assessment Process; and
  - information packages.

Benga initiated engagement with the Stoney Nakoda Nation in June 2013 with a meeting to introduce the Project, describe the Environmental Assessment process and discuss economic opportunities related to the Project. In this meeting, the Stoney Nakoda Nation provided background on their Indigenous interests expressed interest in continued engagement on the Project. Benga followed up in October 2013 with an in-person meeting to provide Project updates and to offer an overview of the technical and regulatory processes. As the Project progressed through early 2014, Benga completed the administrative functions necessary to initiate the Project in the Stoney Nakoda Nation's consultation system, shared periodic updates on Project details and provided further information on the EIA process.

This early consultation laid the groundwork for Benga and the Stoney Nakoda Nation to develop a framework for consultation which was drafted into the First Nations Consultation Plan. The First Nations Consultation Plan was reviewed by the Stoney Nakoda Nation before it was finalized for submission to the Alberta government. Benga then developed a draft proposal for a work plan and budget, based on the First Nations Consultation Plan, to outline the tasks and schedules associated with continued engagement and to ensure that the Stoney Nakoda Nation's resource needs for continued participation were met as the Project progressed through the Environmental Assessment Process. The consultation work plan and budget were revised, as necessary, to accommodate unanticipated changes to the Project, or to the regulatory process. For example, changes leading the Project bringing it under CEAA purview and CEAA's referral of the Project to Review Panel.

In accordance with the First Nations Consultation Plan, Benga provided a copy of the PTOR to the Stoney Nakoda Nation in December 2014 and followed-up with an in-person meeting to discuss the PTOR in detail. In late January 2015, Benga provided the Stoney Nakoda Nation's comments to the ACO and AER. To ensure that the Stoney Nakoda Nation remained informed about the Project's status in the federal regulatory process, Benga met with the Stoney Nakoda Nation in April 2015 to discuss the CEAA Project Description and followed up in July 2015 to provide an update regarding funding opportunities for participation in the CEAA review process.

Between August 2016 and April 2019, Benga and the Stoney Nakoda Nation, including Bearspaw Nation, Chiniki Nation and Wesley Nation, have maintained an ongoing dialogue regarding the EIS mitigation measures and issues and concerns. The Stoney Nakoda Nation have engaged actively in a Project review, providing comments, participating in meetings, conducting traditional land use fieldwork (Cultural Assessment Overview) and site visits.

The Stoney Nakoda Nation has undertaken the following work related to the Project:

- Traditional Use Studies;
- Cultural Assessment Overview; and
- Assessment of archaeological sites of interest identified as part of the Historical Resources Impact Assessment (HRIA).

Benga has provided funding to ensure the Stoney Nakoda Nation's participation in the Project environmental assessment process.

Based on the work done by the Stoney Nakoda Nation to date and supported by a Project Agreement entered into in February 2019, the Stoney Nakoda Nation has indicated in a letter to the JRP that it has no outstanding objections to the Project (CEAR #207).

7.2 Stoney Nakoda Nation Traditional Use and Traditional Knowledge Studies

The Stoney Nakoda Nation submitted the following reports to Benga in relation to the Project:

- We Could Write a Book about this Place. Non-Confidential Summary of Traditional Use: Site Tour in the Grassy Mountain Area in June 2014. (Stoney Nakoda Nation, 2015), herein referred to as "Site Tour Summary."

The Stoney Nakoda Nation's Site Tour Summary of the Grassy Mountain area served as an instrument for the Stoney Nakoda Nation to record traditional knowledge and land uses, to identify potential effects of the proposed Project and to give the Stoney Nakoda Nation knowledge holders an opportunity to provide ideas for mitigation of potential effects. This study is a vital component of the engagement process and aims to ensure confidence in results, avoid potential effects to the Stoney Nakoda Nation and incorporate knowledge of the local environment. The information gathered in the Site Tour Summary by the Stoney Nakoda Nation is the intellectual property of the Nation. The study provided Benga a summary of fieldwork outcomes and Project-related information approved by the Stoney Nakoda Nation for use in the environmental assessment process.

A second non-public report was produced and remains confidential. It is more comprehensive than the public report, was developed for the Stoney Nakoda Nation and kept and controlled by the Stoney Nakoda Nation. Benga provided the funding to undertake the work.

7.3 Current Use of Lands and Resources for the Stoney Nakoda Nation Traditional Purposes

7.3.1 Background of Current Use of Lands and Resources for Stoney Nakoda Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Stoney Nakoda Nation provided to date including from the Site Tour Summary (Stoney Nakoda Nation, 2015).

7.3.1.1 Hunting

Secondary sources indicate the Stoney Nakoda Nation hunted buffalo from the plains to the foothills of the Rocky Mountains and throughout southeastern British Columbia (Getty and Gooding, 2001, p. 596). Hunting activities took place during the summer and fall months along the foothills (Snow, 1977). Getty and Gooding (2001) describe the groups along the foothills:

> To the south of Rocky Mountain House, the Bearspaw, Chiniki and Wesley groups occupied the foothills and headwaters along the front range of the Rocky Mountains. They relied mainly on

> big game such as moose, elk, deer, bighorn sheep and wood buffalo, supplemented by beaver and muskrats. (Section H, 2015, p. 121).

George Ear summarizes the generally recognized land-use areas of the Mountain Stoney as:

> Wesley [and Goodstoney] people migrated north to the North Saskatchewan River … Bearspaw moved down to Chief Mountain area (…) Chiniki stayed along Bow River. (Treaty 7 Elders and Tribal Council 1996, p. 141).

The Stoney Nakoda Nation traditionally hunted in areas that are now part of the United States and British Columbia (Snow, 1977). It became increasingly difficult to continue hunting in the United States due to political boundaries (Snow, 1977). The Stoney Nakoda Nation members hunted and consumed primarily buffalo; however, since buffalo extinction in 1877, they shifted to harvesting other large game, such as deer and elk. The consequences of this extinction on the Stoney Nakoda Nation members were decades of difficulty finding and securing food in the early 1900s (Snow, 1977; Getty and Gooding, 2001). The introduction of the railway system in southern Alberta resulted in species changes and changes in the availability of hunting areas as wildlife was driven from affected areas (Snow, 1977).

The Stoney Nakoda Nation continues to hunt throughout their traditional territory. The Stoney Nakoda Nation has indicated that deer, elk, black bear, coyote, lynx, squirrel, beaver, mink, marten and moose are species of importance for subsistence, medicinal and ceremonial purposes and that their members continue to hunt primarily deer and elk (Stoney Nakoda Nation, 2015).

The Stoney Nakoda Nation did not identify any specific hunting sites in their Site Tour Summary in the Project LSA.

7.3.1.2 Trapping

According to secondary sources, the Stoney Nakoda Nation members trapped furbearers along the Rocky Mountain foothills (Getty and Gooding, 2001). Chief John Snow notes that trapping among Stoney increased with the migration of Euro-Canadian settlers into their territory and that trading changed the way they lived their life. There was a larger need to trap fur-bearing animals to trade; however, trade with settlers never turned into the economic foundation like it did for other nations (Snow, 1977).

The Stoney Nakoda Nation members continue to trap especially within their registered fur management area. Black bear, coyote, lynx, squirrel, beaver, mink and marten were noted as species of interest for trapping. None of the trapping areas registered to the Stoney Nakoda Nation are within the Project LSA (Stoney Nakoda Nation, 2015).

7.3.1.3 Fishing

The Stoney Nakoda Nation has always been unique in valuing fish for subsistence. According to secondary sources:

> Unlike most Plains tribes, fish were important to the Stoney diet. They were caught using three-tined spears, arrows, hooks and lines of bone and twisted inner bark of willow and fish traps. (Getty and Gooding, 2001, p. 597).

Chief John Snow confirms this by stating that "our diet was mainly meat and fish, supplemented by wild vegetables and fruit," (Snow, 1977). Fish were particularly important for subsistence during times of starvation due to a decline in availability of buffalo and other large game (Snow, 1977). The Stoney Nakoda Nation identified species of interest through consultation including white fish and trout (Stoney Nakoda Nation, 2015).

7.3.1.4 Plant Gathering

During the Stoney Nakoda Nation site tour, the field crew identified many plant species that remain central to the Nation's ceremony, healing practices and spirituality located in the Project area. The Stoney Nakoda Nation have identified plant species of interest including lodgepole pine, wild strawberry, spruce, wild leaf rhubarb, balsamroot, three flowered avens, sweet pine, subalpine fir, mushrooms, alpine or arrowhead fern, lupin, mountain ash, tall everlasting, yarrow, fern, heat-leaved arnica, cream-coloured vetchling, silky scorpion weed, phacelia spp., lance-leaved stonecrop, shrubby beard tongue, smooth blue beardtongue and sagebrush (Stoney Nakoda Nation, 2015).

Plants were used for ceremonial purposes, medicinal and subsistence purposes. Secondary sources refer to plant species of importance to Stoney Nakoda Nation for sweat lodges in preparation of vision quests in the mountains:

> The sacred lodge was erected by a chosen few who were appointed by the elders; its construction was vigilantly and prayerfully observed by everyone. The lodge's frame was usually made from willow wood and branches shaped into a dome-roofed, circular building about eight or ten feet across and five feet high; this was usually covered in animals' skins and hides, although sometimes spruce bark and branches and poplar leaves were used. (Snow, 1977, p. 147).

Within the sacred lodge, the Stoney Nakoda Nation built a fire using sweet grass, cedar branch needles and other plants. In addition, the Stoney Nakoda Nation shelters were constructed using spruce bark.

7.3.1.5 Trails and Travelways

The Stoney Nakoda Nation "did not discuss exact details of how the Project area was used and wanted to follow up with their Elders" (Stoney Nakoda Nation, 2015, p. 19). After surveying the area from high vantage points, the Stoney Nakoda Nation pointed out the possibility of "trails according to geomorphology, elevation, and landscape features" (Stoney Nakoda Nation, 2015, p.19). Additionally, it is noted in secondary sources that the Stoney Nakoda Nation members would travel annually in the spring to the Bow River area, with hunting groups in the Sheep and Highwood River area (Galileo Educational Network, 2010).

7.3.1.6 Cultural and Spiritual Values

As with all Nations in the Project area, the Stoney Nakoda Nation have always drawn their culture from their territory – the land, the landscape and the animals. There is a kinship with the animals which continues to provide lessons and teachings by which to live. The Stoney Nakoda Nation Elders and knowledge holders have conveyed the importance of spirituality to the Stoney Nakoda way of life.

> Honouring spirit is crucial to linking different worlds (*i.e.*, animal, people, Creator). Stoney Nakoda spirituality and peoples' connection to the land is profound; the land is where spirit is renewed. Honouring, respecting and trying to understand Stoney Nakoda spirituality is at the core of an appreciation for Stoney Nakoda traditional knowledge and land use. (Stoney Nakoda Nation, 2015, p. 6).

Physical and spiritual levels of existence are central to the Stoney Nakoda Nation's way of life. Plant species are important to the Stoney Nakoda Nation's ceremony, healing practices and spirituality.

While the Stoney Nakoda Nation Site Summary does not provide exact locations of sacred places within the Project area, it mentions that there are areas on the mountain that are recognized by the Stoney Nakoda Members as meditation sites.

While country foods have always been important for food, subsistence and sustenance, the practice of hunting has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

Likewise, fishing has always been important for food, subsistence and sustenance, the activity of fishing has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, legends as well as fish use as medicine, food and more is shared while

fishing. In addition, to this educational context, the activity of fishing is typically linked to other intangible values with spiritual, artistic and aesthetic elements. For example, fishing typically provides for quiet enjoyment of the landscape or access to water for other uses.

The practice of gathering plants has important cultural and spiritual considerations above. While plants for food, subsistence and sustenance. Intergenerational knowledge about ceremonies, legends as well as plant use as medicine, food and more is shared while harvesting berries and plants. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

7.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for the Stoney Nakoda Nation Traditional Purposes

This section describes the potential Project effects on current use of lands and resources for traditional purposes for the Stoney Nakoda Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Stoney Nakoda Nation.

7.3.2.1 Hunting

The Stoney Nakoda Nation continues to hunt throughout their traditional territory for species that are found in the Project area although no specific hunting sites were identified.

The Project activities will intersect or be in proximity to habitat and species that are identified for hunting by the Stoney Nakoda Nation. These species include deer, elk, black bear, coyote, lynx, squirrel, beaver, mink, marten and moose. Each of these species is important for subsistence, medicinal and ceremonial purposes. Nation members continue to hunt primarily deer and elk (Stoney Nakoda Nation, 2015).

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to the Stoney Nakoda Nation hunting. Direct and indirect effects on key wildlife species and habitats of species that are hunted by the Stoney Nakoda Nation include loss of habitat availability (through direct loss, sensory disturbance and fragmentation), disruption of wildlife movement (through habitat

fragmentation, reduced connectivity and creation of barriers), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, could affect the cultural and spiritual relationship between the Stoney Nakoda Nation and wildlife.

CR #5 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with the Project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife hunted by the Stoney Nakoda Nation members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Stoney Nakoda Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Stoney Nakoda Nation and wildlife.

The potential effects to land use activities related to hunting are identified in CR #10 (EIA, CEAR #42). The primary adverse effect is loss of Crown land for hunting and loss of access to wildlife habitat (O'Connor, 2018). The consequence is loss of hunting opportunities and a likely decline in hunting in the TLU LSA and RSA. These effects, in turn, could affect the cultural and spiritual relationship between the Stoney Nakoda Nation and wildlife.

The consequence is loss of hunting opportunities and a likely decline in hunting in the TLU LSA and RSA. These effects, in turn, affect the cultural and spiritual relationship between the Stoney Nakoda Nation and wildlife.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect the Project infrastructure. This will limit the Stoney Nakoda Nation access during construction and operation of the Project. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga has produced an Access Management Plan (AMP) to facilitate access for traditional land use activities within the LSA.

To address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and by extension effects on hunters. Key features are:

- continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during the Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
    - commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover; and
    - establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation.
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- engage with the Stoney Nakoda Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;

- retain vegetation adjacent to high-activity linear corridors (*e.g.*, access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- continue to work with the Stoney Nakoda Nation to identify species of importance for harvesting prior to construction activities;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- store all toxic materials, including those used for blasting, in secure areas that are inaccessible to wildlife (*e.g.*, buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of hunters. Benga has proposed mitigation for visual impacts and dust in CR #1 (EIA, CEAR #42) and for noise in CR #2 (EIA, CEAR #42). If the Stoney Nakoda Nation has additional measures to suggest mitigating for hunting experience, Benga will continue to work with the Nation on mitigation measures.

7.3.2.2 Trapping

The Stoney Nakoda Nation Consultation Team has not identified an interest in trapping in the Project area. It is not anticipated that the Project will have adverse effects to trapping activities for the Stoney Nakoda Nation, however, if they do trap, the mitigations above in the hunting section will apply.

7.3.2.3 Fishing

During consultation, the Stoney Nakoda Nation identified that they have a fishing interest in the Project area and identified Whitefish and Bull trout as species of interest (Stoney Nakoda Nation, 2015).

Land and Resource Use addresses potential effects to land use activities including accessibility to the Project area. Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and Blairmore Creek can be assessed from Highway 40 using existing trails.

CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred fishing method.

Mitigation measures Benga has planned to avoid or minimize potential effects to the availability of fishing areas include:

- a detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan have been proposed (Appendices B1 and B2, Addendum 8, CEAR #89) that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek;
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Stoney Nakoda Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- engage with the Stoney Nakoda Nation prior to and during mine construction to allow for opportunities for species of interest to be harvested, re-located or otherwise utilized;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Stoney Nakoda Nation has additional measures to suggest mitigating for fishing experience, Benga will continue to work with the Nation on mitigation measures.

7.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Stoney Nakoda Nation. Plant species of interest include lodgepole pine, wild strawberry, spruce, wild leaf rhubarb, balsamroot, three flowered avens, sweet pine, subalpine fir, mushrooms, alpine or arrowhead fern, lupin, mountain ash, tall everlasting, yarrow, fern, heat-leaved arnica, cream-coloured vetchling, silky scorpion weed, phacelia spp., lance-leaved stonecrop, shrubby beard tongue, smooth blue beardtongue and sagebrush (Stoney Nakoda Nation, 2015).

CR #8 (EIA, CEAR #42) addresses potential effects on key vegetation species and habitat including the species identified by the Stoney Nakoda Nation. Further, a summary of species identified by the Stoney Nakoda Nation with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure.

The potential effects described in these sections of the EIA could result in a change in identified plant species and habitat, change in use or access to identified plant gathering locations, or change in preferred harvesting method. These effects, in turn, could affect the cultural and spiritual relationship between the Stoney Nakoda Nation and plants. Input provided by the Stoney Nakoda Nation during consultation is considered in the identification of potential effects and proposed mitigation measures.

The EIA details the mitigation measures relating to Vegetation and Wetlands (CR #8, EIA, CEAR #42) and Land and Resource Use (CR #10, EIA, CEAR #42). Reclamation specific mitigation is detailed in the Updated Conceptual Conservation and Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to JRP IR-2.6). In addition, vegetation species identified during the consultation process, including TU species observed in the vegetation LSA vegetation field surveys are included in the updated C&R Plan (Table F.1.9-1). Key plant gathering mitigation includes:

- on-going consultation with the Stoney Nakoda Nation in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants will be made available for harvesting by the Stoney Nakoda Nation potentially affected by the Project; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will consult with the Stoney Nakoda Nation on updates to the Conservation and Reclamation (C&R) plan. The C&R Plan will include the use of native species wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Stoney Nakoda Nation Traditional land use opportunities will be integrated;
- Benga will support an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise;
- Benga will support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes;
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation; and
- Benga will consider mitigation suggestions proposed by the Stoney Nakoda Nation regarding traditional and medicinal plants.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 (EIA, CEAR #42) Air Quality and CR #2 (EIA, CEAR #42) Noise discuss mitigation measures that are being adopted by Benga to minimize any adverse effects.

7.3.2.5 Trails and Travelways

The Stoney Nakoda Nation "did not discuss exact details of how the Project area was used and wanted to follow up with their Elders" (Stoney Nakoda Nation, 2015, p. 19). After surveying the area from high vantage points, the Stoney Nakoda Nation pointed out the possibility of "trails according to geomorphology, elevation, and landscape features" (Stoney Nakoda Nation, 2015, p.19). Additionally, it is noted in secondary sources that the Stoney Nakoda Nation members would travel annually in the spring to the Bow River area, with hunting groups in the Sheep and Highwood River area (Galileo Educational Network, 2010). Although it is possible that the Project may intersect or be in proximity to areas that are identified for trails and travelways by Stoney Nakoda, none were identified.

7.3.2.6 Cultural and Spiritual Values

The Project may intersect or be in proximity to areas that are identified for cultural and spiritual values for the Stoney Nakoda Nation. Therefore, it is anticipated that the Project may affect cultural and spiritual values within the LSA.

In addition to a direct change to cultural and spiritual values and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the relationship between the Stoney Nakoda Nation and their cultural and spiritual values.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Stoney Nakoda Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

7.3.3 Residual Effects to Current Use of Lands and Resources for the Stoney Nakoda Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects to current use for hunting, plant gathering and trails and travelways. These effects, in turn, affect the cultural and spiritual relationship between the Stoney Nakoda Nation and surrounding lands and resources.

7.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects (CR #9, EIA, CEAR #42) and input provided by the Stoney Nakoda Nation. Changes in wildlife

may have an effect on hunting activities and therefore, wildlife mitigation measures are directly relevant to the interest of the Stoney Nakoda Nation. These effects affect the cultural and spiritual relationship between the Stoney Nakoda Nation and wildlife.

The Project will affect the ten wildlife VCs through changes in habitat availability, habitat fragmentation/connectivity, mortality risk and abundance all of which will affect local populations to some degree. With successful application of mitigation measures, the residual effects of the Project on habitat availability, habitat fragmentation/connectivity, mortality risk and abundance within the Wildlife LSA (WLSA) were deemed not significant (CR #9, EIA, CEAR #42).

Just as with wildlife, Project effects to land and resource use: hunting and trapping and access (CR #10, EIA, CEAR #42) have been characterized as local in geographic extent, extended in duration, continuous (access) or occasional (hunting) in frequency, reversible in the long-term and moderate in magnitude and not significant.

In summary, the Project is not expected to have measurable effects on species hunted by the Stoney Nakoda Nation. Similarly, with the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

Measures to be implemented to mitigate these effects are outlined in Section 4.3.2.1 of this Information Request. After implementation of mitigation, residual effects to hunting are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

In totality, the changes to hunting by the Stoney Nakoda Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. Further, the implementation of an Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will function to address issues related to traditional use, wildlife and hunting throughout the life of the Project. It will also provide a mechanism by

which community members can actively contribute to and participate in on-going reclamation and conservation planning.

7.3.3.2 Trapping

Given the relationship between hunting and trapping in use and access to wildlife, Benga considered the residual effects the same.

7.3.3.3 Fishing

The characterization of residual effects to fishing includes consideration of residual effects and input provided by Stoney Nakoda Nation. Changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Stoney Nakoda Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Stoney Nakoda Nation and fish.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Káínai Nation. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience of and enjoyment of fishing can be managed through noise and visual impact management as discussed in CR #1 and CR #2 (EIA, CEAR #42). Nonetheless, the Stoney Nakoda Nation may avoid fishing in visual and auditory range of Project activities.

As a result, residual effects to fishing are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- reversible;
- continuous frequency; and
- sensitive in ecological and social context

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Stoney Nakoda Nation. With the implementation of mitigation measures including an AMP and ongoing consultation, the Project is not expected to affect current access patterns.

7.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of residual effects described in CR #8 (EIA, CEAR #42) and input provided by the Stoney Nakoda Nation. Changes to plant habitat may have an effect on the plant gathering activities and therefore plant gathering measures are directly relevant to the interest of the Stoney Nakoda Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Stoney Nakoda Nation and plants.

The Project is expected to remove traditional use plants within the Project LSA. Beyond the Project area, habitats are expected to remain intact. Therefore, the overall availability of habitat is not anticipated to be substantially affected by the Project.

Vegetation in CR #8 and Land use in CR #10 (EIA, CEAR #42) characterize residual effects to vegetation as local in geographic extent, long-term in duration, continuous in frequency, reversible and high magnitude. The mitigation proposes reclaiming the land that will support a range of communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. The residual effects for vegetation are not considered significant.

As described in CR #10 (EIA, CEAR #42) while the Project will result in some loss of traditional use of vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. The Project-specific residual effects are not likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment.

With the mitigation measures summarized above especially those related to access and experience and pleasure of plant gathering, the Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Stoney Nakoda Nation. As a result, residual effects to plant gathering are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the residual effects to plant gathering by the Stoney Nakoda Nation are not considered significant.

Although residual effects to plant gathering are not considered significant in this context, the Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will include vegetation identification and monitoring of reclamation success. Benga has committed to continued community engagement with the Stoney Nakoda Nation and will obtain input from the Stoney Nakoda Nation into the Environmental Management Plans, including the Conservation and Reclamation Plan; this input may be facilitated *via* the Environmental Stewardship Committee, the Indigenous monitoring program or another process determined in collaboration with the Stoney Nakoda Nation.

7.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary.

Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area west of Blairmore Creek and Crown Land north of the Project and from either the north or the south along the Gold Creek. With the implementation of the Access Management Plan (AMP), potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Stoney Nakoda Nation and trails and travelways

As a result, residual effects to trails and travelways are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- non-reversible where trails and travelways are lost; and
- resilient in ecological and social context.

In totality, the changes to trails and travelways used by the Stoney Nakoda Nation are not considered significant. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and

- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

7.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by the Stoney Nakoda Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project would still affect the Stoney Nakoda Nation cultural and spiritual values and interests. The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts.

As a result, residual effects to trails and travelways are characterized as:

- moderate magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the changes to cultural and spiritual values of the Stoney Nakoda Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

7.3.4 Significance Determination of Current Use of Lands and Resources for Stoney Nakoda Nation Traditional Purposes

No adverse significant effects post-mitigation was identified for Current Use of Lands and Resources for the Stoney Nakoda Nation Traditional Purposes. Overall, the Project is not anticipated to measurably change the Stoney Nakoda Nation's ability to continue traditional practices. It is predicted that the effect of the Project on access to hunting and gathering areas will not be significant as a large portion of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability and Benga will continue to consult with the Stoney Nakoda Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

7.4 Stoney Nakoda Nation Physical and Cultural Heritage

7.4.1 Background of Stoney Nakoda Nation Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Stoney Nakoda Nation since the EIA was submitted, and the Site Tour Summary (Stoney Nakoda Nation, 2015).

In the Site Tour Summary, the Stoney Consultation Team did not discuss exact locations of habitation areas in and around the Grassy Mountain Project (Stoney Nakoda Nation, 2015). However, they reported areas in the Project area that are recognized by the Stoney Nakoda Nation members as meditation sites. Based on a review of literature about the Stoney, general information is noted about the sacred importance and uses of the mountainous areas along the Rocky foothills, as well as the types of shelters and the history of Stoney settlements, including Eden Valley reserve (the most proximate Stoney reserve at a distance of approximately 95 kilometers northeast of the Grassy Mountain Project).

7.4.2 Potential Effects and Mitigations on Stoney Nakoda Nation Physical and Cultural Heritage

The Stoney Nakoda Nation reported areas in the Project area that are recognized as sacred sites for meditation however specific locations have not been provided to Benga. In addition, during consultation the Stoney Nakoda Nation identified potential effects to sites of cultural or spiritual importance (Stoney Nakoda Nation, 2015).

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of any unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;
- If avoidance of any identified TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Stoney Nakoda Nation to develop and plan for mitigation of the site;
- Consultation will include sharing information with the Stoney Nakoda Nation about construction timing;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations;
- Benga and the Stoney Nakoda Nation will continue to meet to discuss management of culturally important and sacred sites;
- Benga will work with the Stoney Nakoda Nation to design and implement an Indigenous Monitoring Program that will include consideration of cultural heritage impacts and monitoring for cultural sites; and
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate land use locations.

It is expected that the change in quality of the experience by Indigenous members in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) present that noise, dust and visual impact mitigation measures are being adopted by Benga to minimize any adverse effects.

Where the Stoney Nakoda Nation has identified additional mitigation measures, these will be discussed with the Stoney Nakoda Nation in follow-up meetings.

7.4.3 Residual Effects on Stoney Nakoda Nation Physical and Cultural Heritage

The characterization of residual effects to Indigenous physical and cultural heritage includes consideration of residual effects described in CR #10 (EIA, CEAR #42) and input provided by the Stoney Nakoda Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project could still have measurable effects on sacred sites used by the

Stoney Nakoda Nation and the Stoney Nakoda Nation's use of these sites would be disturbed. After mitigation, residual effects to sacred, gathering and habitation sites are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- regular frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the residual effects of changes to physical and cultural heritage of the Stoney Nakoda Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

7.4.4 Significance Determination of Physical and Cultural Heritage for Stoney Nakoda Nation

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Stoney Nakoda Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Stoney Nakoda Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Stoney Nakoda Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

In summary, the residual effects of the Project on the Stoney Nakoda Nation are determined to be not significant and shown in Table 7.4.4-1.

Table 7.4.4-1 Summary of Residual Effects to the Stoney Nakoda Nation

Valued Components	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting	Moderate	Local	long-term	Continuous	Reversible	Sensitive	Not significant
Fishing	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Plant Gathering	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Trails and Travelways	Moderate	Local	Long-term	Continuous	Not Reversible where trails and travelways are lost	Resilient	Not significant
Cultural and Spiritual Values	Moderate	Local	Long-term	Continuous	Not Reversible	Sensitive	Not significant
Indigenous Physical and Cultural Heritage	Moderate	Local	Long-term	Regular	Not Reversible	Sensitive	Not significant

8.0 TSUUT'INA NATION CONSULTATION AND ASSESSMENT

8.1 Tsuut'ina Nation Consultation Summary

Consultation and engagement activities with the Tsuut'ina Nation include:

- ongoing and regular phone and e-mail communications;
- development of on-going field programs to:
  - assess and refine recommendations for mitigation of specific Traditional Use sites; and
  - assess potential impacts of the Project on archaeological sites of cultural interest identified as part of the Historic Resources Impact Assessment (HRIA) and consider recommendations for mitigation as outlined in the HRIA.
- meetings to discuss Project updates and seek input on the Project and the environmental assessments; and
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - Project description for the Environmental Assessment Process; and
  - information packages

Benga initiated engagement with the Tsuut'ina Nation in June 2013 with a meeting to introduce the company and team members and express Benga's interest in developing the Project in the Crowsnest Pass. In the meeting, the Tsuut'ina Nation, provided a background on the area, their Indigenous Interests, their administrative structure and expressed interest in continued engagement.

In April 2014, Benga and the Tsuut'ina Nation began to develop a framework for continued consultation, which was ultimately drafted into a First Nations Consultation Plan and provided to the Tsuut'ina Nation for review before it was finalized for submission to the Alberta government. Based on this First Nations Consultation Plan, Benga and the Tsuut'ina Nation then discussed a draft work plan and budget to outline the tasks and schedules associated with continued engagement and to plan for the Tsuut'ina Nation's resource needs for continued participation as the Project progressed through the Environmental Assessment Process. The consultation work plan and budget were revised, as necessary, to accommodate unanticipated changes to the Project or the regulatory process such as Project changes bringing it under CEAA purview and referral of the Project to a JRP.

In accordance with the First Nations Consultation Plan, Benga provided a copy of the PTOR to the Tsuut'ina Nation in December 2014 and followed-up with a meeting to discuss the PTOR in detail. In March 2015, Benga advised the Tsuut'ina Nation when the AER finalized the TOR, confirming at that time that the Tsuut'ina Nation's comments had been provided to the AER. To ensure that the Tsuut'ina Nation remained informed about the Project's status in the federal regulatory process, Benga met with the Tsuut'ina Nation in April 2015 to discuss the CEAA Project Description and followed up in July 2015 to provide an update on information on funding opportunities for participation in the CEAA review process.

Between August 2016 and April 2019, Benga and the Tsuut'ina Nation representatives have had ongoing dialogue around the EIS mitigation measures, issues and concerns. The Tsuut'ina Nation have engaged actively in Project review, submitting comments, participating in meetings, undertaking traditional land use fieldwork and carrying out site visits.

The Tsuut'ina Nation engaged in a project review by submitting comments, participating in meetings, undertaking traditional use fieldwork and site visits and carrying out the following additional work for the Project:

- Cumulative effects assessment;
- TK/TU Assessment; and
- Assessment of archaeological sites of interest identified as part of the Historic Resources Impact Assessment (HRIA).

Information provided to Benga after the submission of this consultation update report will be considered by Benga and incorporated into the Project planning as appropriate.

8.2 Tsuut'ina Nation Traditional Use and Traditional Knowledge Studies

Tsuut'ina Nation has submitted two traditional use studies for the Project to Benga. Funding to undertake this work was provided by Benga:

- Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area, Tsuut'ina Nation, July 2015 (Tsuut'ina Nation 2015).

This report was produced prior to the EIA submission and was fully integrated. Both reports were used to compile Addendum 9 (CEAR #185). A non-public and confidential version of the 2015 TKU report was produced and was not provided to Benga. It is more comprehensive than the public report, was developed for the Tsuut'ina Nation and is housed and controlled by the Tsuut'ina Nation.

A second TK/TU study has been funded by Benga and field work was conducted in 2017 however no report has been received to date.

The Tsuut'ina Nation's Traditional Knowledge and Use (TK/TU) of the Grassy Mountain Area served as an instrument for the Tsuut'ina Nation to record traditional knowledge and land uses, to identify potential effects of the proposed Project and to give the Tsuut'ina Nation knowledge holders an opportunity to provide ideas for mitigation of potential effects. This study is a vital component of the consultation process because TK/TU studies enhance the quality of an environmental assessment in terms of confidence in results, avoiding potential effects to the Tsuut'ina Nation and incorporating knowledge of the local environment.

8.3 Current Use of Lands and Resources for Tsuut'ina Nation Traditional Purposes

8.3.1 Background of Current Use of Lands and Resources for the Tsuut'ina Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Tsuut'ina Nation to date including the TKU (Tsuut'ina Nation, 2015) .

The Tsuut'ina study depicts historical and current practices and use of the Crowsnest Pass. Historically, the Crowsnest Pass provided a range of important resources and Tsuut'ina both visited and lived in the Pass, enjoying the resources it offered. Tsuut'ina used well-established trading routes (*e.g.*, Shuswap) that Tsuut'ina used throughout the Crowsnest Pass. Geophysical and landscape elements of the Crowsnest Pass and the surrounding area also reportedly play important parts in Tsuut'ina culture and spirituality. Large game animals and widely used plant resources were exploited in the Pass during all seasons.

Historically, the Tsuut'ina Nation citizens traveled their territory to trade with neighboring groups and the Hudson's Bay Company as well as to undertake their seasonal round. The Tsuut'ina Nation used Crowsnest Pass as a trading route to reach the Shuswap to the west and would travel to Rocky Mountain House or Fort Edmonton to trade buffalo robes, dried meat and horses to the Hudson's Bay Company in the fall and in the spring (Dempsey, 2001).

Today, First Nations still use the Crowsnest Pass area for the acquisition of plants and spiritual purposes as well as hunting, although hunting and gathering is less intensive in that area than it was in the past. Since the development of Grassy Mountain began over a century ago, the Tsuut'ina have sought out other less disturbed areas for hunting and harvesting (Tsuut'ina Nation, 2015).

8.3.1.1 Hunting

The Tsuut'ina Nation members were nomadic and hunted in areas where they travelled including through the territories of neighboring tribes (Tsuut'ina Nation, 2015). The Tsuut'ina Nation hunting areas were traditionally concentrated on the plains and foothills of southwestern Alberta including areas between the Red Deer and Battle River (Hudson's Bay Company, 1967; Tsuut'ina Nation, 2013b). By the mid-nineteenth century, hunting occurred mainly along the Bow River and Red River (Dempsey, 2001). At Crowsnest Pass, large game was hunted through all seasons (Tsuut'ina Nation, 2015). In the past, buffalo were available in Crowsnest Pass during winter as they concentrated in the bottom of the valley at Crowsnest River.

The Tsuut'ina Nation members hunted deer, elk, antelope, mountain sheep, mountain goat, porcupine, rabbit and squirrel for sustenance as well as for spiritual and ceremonial purposes. They would also collect eggs and harvest ducks, geese and swans (Dempsey, 2001). Hunting for buffalo was a primary harvesting activity while fishing and beaver-trapping were less prominent (Parks Canada, 2015).

Due to mining in the Grassy Mountain area in the 1940s and 1950s, the Tsuut'ina Nation members have shifted their attention to areas that are less disturbed (Tsuut'ina Nation, 2015). Today, the Tsuut'ina Nation still use the Crowsnest Pass area for hunting; however, the scale is reduced compared to past levels of hunting.

As reported during the ground-truthing fieldwork, species of importance to the Tsuut'ina Nation continue to be elk, moose, deer, sheep, buffalo and eagles (Tsuut'ina Nation, 2015).

8.3.1.2 Trapping

The Tsuut'ina Nation Consultation Team did not provide information about trapping practices during ground-truthing activities; however, it is noted that the Tsuut'ina Nation's knowledge of wildlife has been cultivated from hunting and trapping experiences since time immemorial (Tsuut'ina Nation, 2015). The Tsuut'ina Nation members trapped coyotes, wolves and foxes in late fall using dead falls which is a type of trap (Dempsey, 2001). The practice of trapping eagles was sacred and spiritual among the Tsuut'ina Nation (Dempsey, 2001). Eagles are a particularly revered bird species. As in the Tsuut'ina Report of TKLUO (Tsuut'ina Nation, 2013b), they did not trap as intensively as the Cree and other northern the Tsuut'ina Nation, as they relied heavily on the buffalo hunt.

The Tsuut'ina Nation Consultation Team did not provide information about current trapping practices. Based on information provided by the Tsuut'ina Nation, there are no traplines currently in use within the LSA.

8.3.1.3 Fishing

During ground-truthing activities, the Tsuut'ina Nation field crew observed three different kinds of trout in Blairmore Creek (Tsuut'ina Nation, 2015). No other fish were identified during the field activities and there was limited discussion about fish. Secondary sources indicate current Tsuut'ina Nation fishing occurs in the Bow River, Bragg Creek and Fish Creek during the summer south of Calgary; however, nothing is mentioned about the Crowsnest Pass or in the assessment area for the Project (Government of Alberta, 2015).

Secondary sources note that the Tsuut'ina Nation engaged in fishing activities although not as much as hunting and that fish were generally not eaten (Dempsey, 2001). There is no mention of fishing in Crowsnest Pass near the Project (Tsuut'ina Nation, 2015).

8.3.1.4 Plant Gathering

Traditionally, the Tsuut'ina Nation harvested and subsisted on a variety of plant species, including prairie turnips, serviceberries, blueberries and chokeberries (Dempsey, 2001). They also harvested lodgepole pine for constructing tipis and both harvested and used alpine plants in Crowsnest Pass during all seasons (Tsuut'ina Nation, 2015).

An abundance of plants used for ceremonial, spiritual and subsistence were documented in and around the proposed Project (Tsuut'ina Nation, 2015). Many of these plants are important to ceremony, healing practices, cultural identify and spirituality and are not found at lower elevations near the Tsuut'ina Nation (southwest of Calgary). The full value of these unique plants to Tsuu'tina Nation was provided in a confidential report and is not detailed here.

The medicinal power of a plant can be in the root, flowers, leaves and bark. During ground-truthing, the Tsuut'ina Nation field crew identified the following important plant species near the proposed Project: berries, sweet pine, lodgepole pine, juniper, bear root, muskeg tea, trees, shrubs, lichen, fungus, willow and poplar (Tsuut'ina Nation, 2015).

The following plants were harvested during ground- truthing as they were in season: tree fungus, raspberry, bearberry, sweetgrass, sweet pine and lingonberries (Tsuut'ina Nation, 2015). The Tsuut'ina Nation also identified culturally important species such as tamarack, teaberry, bear root, lowbush cranberry, thistle, buffalo horn lichen, mushrooms, old man's beard, muskeg tea, hawthorn berry, scouring rush, Saskatoon berries, dog berry, mountain sage, white fungus, kinnickinnick, bearberry and juniper (Tsuut'ina Nation, 2015).

Different plants are harvested during different times of the year. This depends not only on the plant species, but also on the desired use. For some plants, spring and early summer are good times for harvesting, while berries are sweet and not as potent after the first frost. The

Tsuut'ina Nation harvests some shrub leaves in the spring, before the berries come out. June is known to be a "very good" month for harvesting many plants in the alpine areas. Spring is best for harvesting lodgepole pine, however, if harvesting to build log houses, this should be done in the winter. Lodgepole pine is plentiful in the Grassy Mountain area and the Tsuut'ina have expressed an interest in harvesting the logs in the Project area for tipi poles.

8.3.1.5 Trails and Travelways

The Tsuut'ina oral history describes where they travelled, including in proximity of the Project (Tsuut'ina Nation, 2015). No site-specific details were provided to Benga: Tsuut'ina Nation members did not provide any specific information about traditional trails and travel corridors and spoke more generally about navigation methods through the mountains.

Travel and access to the Crowsnest Pass by the Tsuut'ina Nation members has diminished since contact with Euro-Canadian settlers. While Tsuut'ina continue to use hunting trails throughout the Grassy Mountain area, this is done less than in the past (Tsuut'ina Nation, 2015).

8.3.1.6 Cultural and Spiritual Values

The Tsuut'ina Nation has a strong spiritual and cultural connection with the land in and around the proposed Project area. The geography and landscape of the Crowsnest Pass and the surrounding area play important roles in the spirituality of the Tsuut'ina Nation. There are sites sacred to the Tsuut'ina Nation in the area, including ceremonial sites and natural material to make ceremonial paint (*e.g.,* ochre) and items (Tsuut'ina Nation, 2015).

There are many well-known and documented sacred places and gathering areas throughout the Tsuut'ina Nation territory. These sacred sites are unifying symbols, providing evidence for cultural continuity and establishing and reinforcing national and personal connections to the landscape. The Project area and its associated features are used for spiritual purposes, including ceremonies. For example, various alpine plants are crucial for the Tsuut'ina Nation ceremonial purposes on Grassy Mountain and for healing practices and cultural identity (Tsuut'ina Nation, 2015).

While the Tsuut'ina Nation works to retain and pass on knowledge from generation to generation, the Tsuut'ina Nation's, "connection to their homeland through stories, myths and the continued use of and reverence for, sacred elements in the landscape such as Crowsnest Mountain is paramount to their cultural identity and survival" (Tsuut'ina Nation, 2015, p. 49).

The Tsuut'ina way of life operates at different levels of existence, through the physical and spiritual worlds (Tsuut'ina Nation, 2015). The Tsuut'ina Nation members act as stewards to plants and wildlife, with specific responsibilities, rights and powers transferred through songs

and oral history (Tsuut'ina Nation, 2015). For example, such rights are designated within the context of celebrations and customs, such as annual bundle openings and Sun Dance ceremonies. Indeed, the Tsuut'ina 'feel closer to the Creator' at elevations and vision quest sites such as those on Grassy Mountain (Tsuut'ina Nation, 2015, p. 49).

While country foods have always been important for subsistence and sustenance, the practice of hunting has important cultural and spiritual values. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. Many species of wildlife and birds are culturally and spiritually important to the Tsuut'ina Nation. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements (Tsuut'ina Nation, 2015).

Intergenerational knowledge provides instruction on cultural and spiritual practices such as gathering plants for food and subsistence, ceremonial procedures, legends, using plants as medicine and harvesting berries. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

8.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for Tsuut'ina Nation Traditional Purposes

This section describes the Project effects on current use of lands and resources for traditional purposes for the Tsuut'ina Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Tsuut'ina Nation.

8.3.2.1 Hunting

The Tsuut'ina Nation continue to hunt throughout their traditional territory. No specific hunting sites were identified by the Tsuut'ina Nation in the Project LSA. Species that continue to be hunted include elk, moose, deer, bighorn sheep and eagles (Tsuut'ina Nation, 2015).

The Project activities will intersect or be in proximity to habitat and species that are identified for hunting by the Tsuut'ina Nation.

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to the Tsuut'ina Nation hunting. CR #9 (EIA, CEAR #42) addresses direct and indirect effects on key wildlife species and their habitats of species that are hunted by the Tsuut'ina Nation; these include loss of habitat availability (through direct loss or indirect through sensory disturbance), disruption of wildlife movement (through habitat fragmentation and reduced connectivity), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, could affect the cultural and spiritual relationship between the Tsuut'ina Nation and wildlife.

CR #5 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. In summary, the Project is not expected to have direct adverse effects on water quality or aquatic health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as elk, moose, deer, sheep, antelope, mountain sheep, mountain goat, porcupine, rabbit and squirrel hunted by the Tsuut'ina Nation members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Tsuut'ina Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Tsuut'ina Nation and wildlife.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect project infrastructure. This will limit the Tsuut'ina Nation access during construction and operation of the Project. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga has produced an Access Management Plan to facilitate access for traditional land use activities within the LSA.

To address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and, by extension, effects on hunters. Key features are:

- continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
- commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover;
- establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation;
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- engage with the Tsuut'ina Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;

- retain vegetation adjacent to high-activity linear corridors (*e.g.*, access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- continue to work with the Tsuut'ina Nation to identify species of importance for harvesting prior to construction activities;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- store all toxic materials, including those used for blasting, in secure areas that are inaccessible to wildlife (*e.g.*, buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of hunters. Benga has proposed mitigation for visual impacts and dust in CR #1 (EIA, CEAR #42) and for noise in CR #2 (EIA, CEAR #42). If the Tsuut'ina Nation has additional measures to suggest mitigating for hunting experience, Benga will continue to work with the Nation on mitigation measures.

8.3.2.2 Trapping

The Tsuut'ina Consultation team indicated that porcupine, rabbit and squirrel are being trapped by Tsuut'ina members although no specific trapping sites in the LSA were identified.

Mitigations mentioned for hunting apply to trapping as well.

8.3.2.3 Fishing

Based on consultation and TKU reports, the Tsuut'ina Nation has not identified an interest in fishing in the Project area. Thus, it is anticipated that the Project would not affect fishing activities, resources or access for the Tsuut'ina Nation.

8.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Tsuut'ina Nation. These include berries, sweet pine, lodgepole pine, juniper, bear root, muskeg tea, shrubs, lichen, fungus, willow, poplar, sweetgrass, lingonberries and raspberry. Plant gathering occurs mainly in June for alpine plants. The assessments for vegetation (CR #8, EIA, CEAR #42) and land and resource use are relevant to the assessment on plant gathering.

CR #8 (EIA, CEAR #42) addresses potential effects on key vegetation species and habitat including the species identified by the Tsuut'ina Nation. Further, a summary of species identified by the Tsuut'ina Nation with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure.

The potential effects described in these sections of the EIA could result in a change in identified plant species and habitat, change in use or access to identified plant gathering locations, or change in preferred harvesting method. These effects, in turn, could affect the cultural and spiritual relationship between the Tsuut'ina Nation and plants. Input provided by the Tsuut'ina Nation during consultation is considered in the identification of potential effects and proposed mitigation measures.

The EIA details the mitigation measures relating to Vegetation and Wetlands (CR #8, EIA, CEAR #42) and Land and Resource Use (CR #10, EIA, CEAR #42). Reclamation specific mitigation is detailed in the Updated Conceptual Conservation and Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to JRP IR-2.6). In addition, vegetation species identified during the consultation process, including TU species (vascular and non-vascular) observed in the vegetation LSA vegetation field surveys are included in the updated C&R Plan (Table F.1.9-1). Key plant gathering mitigation includes:

- on-going consultation with the Tsuut'ina Nation in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;

- on Benga private land, lodgepole pine and other culturally important plants will be made available for harvesting by the Tsuut'ina Nation potentially affected by the Project; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will consult with the Tsuut'ina Nation on updates to the Conservation and Reclamation (C&R) plan. The C&R Plan will include the use of native species wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Tsuut'ina Nation Traditional land use opportunities will be integrated;
- Benga will support an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise;
- Benga will support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes;
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation; and
- Benga will consider mitigation suggestions proposed by the Tsuut'ina Nation regarding traditional and medicinal plants.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 (EIA, CEAR #42) Air Quality and CR #2 (EIA, CEAR #42) Noise discuss mitigation measures that are being adopted by Benga to minimize adverse effects.

8.3.2.5 Trails and Travelways

The Tsuut'ina Nation identified sites associated with trails and travelways that are fully or partially within the mine permit boundary, however, specific locations have not been provided. Direct effects to trails and travelways are expected as a result of Project construction. These effects, in turn, affect the cultural and spiritual relationship between the Tsuut'ina Nation a and their trails and travelways. It is assumed that trails and travelways connect these sites.

In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the Access Management Plan (AMP) that will include the following:
  - access points and roads to be clearly labelled and documented;
  - notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
  - identified sensitive features (*e.g.*, species of management concern, important habitat features) to be flagged or fenced ahead of clearing; and
  - signage to be used for identifying areas that are not open for public use.
- share information about construction timing; and
- will work with Tsuut'ina to develop the Cultural Site Discovery Contingency Plan for culturally important sites identified during construction and operations.

In addition to a direct change to trails and travelways and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the cultural and spiritual relationship between the Tsuut'ina Nation and their trails and travelways.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Tsuut'ina Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

8.3.2.6 Cultural and Spiritual Values

Changes resulting from the Project may interfere with the Tsuut'ina Nation's ability to pass on cultural teachings to the next generation in the Project LSA. The Project area has previously been disturbed by historic mining, impacting the Tsuut'ina Nation landscape and spirit (Tsuut'ina Nation, 2015). The Tsuut'ina Nation has listed the following as concerns related to potential effects to cultural and spiritual values from the development of Grassy Mountain (Tsuut'ina, 2015, p. 50):

- Access to and health of plants;
- Access to and health of the land;
- Access to and health of the water;
- Health and wellness of the wildlife and birds;
- Access to wildlife and birds; and

- Concern for continuing to carry out ceremonies and to respect ceremonies held in the past.

Ongoing access to their lands and important wildlife and plant areas are key elements of Tsuut'ina culture, identity, ceremony and spirituality (Tsuut'ina Nation, 2015). These changes will result in indirect effects that can be characterized as an interference with the ability to pass culture along to the next generation. For example, the loss of a harvesting area means there is one fewer place to teach harvesting practices or share a language unique to the area.

Initial ideas for mitigation and management of potential effects to cultural and spiritual values proposed by Tsuut'ina Elders are as follows (Tsuut'ina, 2015, p. 51):

- Hold workshop with Tsuut'ina Elders knowledgeable about plants of interest in the Crowsnest area; and
- Negotiate and sign Agreement between Tsuut'ina and Riversdale so that Tsuut'ina can still go hunt and practice their traditional ways on-site.

Benga has proposed mitigation measures relevant to sites of cultural and spiritual importance and committed to the following measures to mitigate effects related to cultural and spiritual values:

- Benga will continue to work with the Tsuut'ina Nation to improve the Access Management Plan (AMP) to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Tsuut'ina Nation where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- Where identified by the Tsuut'ina Nation, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;
- If avoidance of any TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Tsuut'ina Nation to develop and plan for mitigation of the site;
- Benga will continue to work with the Tsuut'ina Nation to identify ways in which TK can be considered during Project activities and in the development of environmental management plans;
- Benga will continue to work with the Tsuut'ina Nation to interweave TK in the development of Project management and monitoring plans and in Project activities;

- Benga will support a cultural orientation program for its employees and contractors;
- Benga has and will continue to support local and Indigenous cultural events and ceremonies through its Indigenous engagement and initiatives such as its community sponsorship program;
- Benga will fund and will arrange a ceremony with the Tsuut'ina Nation in advance of ground disturbance for Project Construction;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction or operations;
- An Indigenous Environmental Stewardship Committee will be established, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program will be implemented, which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

In addition to a direct change to cultural and spiritual values and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the relationship between the Tsuut'ina Nation and their cultural and spiritual values. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Tsuut'ina Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

8.3.3 Residual Effects to Current Use of Lands and Resources for the Tsuut'ina Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects on the current use of lands and resources valued by the Tsuut'ina Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Tsuut'ina Nation and surrounding lands and resources.

8.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects described in CR #9 and CR #10 (EIA, CEAR #42) and input provided by the Tsuut'ina Nation. Changes to wildlife may have an effect on the hunting activities and therefore, wildlife

mitigation measures are directly relevant to the interest of the Tsuut'ina Nation. These effects, in turn, affect the cultural and spiritual relationship between the Tsuut'ina Nation and wildlife.

The Project will affect the ten wildlife VCs, including moose, elk and bear, through changes in habitat availability, habitat fragmentation/connectivity, mortality risk and abundance all of which will affect local populations to some degree. With successful application of mitigation measures, the residual effects of the Project on habitat availability, habitat fragmentation/connectivity, mortality risk and abundance within the Wildlife LSA (WLSA) were deemed not significant (CR #9, EIA, CEAR #42).

Just as with wildlife, Project effects to land and resource use: hunting and trapping and access (CR #10, EIA, CEAR #42) have been characterized as local in geographic extent, extended in duration, continuous (access) or occasional (hunting) in frequency, reversible in the long-term and moderate in magnitude and not significant.

In summary then, the Project is not expected to have measurable effects on species hunted by the Tsuut'ina Nation. Similarly, with the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

Measures to be implemented to mitigate these effects are outlined in Section 4.3.2.1 of this Information Request. After implementation of mitigation, residual effects to hunting are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

In totality, the changes to hunting by the Tsuut'ina Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. Further, the implementation of an Indigenous Environmental Stewardship Committee and an Indigenous monitoring program will function to address issues related to traditional use, wildlife and hunting throughout the life of the Project. It will also provide a mechanism by which community members can actively contribute to and participate in on-going reclamation and conservation planning.

8.3.3.2 Trapping

Given the relationship between hunting and trapping in use and access to wildlife, Benga considered the residual effects the same.

8.3.3.3 Fishing

Based on consultation and TKU reports, the Tsuut'ina Nation has not identified an interest in fishing in the Project area. Thus, it is anticipated that the Project would not affect fishing activities, resources or access for the Tsuut'ina Nation.

As a result, residual effects to fishing are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

In totality, the changes to fishing by the Tsuut'ina Nation are not considered significant. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

8.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of residual effects described in CR #8 and CR #10 (EIA, CEAR #42) input provided by the Tsuut'ina Nation. The Project is expected to remove traditional use plants within the Project LSA. Beyond the LSA, habitats are expected to remain intact. Therefore, the overall availability of habitat is not anticipated to be substantially affected by the Project.

Vegetation in CR #8 and Land use in CR #10 (EIA, CEAR #42) characterize residual effects to vegetation as local in geographic extent, long-term in duration, continuous in frequency, reversible and high magnitude. The mitigation proposes reclaiming the land that will support a range of communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. The residual effects for vegetation are not considered significant. CR #8 (EIA, CEAR #42) while the Project will result in some loss of traditional use vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially result due to noise, dust and the visual impact of the Project. CR #1 (EIA, CEAR #42) Air Quality and CR #2 (EIA, CEAR #42).

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Tsuut'ina Nation. With the implementation of mitigation measures including an AMP and ongoing consultation, the Project is not expected to affect current access patterns. As a result, residual effects to plant gathering are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to plant gathering by the Tsuut'ina Nation are not considered significant, providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

8.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary.

The Project footprint will be reclaimed to land use capability equivalent to pre-mining; however, it will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area west of Blairmore Creek and Crown Land to the north of the Project and from either the north or the south along the Gold Creek. With the implementation of the AMP, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Tsuut'ina Nation and trails and travelways.

Therefore, the residual effects on trails and travelways are:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- non-reversible where trails and travelways are lost; and
- resilient in ecological and social context.

In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

In totality, the changes to trails and travelways used by the Tsuut'ina Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

8.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by the Tsuut'ina Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project would still affect the Tsuut'ina Nation cultural and spiritual values and interests. The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts.

As a result, residual effects to cultural and spiritual values are characterized as:

- moderate magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- sensitive in ecological and social context.

In totality, the changes to cultural and spiritual values of the Tsuut'ina Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.
- Significance Determination of Current Use of Lands and Resources for the Tsuut'ina Nation Traditional Purposes.

8.3.4 Significance Determination of Current Use of Lands and Resources for the Tsuut'ina Nation Traditional Purposes

No adverse significant effects post-mitigation was identified for Current Use of Lands and Resources for the Tsuut'ina Nation Traditional Purposes. Overall, the Project is not anticipated to measurably change the Tsuut'ina Nation's ability to continue traditional practices. It is predicted that the effect of the Project on access to hunting and gathering areas will not be significant as a large portion of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability and Benga will continue to consult with the Tsuut'ina Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

8.4 Tsuut'ina Nation Physical and Cultural Heritage

8.4.1 Background of Tsuut'ina Nation Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Tsuut'ina Nation since the EIA was submitted, in the TKU (Tsuut'ina Nation, 2015).

During ground-truthing, the Tsuut'ina Nation field crew recorded several rock cairns used as a navigational tool situated along historic trails. More specific to the Crowsnest Pass, geophysical and landscape elements, such as Crowsnest Mountain and surrounding areas also play important parts in the Tsuut'ina Nation spirituality (Tsuut'ina Nation, 2015).

There are many well-known and documented sacred places and gathering areas throughout the Tsuut'ina Nation territory. According to the Tsuut'ina Nation, these sacred sites are unifying symbols, providing evidence for cultural continuity and establishing and reinforcing national and personal connections to the landscape. During ground-truthing fieldwork, there was limited discussion about current habitation and sacred areas in and around the Grassy

Mountain Project. The Tsuut'ina Nation identified one vision quest site more than 500 m away from the Grassy Mountain Project boundary.

8.4.2 Potential Effects and Mitigations on Tsuut'ina Nation Physical and Cultural Heritage

The Project will intersect or be in proximity to physical and cultural heritage sites. The Tsuut'ina Nation field crew recorded a rock cairn however specific locations were not identified. The field crew also identified sites that had potentially been used for vision quests.

The Historical Resources Impact Assessment (Section E.13, EIA, CEAR #42) addresses potential effects to sites as defined as any work of nature or humans that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic interest. There are 32 recorded archaeological or historic resources located in the Project area including sites that are valued as cultural heritage sites to Indigenous groups (O'Connor, 2018, p. 33). Of the 32 sites, 10 overlap the Project footprint. Direct effects to historical resources are anticipated for sites within the Project footprint as a result of Project construction. If avoidance is not possible, the Project may damage or disturb sites that are identified by the Tsuut'ina Nation as sacred sites (Tsuut'ina Nation, 2015).

The potential effects described in the sections listed above could result in a change in use or access or disturbance to features associated with sacred, gathering, or habitation sites. Together, these changes will change the cultural value or importance to the value.

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of any unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;
- If avoidance of any identified TK/TU features is not possible, Benga will work with Alberta Culture and Tourism and the Tsuut'ina Nation to develop and plan for mitigation of the site;
- Consultation will include sharing information with the Tsuut'ina Nation about construction timing;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations;
- Benga and the Tsuut'ina Nation will continue to meet to discuss management of culturally important and sacred sites;

- Benga will work with the Tsuut'ina Nation to design and implement an Indigenous Monitoring Program that will include consideration of cultural heritage impacts and monitoring for cultural sites; and
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate land use locations.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) present that noise, dust and visual impact mitigation measures are being adopted by Benga to minimize any adverse effects.

8.4.3 Residual Effects on Tsuut'ina Nation Physical and Cultural Heritage

The characterization of residual effects to Indigenous physical and cultural heritage includes consideration of residual effects input provided by the Tsuut'ina Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project could still have measurable effects on sacred sites used by the Tsuut'ina Nation and the Tsuut'ina Nation's use of these sites would be disturbed. After mitigation, residual effects to sacred, gathering and habitation sites are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- regular frequency;
- not reversible;
- sensitive in ecological and social context.

In totality, the residual effects of changes to physical and cultural heritage of the Tsuut'ina Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and

- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

8.4.4 Significance Determination of Physical and Cultural Heritage for the Tsuut'ina Nation

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Tsuut'ina Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Tsuut'ina Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Tsuut'ina Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

In summary, the residual effects of the Project on the Tsuut'ina Nation are determined to be not significant and shown in Table 8.4.4-1.

Table 8.4.4-1 Summary of Residual Effects to the Tsuut'ina Nation

Valued Components	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting	Moderate	Local	Short-term	Continuous	Reversible	Resilient	Not significant
Fishing	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Plant Gathering	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Trails and Travelways	Moderate	Local	Long-term	Continuous	Non-reversible where trails and travelways are lost	Resilient	Not significant
Cultural and Spiritual Values	Moderate	Local	Long-term	Continuous	Non-reversible	Sensitive	Not significant
Indigenous Physical and Cultural Heritage	Moderate	Local	Long-term	Regular	Non-Reversible	Sensitive	Not significant

9.0 KTUNAXA NATION CONSULTATION AND ASSESSMENT

9.1 Ktunaxa Nation Consultation Summary

Consultation and engagement activities with the Ktunaxa Nation have included:

- ongoing and regular phone and e-mail communications;
- development of on-going field programs to:
  - assess and refine recommendations for mitigation of specific TU sites; and
  - assess potential impacts of the Project on archeological sites of cultural interest identified as part of the HRIA and consider recommendations for mitigation as outlined in the HRIA.
- meetings to discuss project updates issues and concerns and to seek input on the Project and the environmental assessment; and
- provision of key regulatory documents, such as:
  - proposed terms of reference;
  - First Nations Consultation Plan;
  - Draft CEAA EIS guidelines;
  - Final CEAA Project description; and
  - Information packages.

Benga initiated contact with the Ktunaxa Nation by telephone in December 2014 to introduce the Project, describe the Environmental Assessment process and to discuss economic opportunities related to the Project. Benga asked if the Ktunaxa Nation would like to engage to learn more. Benga emailed Project information in early January 2015. In reply, the Ktunaxa Nation advised that Benga should contact them if/when CEAA scopes the Ktunaxa Nation into a federal assessment. Thereafter, Benga provided periodic updates.

CEAA published the Project's Final Guidelines for the Preparation of an Environmental Impact Statement (Final Guidelines) in June 24, 2015 and concurrently notified potentially affected Indigenous Groups of its publication. The CEAA Guidelines identifies six Indigenous groups that may be less affected by the Project for consultation including the Ktunaxa Nation. Benga promptly initiated consultation with the Ktunaxa Nation with a letter offering information on the Project to assist Benga in understanding the Ktunaxa Nation's uses in the Project area and to discuss any concerns.

Benga followed up in July 2015 with a letter describing a plan for continued consultation on the Project and referencing participation funding opportunities for the Ktunaxa Nation. In

August 2015, Benga met with the Ktunaxa Nation to provide an overview of the Project, distribute hard copies of the regulatory documents that had been sent to-date and review consultation that had taken place with Alberta First Nations. The Ktunaxa Nation indicated that continued engagement on the Project would be discussed during their Land and Resource Council's next scheduled meeting on September 9, 2015. In the interim, Benga provided electronic copies of the information package seeking feedback on Benga's understanding of the Ktunaxa Nation's Aboriginal interests.

In December 2015, Benga provided the EIS in electronic format and in hard copy. In April 2016, Benga met with the Ktunaxa Nation to provide an overview of the Project, present about the environmental and Indigenous portions of the EIA and to seek input on the EIS report including proposed mitigation measures. In addition, information about the panel review process was provided.

In February 2019, Benga provided the Ktunaxa Nation with a one-year advance notification of plans to clear timber within the Project and access to site prior to clearing operations for harvesting. As requested, in March 2019, Benga shared information regarding vegetation including Ecosite Phases within the local study. In April 2019, Benga offered employment and contract opportunities for the Ktunaxa Nation members. In May 2019, Benga and the Ktunaxa Nation corresponded about organizing an opportunity for Elders and Ktunaxa Nation members to access the clearing area to harvest vegetation.

Information provided to Benga after the submission of this consultation update report will be considered by Benga and incorporated into the Project planning as appropriate.

9.2 Ktunaxa Nation Traditional Use and Traditional Knowledge Studies

Ktunaxa Nation has submitted the following use study for the Project to Benga:

- Technical Memorandum: Ktunaxa Nation Rights, Use and Interests Study in relation to the Grassy Mountain Coal Project (Firelight Group, 2019).

This technical memo provides a summary of results and preliminary assessment based on review of Project information provided by Benga, relevant EA documents (including material submitted by Ktunaxa Nation for the Baldy Ridge Expansion process in BC in 2015), existing Ktunaxa Nation data for the Project area, ethnohistorical and archival evidence and interviews with Ktunaxa Nation knowledge holders plus a respected Blackfoot elder having Ktunaxa Nation family ties. In June 2016, Benga provided funding to the Ktunaxa Nation to support a Ktunaxa Nation Knowledge and Use Study and Preliminary Assessment which was then contracted to The Firelight Group. The technical memo prepared by the Firelight Group was

submitted by the Ktunaxa Nation to Benga in January 2019, for use in the environmental assessment process.

The following sections are based on the information contained in the technical memorandum and from other reports and secondary sources. No other traditional use or traditional knowledge study has been submitted to Benga from the Ktunaxa Nation.

9.3 Current Use of Lands and Resources for the Ktunaxa Nation Traditional Purposes

9.3.1 Background of Current Use of Lands and Resources for the Ktunaxa Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands and Resources for Traditional Purposes VC (and its VC subcomponents) which has been provided by the Ktunaxa Nation since the EIS was submitted, in the Technical Memorandum: Ktunaxa Nation Rights and Interest in relation to Benga Mining Limited's proposed Grassy Mountain Coal Project (Firelight Group, 2019).

The Project is within an area considered by the Ktunaxa Nation to be *ʔamakʔis Ktunaxa* (Ktunaxa Nation territory or homeland) and associated with the traditional land district of *qukinʔama* (Raven's Land) which includes *Kuɬwiaʔki* (the Crowsnest Pass), as well as the Michel Creek and Elk Valleys. Further, the Ktunaxa Nation citizens rely on the Project area for the preferred practice of a range of rights and interests that rely on preferred or critical places, species and practices. The Ktunaxa Nation maintains underlying sovereign and *sui generis* rights to all lands and waters within its territories, having never ceded, surrendered or given up these to the Canadian Crown (Firelight Group, 2019).

The Crowsnest Pass area, like the Michel and Elk Valleys to the west, has been used and occupied continuously by the Ktunaxa Nation since time immemorial (Firelight Group, 2019). While several branches of the Ktunaxa Nation were decimated by smallpox in the late 1700s, at least some of the survivors returned to the area of the Crowsnest Pass, as documented through oral history (Firelight, Group, 2019). Regular and ongoing use of the Crowsnest Pass continued through the early 1900s, for war or trade with other Indigenous peoples from east of the Rockies. Archival and ethnographic records speak to the complex social context of the Crowsnest Pass prior to and after 1846 whereby Indigenous law as well as both historic and modern treaties entered into with the Piikani, Nakoda and others governed the Ktunaxa Nation's historical and ongoing relationships with their eastern neighbours (Firelight Group, 2019). Today, the Buffalo Treaty is an example of neighbouring Nations working together to restore and steward the return of the bison.

Traditional use and the practice of the Ktunaxa Nation rights in the Project area are ongoing and current, despite impacts from past mining activities, road development, bison extirpation and ongoing policies such as those associated with national parks and protected areas (Firelight Group, 2019).

Current and historical use of the Crowsnest Pass by the Ktunaxa Nation is affirmed through archival and oral historical data from the late 19th and early 20th centuries which highlights its' importance as a cultural area, for example, as a base for bison hunts and other activities east of the Rockies. Oral history combined with ethnographic and archival works point to habitation, cultural use, hunting, trapping, fishing, plant gathering and travel ways by the Ktunaxa Nation throughout *Kułwiaʔki* (Crowsnest Pass). Further, there is documentation of the Ktunaxa Nation surface and sub-surface mining of coal and stone tool material. The Ktunaxa Nation continue to quarry for mineral resources today including for ceremonial use as pipes and other purposes (Firelight Group, 2019).

The Ktunaxa Nation practiced an annual round throughout the *Kułwiaʔki* (Crowsnest Pass) that included, for example, hunting bison, sheep, deer, elk and mountain goat, fishing for cutthroat trout and other species, as well as plant gathering (*e.g.,* berries) and cultivating tobacco (*e.g.,* at *kaqawakanmituk,* Sparwood). Travel ways, trails and mountain pass connected the Ktunaxa Nation communities and important sites, creating a network of cultural and subsistence importance that remains relevant today.

The Ktunaxa Nation citizens have relied on and, to the extent possible, continue to rely on the area of the Crowsnest Pass for a range of practices including harvesting fish, plant, wildlife and mineral resources; trails and transportation routes and associated camps, cultural areas and practices (Firelight Group, 2019). Despite impacts to the Ktunaxa Nation use, rights and interests through land privatization, railway development, coal-related industrial development and government policy, the Ktunaxa Nation elders and land users continue to use and value the LSA and the surrounding area (Firelight Group, 2019).

Biophysical disturbances combined with concerns about residual contamination and confidence in wild foods has led the Ktunaxa Nation to seek land and resource use elsewhere nearby (Firelight Group, 2019). However, current use that has ceased due to these 'external factors' is still considered under the assumption that they can reasonably be expected to resume once conditions change.

9.3.1.1 Hunting

Wildlife species that are reported to have been hunted traditionally by the Ktunaxa Nation citizens include grizzly bear, black bear, mule deer, whitetail deer, elk, moose, caribou,

mountain goat, beaver, wolverine, marten, muskrat, weasel, duck, American coot and Canada geese (Keefer, 2002; Arrow Archaeology Ltd, 2014; Firelight Group, 2019). In addition, mountain sheep, muskrat, gopher and Spruce grouse were sustenance species (Firelight Group, 2011; 2019). Bison were hunted along the sheltered eastern slopes of the Rockies in the winter season through mountain passes including Tornado Pass and Crowsnest Pass (Firelight Group, 2011; Arrow Archaeology Ltd, 2014; Firelight Group, 2019). Ethnographic sources also document year-round bison hunting in Crowsnest Pass (Turney-High, 1941). Bison populations were diminished by 1875 to a few hundred (Firelight Group, 2011; BC MOE, 2013). As a signatory to the Buffalo Treaty, the Ktunaxa Nation are committed to supporting the reintroduction and return of the plain's bison.

Ktunaxa Nation knowledge holders and land users have identified culturally important food species such as elk, deer, caribou, bighorn sheep, mountain goat, caribou, cougar, wolverine, wolf and grizzly bear for the Line Creek Operations Phase II Project located approximately 20 km northeast of Sparwood (Firelight Group, 2011). Hunting, including throughout the Crowsnest Pass, remains important to the Ktunaxa Nation for subsistence as well as guide-outfitting activities (Firelight Group, 2019) and both the practice and potential for hunting remain important tangible and intangible values related to traditional purposes and cultural use (Firelight Group, 2019).

Current use of the Project assessment area for hunting has been impeded since coal mining began in the 1900s. The Ktunaxa Nation have not identified site-specific hunting areas within the Project assessment area. Given continuity with traditional practices, traditions or customs, it is reasonable to assume that hunting might resume in the foreseeable future. The Project area includes "preferred habitation (camp) areas and subsistence harvest areas (hunting, fishing, plant gathering) (Firelight Group, 2019, p. 3). Further, the Project area is "especially important as it is located in the only area where Ktunaxa Nation citizens can practice hunting rights on both sides of the Rockies without interruption and interference from National Park restrictions" (Firelight Group, 2019, p. 3).

Hunting also depends on maintaining a healthy and contiguous habitat for key species. In this way, supporting harvesting means supporting habitat and ecological integrity.

9.3.1.2 Trapping

The Ktunaxa Nation used various methods to trap depending on the species. In terms of trapping, the Ktunaxa Nation constructed large traps around waterbodies such as ponds in order to harvest wildlife by using their canoe paddles to disturb water fowl from the bulrushes and into nets supported on poles of up to 30 feet in height (Lower Kootenay Band, 2015).

Current use of the Project assessment area for trapping has been impeded since coal mining began in the 1900s. The Ktunaxa Nation do not currently actively trap within the Project assessment area: the Ktunaxa Nation has not identified site specific trapping in the Project assessment area in Firelight Group 2019.

9.3.1.3 Fishing

While fish have always been a reliable wild food for the Ktunaxa Nation, fishing became more important to subsistence after the extirpation of the bison and continue to be an important wild food that depends on healthy waterways (Firelight Group, 2019). Fish and fish habitat are important to the Ktunaxa Nation citizens for ecological, cultural, traditional and commercial uses (Firelight Group, 2011; 2019). Historically, the Ktunaxa Nation fished for Kokanee, Chinook, Rainbow trout, Bull trout, Mountain Whitefish, Sturgeon and Burbot (Lower Kootenay Band, 2015). Northern pike-minnow, sucker and sturgeon were also important fish species (Keefer, 2002). Historical fishing locations identified in the literature are located outside of the Project assessment area (Firelight Group, 2011; 2019). Important fish species were identified by the Ktunaxa Nation land users and knowledge holders for the Line Creek Phase II Project such as Westslope Cutthroat trout, Mountain Whitefish and Bull trout (Firelight Group, 2011). Fishing areas for cutthroat and Rainbow trout are used by the Ktunaxa Nation to the west of the Project area (Firelight Group, 2019).

Current use of the Project assessment area for fishing has been impeded since coal mining began in the 1900s. The Ktunaxa Nation do not currently actively fish within the Project assessment area: Ktunaxa Nation has not identified site specific current use in the Project area for fishing (Firelight Group, 2019).

Industrial development has resulted in reduced availability of anadromous salmon – a loss of salmon from the Upper Columbia has been documented as a result of the Grand Coulee Dam (Firelight Group, 2011). Further, concerns about selenium in the Elk River due to coal mining have affected the Ktunaxa Nation citizen's confidence in wild foods (Firelight Group, 2019). Concerns about residual contamination and confidence in wild foods may lead the Ktunaxa Nation to fish elsewhere.

9.3.1.4 Plant Gathering

Plant gathering throughout the Crowsnest Pass and surrounding areas continues to be important to the Ktunaxa Nation citizens (Firelight Group, 2019). Plants including berries and roots were used by the Ktunaxa Nation members for sustenance, medicinal purposes, crafting tools, camps and canoes (Lower Kootenay Band, 2015). Canoes were constructed with Western White pine, birch, cedar, maple sap, or pitch from coniferous trees (Lower Kootenay Band, 2015). Plant species identified as traditionally important to the Ktunaxa Nation for the Mica

Unit 5 and Mica Unit 6 Project include Western Red Cedar, Black Cottonwood, Pacific Yew, Beaked hazelnut, Highbush and lowbush cranberry, Devil's Club, Oregon Grape, Red Osier Dogwood, Currents and Gooseberries and Cow Parsnip (Keefer, 2002). Roots such as bitterroot, camas, nodding onion, biscuit root, balsamroot, yampa, tiger lily, yellow avalanche lily, mariposa lily, bugleweed, spring beauty, wild thistle, greens (*e.g.*, sprouts, stems, leaves), prickly pear, lichen, cambium, lodgepole pine, ponderosa pine and cottonwood were gathered for food (Keefer and McCoy, 1999; Firelight Group, 2011). Kinnikinnick, also known as bearberry, produces berries that were fried, and leaves used in a medicinal tea (Arrow Archaeology Ltd. 2014). Culturally and economically important plants were identified for the Line Creek Phase II Project including huckleberry, shaggy mane mushroom and *?ayut* – a culturally important plant in the genus *Ligusticum* (Firelight Group, 2011). White bark pine is of cultural importance (Firelight Group, 2019).

The Project area and the Crowsnest Pass contain a multitude of ecological values and ties to cultural use and stewardship of the landscape, including white bark pine as a plant species of critical importance (Firelight Group, 2019). While the Ktunaxa Nation has not identified site-specific current use in the Project area for plant gathering, this knowledge is typically sacred and not widely shared. Given continuity with traditional practices traditions or customs, it is reasonable to assume that plant gathering in the Project area might resume in the foreseeable future although nearby areas would likely be preferable. Concerns about residual contamination and confidence in wild foods may lead the Ktunaxa Nation to gather plants elsewhere (Firelight Group, 2019).

9.3.1.5 Trails and Travelways

For the Ktunaxa Nation, trails and travelways have long provided for movement as well as access to cultural landscapes and lands and resources for traditional use. Trails and travelways are located on land and water for accessing resource harvesting areas, seasonal migration, as well as for trade (or war) with neighboring Indigenous groups (Paskin, 2010; Firelight Group, 2019). These same trails and travel routes remain important for the transmission of knowledge, connection to ancestors and oral history (Firelight Group, 2019).

The Crowsnest Pass area held a primary use for the Ktunaxa Nation as a travel corridor in the mountain valleys to the Plains of what is now southern Alberta, of which many trails generally followed the present-day Crowsnest highway (Arrow Archaeology Ltd, 2014; Firelight Group, 2019). Several trails and travelways used by the Ktunaxa Nation for movement through the Rocky Mountains to and from the plains, directly intersect the Project area and areas to the north and south (Firelight Group, 2019). Further, numerous the Ktunaxa Nation "use values are documented in the Project area along the Crowsnest Pass and eastern foothills" including transportation values (Firelight Group, 2019, p. 13). The Ktunaxa Nation camps, including

historic camp locations at Crowsnest Lake, along the Crowsnest River and east of Crowsnest Mountain, depend on access and trail networks (Firelight Group, 2019).

Current use of trails and travelways within the Project assessment has been impeded since coal mining began in the early 1900s. The Ktunaxa Nation do not currently actively use the trails and travelways within the Project assessment area.

9.3.1.6 Cultural and Spiritual Values

The Ktunaxa Nation have identified several cultural, ceremonial and spiritual sites throughout the Crowsnest Pass including during site visits to the Project area. In particular, *ʔakitɬaʔis* (Raven's House or Crowsnest Mountain) is of significance as it not only serves as the headwaters for the Crowsnest watershed, but also is considered the home of the creation being, Raven. This site is associated with oral histories of Ktunaxa chiefs from the area, home to specific ceremonial practices and a literal lookout for movements of members and buffalo in the Crowsnest area.

Another key site located west of the LSA is *Kuɬwiaʔki* (Crowsnest Lake) which is part of the Crowsnest Watershed and known to the Ktunaxa Nation as, "Heart of the Water" (Schaeffer fieldnotes, 1932, p. 33, 1966 *in* Firelight Group, 2019, p. 15). There is also Ktunaxa Nation oral history associated with Frank and nearby Turtle Mountain.

Current use of lands and resources for the Ktunaxa Nation is grounded in the concept of *ʔa·kxamǐs qȁpi qapsin* meaning "the root all things and the relationship between all things including land, water, animals, Indigenous peoples and the air that we breathe," (Firelight Group, 2019, p. 16). The Project will affect this living balance that is said to link to the Ktunaxa Nation language and culture, connecting all things with the creator and with one another (Firelight Group, 2019).

The Project area and the Crowsnest Pass contain a multitude of ecological values tied to cultural and spiritual use and stewardship of the landscape, including the following animal species of critical importance: bighorn sheep, moose, elk, grizzly bear, mountain goat and bison (Firelight Group, 2019).

While country foods have always been important for food, subsistence and sustenance, the practice of hunting has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

Likewise, fishing has always been important for food, subsistence and sustenance, the activity of fishing has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, legends as well as fish use as medicine, food and more is shared while fishing. In addition, to this educational context, the activity of fishing is typically linked to other intangible values with spiritual, artistic and aesthetic elements. For example, fishing typically provides for quiet enjoyment of the landscape or access to water for other uses.

The practice of gathering plants has important cultural and spiritual considerations above. While plants for food, subsistence and sustenance. Intergenerational knowledge about ceremonies, legends as well as plant use as medicine, food and more is shared while harvesting berries and plants. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

The Ktunaxa Nation elders and land users:

> Continue to actively use and rely on the landscape of the Crowsnest Pass and surrounding mountains as integral to Ktunaxa identity and to the practice of place-specific Aboriginal rights including teaching, cultural practice, harvesting and transportation. (Firelight Group 2019, p. 12).

One site-specific cultural site called *maɬuk* (Dirty Water/ Bellevue) was reported in the category of cultural activity within the LSA although it is unclear whether this in a cultural heritage site or an area of use (Firelight Group, 2019).

While travel throughout *ʔamakʔis Ktunaxa* on traditional travelways was once necessary for subsistence and sustenance, today the practice of engaging with these travelways is in addition a part of cultural identity and ceremonial and spiritual practice. Beyond using trails for traditional activities such as hunting, fishing, gathering plants, *etc.*, travelways are paths to reconnect with ancestors, oral traditions and the quiet enjoyment of nature (Firelight Group, 2019).

Travelways are both by land and by water. Water is considered to be sacred to the Ktunaxa Nation members because it is part of all living things (Teck, 2011). Water is often understood to have its own spirit and there is both a strong cultural and spiritual connection between Indigenous peoples and water.

Drinking water for the Ktunaxa Nation is not derived from the Project area. The Tobacco Plains Indian Band maintains two groundwater wells and participates in the Columbia Basin Water Smart Initiative (2014). St. Mary's Indian Band maintains a small water- system and is planning the construction of a new reservoir system and a retrofit to the existing pump house.

The Ktunaxa Nation is within the Columbia River Watershed which does not overlap the Project. The Ktunaxa Nation member bands are serviced by community drinking water supply and distribution systems at Columbia Lake No. 3, Tobacco Plains No. 2, Kootenay No. 1 and Creston No. 1 (AANDC, 2013). The Tobacco Plains Indian Band maintains two groundwater wells and participates in the Columbia Basin Water Smart Initiative (2014). St. Mary's Indian Band maintains a small water- system and is planning the construction of a new reservoir system and a retrofit to the existing pump house.

9.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for Ktunaxa Nation Traditional Purposes

This section describes the Project effects on current use of lands and resources for traditional purposes for the Ktunaxa Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Ktunaxa Nation. Specifically, this section includes the Ktunaxa Nation's assessment of potential effects to the Current Use of Lands and Resources for Traditional Purposes VC, as described in Firelight Group (2019).

9.3.2.1 Hunting

The Ktunaxa Nation continues to hunt throughout their traditional territory. There are no specific hunting sites identified by the Ktunaxa Nation in the Project LSA (Firelight Group, 2019). However, Project activities will intersect or be in proximity to habitat and species that are identified for hunting by the Ktunaxa Nation. These species include grizzly bear, black bear, mule deer, whitetail deer, elk, moose, caribou, mountain goat, beaver, wolverine, marten, muskrat, weasel, duck, American coot and Canada geese. With respect to subsistence, important hunting values are contained in the area including moose and Whitetail deer.

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to the Ktunaxa Nation hunting. CR #9 (EIA, CEAR #42) addresses direct and indirect effects on species that are hunted by the Ktunaxa Nation; these include loss of habitat availability (through direct loss, sensory disturbance and fragmentation), disruption of wildlife movement (through habitat fragmentation, reduced connectivity and creation of barriers), increased wildlife mortality risk (through vehicle

collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, affect the cultural and spiritual relationship between the Ktunaxa Nation and wildlife.

CR #5 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. In summary, the Project is not expected to have direct adverse effects on water quality or aquatic health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as moose, elk, deer and bear hunted by the Ktunaxa Nation members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Ktunaxa Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Ktunaxa Nation and wildlife.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect Project infrastructure. This will limit the Ktunaxa Nation access during construction and operation of the Project. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga will continue to consult with the Ktunaxa Nation in developing an AMP to facilitate access for traditional land use activities within the LSA.

Within the context of ecological values tied to cultural use and stewardship of the landscape, the Ktunaxa Nation are specifically concerned with the Project impacts on grizzly bear and bison (Firelight Group, 2019). The Ktunaxa Nation would like to ensure that "the Project provides a reasonable assessment of impacts on bison habitat suitability and capability, that it provide reliable habitat offsetting supportive of bison for the duration of Project impacts and that end land use goals are clearly supportive of long-term future habitat restoration for bison and the Ktunaxa Nation harvest in the area", (Firelight Group 2019, p. 18-19). Project impacts to the success of bison restoration and to grizzly bear and other species, including sensory disturbance, habitat loss and degradation (including contamination) and connectivity impacts including fragmentation within an important corridor are specified by the Ktunaxa Nation.

The Ktunaxa Nation cite anticipated Project impacts related to current use, particularly related to hunted, trapped and/or fished species used for subsistence, to include:

- Reduction of habitat for food animals and plants that support and sustain the Ktunaxa Nation harvesting rights;
- Loss of confidence in the quality of traditional foods due to contamination concerns associated with the Project; and
- Increased sensory disturbance in key harvesting areas associated with activities and increased traffic at the Project site as well as along the rail route through ʔamakʔis Ktunaxa, resulting in sense of place impacts and avoidance of the areas by animals targeted by the Ktunaxa Nation harvesters (Firelight Group 2019, p. 18).

Further, anticipated Project impacts on Grizzly Bear, bison and other animals and habitats are of particular concern to the Ktunaxa Nation. Impacts to the "success of bison restoration and to grizzly bear and other species, are anticipated to include sensory disturbance, habitat loss and degradation (including contamination) and connectivity impacts including fragmentation within an important corridor", (Firelight Group 2019, p. 17).

In order to address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and by extension effects on Ktunaxa hunters. Key features are:

- Benga will continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
    - commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover; and

  - establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation;
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- Benga will continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- engagement with the Ktunaxa Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- vegetation adjacent to high-activity linear corridors (*e.g.,* access roads, coal conveyor) will be retained to reduce the extent of noise and visual sensory disturbances to the extent possible;
- wildlife crossing signs will be put up to minimize wildlife-vehicle collisions;
- Benga will conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- all toxic materials, including those used for blasting will be stored in secure areas that are inaccessible to wildlife (*e.g.,* buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- Benga will mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of hunters. Benga's proposed mitigation measures to minimize effects are identified in CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42). Benga will continue to work with the Ktunaxa Nation on any additional mitigation measures related to hunting experience that are presented.

9.3.2.2 Trapping

The Ktunaxa Nation has not identified traplines in the Project area (Firelight Group, 2019). It is not anticipated that the Project will have adverse effects to trapping activities for the Ktunaxa Nation, however, if they do trap, the mitigations above in the hunting section will apply.

9.3.2.3 Fishing

The Ktunaxa Nation has not identified site-specific fishing areas in the Project area, but they maintain a fishing interest for important fish species as well as express concern around healthy waterways and fish, including those identified by the Ktunaxa Nation land users and knowledge holders for the Line Creek Phase II Project such as Westslope Cutthroat trout, Mountain Whitefish and Bull trout (Firelight Group, 2011). Fishing areas for Cutthroat and Rainbow trout are used by the Ktunaxa Nation to the west of the Project area (Firelight Group, 2019).

The Project is located within an area valued by the Ktunaxa Nation for clean freshwater sources, an important feature of key fishing sites. Anticipated Project impacts on water would affect fishing. The Ktunaxa Nation have expressed particular concern around water quality within the Crowsnest River watershed. The Ktunaxa Nation cite the issue of selenium in waterways from nearby surface coal mining (I.e. Elk River) and the health of cutthroat trout and other species. Specifically, maintaining healthy water quality and avoiding mining or rail-related contamination (*e.g.,* sulphate and selenium) is a primary Ktunaxa concerns in relation to the Project and the Crowsnest River Watershed (Firelight Group 2019, p. 17). Health concerns and contamination affect the relationship between Ktunaxa and fish as well as confidence in country foods.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience and enjoyment of fishing can be managed through noise and visual impact management as discussed in CR #1 and CR #2 (EIA, CEAR #42). Nonetheless, the Ktunaxa Nation may avoid fishing in visual and auditory range of Project activities.

Land and Resource Use addresses potential effects to land use activities including accessibility to the Project area. Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and

Blairmore Creek can be assessed from Highway 40 using existing trails. CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: Detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred fishing method.

Mitigation measures Benga has planned to avoid or minimize potential effects to the availability of fishing areas for include:

- a detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan has been proposed to more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek (Addendum 8, Appendices B1 and B2, CEAR #89);
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Ktunaxa Nation during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- engage with the Ktunaxa Nation prior to and during mine construction to allow for opportunities for species of interest to be harvested, re-located or otherwise utilized;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the sensory and visual experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and CR #2 (EIA, CEAR #42). If the Ktunaxa Nation has additional measures to suggest mitigating for fishing experience, Benga will continue to work with the Ktunaxa Nation on mitigation measures.

9.3.2.4 Plant Gathering

There are no site-specific plant gathering areas that overlap the Project LSA identified by the Ktunaxa Nation, but it is recognized that they may exist in terms the broader definition of current use. The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by Ktunaxa. These include Western White pine, birch, cedar,

maple and other coniferous trees (Lower Kootenay Band, 2015). Additional plants species identified as traditionally important include Western Red Cedar, Black Cottonwood, Pacific Yew, Beaked hazelnut, Highbush and lowbush cranberry, Devil's Club, Oregon Grape, Red Osier Dogwood, Currents and Gooseberries and Cow Parsnip (Keefer, 2002). Roots such as bitterroot, camas, nodding onion, biscuit root, balsamroot, yampa, tiger lily, yellow avalanche lily, mariposa lily, bugleweed, spring beauty, wild thistle, greens (*e.g.*, sprouts, stems, leaves), prickly pear, lichen, cambium, lodgepole pine, ponderosa pine and cottonwood were gathered for food (Firelight Group, 2011; Keefer and McCoy, 1999).

The assessments for vegetation (CR #8, EIA, CEAR #42) and land and resource use are relevant to the assessment on plant gathering. CR #8 (EIA, CEAR #42) addresses potential effects on key species and habitat including the species identified by the Ktunaxa Nation. A summary of species identified by the Ktunaxa Nation for the Project with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure. In addition, air emissions released into the atmosphere during Project construction and operations may result in potential direct and indirect effects on vegetation.

Therefore, potential effects are a change in identified plant species and habitat, change in use or access to identified plant gathering locations and change in preferred harvesting method.

The mitigation measures are described in the Conservation & Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to the JRP IR-2.6) are part of the reclamation program, especially for returning of wildlife habitat. In addition, vegetation species identified during consultation process including TK species observed in the vegetation LSA vegetation field surveys are included in the reclamation plan Key plant gathering mitigation includes

- on-going consultation with the Ktunaxa Nation in designing mitigation measures for plant gathering including sharing information about construction timing;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants be made available to the Ktunaxa Nation potentially affected by the Project for harvesting; and

where practicable, utilize locally collected seed to preserve the legacy of species and of place;

- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will consider mitigation suggestions proposed by the Ktunaxa Nation regarding traditional and medicinal plants;
- Benga will consult with the Ktunaxa Nation on the Conservation and Reclamation plan and vegetation management program. The C&R plan will include the use of native species and wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Ktunaxa Nation. Traditional land use opportunities will be interwoven; and
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation.

Benga has committed to share the environmental performance of the Project with the Ktunaxa Nation four times annually.

9.3.2.5 Trails and Travelways

The Project will intersect or be in proximity to areas that are identified for trails and travelways by the Ktunaxa Nation, particularly given that the Crowsnest Pass area held a primary use for the Ktunaxa Nation as a travel corridor in the mountain valleys to the Plains of what is now southern Alberta, of which many trails generally followed the present-day Crowsnest highway (Arrow Archaeology Ltd, 2014; Firelight Group, 2019). Several trails and travelways used by the Ktunaxa Nation for movement through the Rocky Mountains to and from the plains, directly intersect the Project area and areas to the north and south (Firelight Group, 2019). It is assumed that trails and travelways connect these sites. Further, the Ktunaxa Nation use values are documented along the Crowsnest Pass and eastern foothills including transportation values (Firelight Group, 2019). The Ktunaxa Nation camps, including historic camp locations at Crowsnest Lake, along the Crowsnest River and east of Crowsnest Mountain, depend on access and trail networks, although these are located outside the LSA (Firelight Group, 2019). Specifically, the Ktunaxa Nation asserts that the Project is likely to attribute residual impacts on Ktunaxa use, rights and interests in the Project area including, but not limited, to:

> Impacts on use of trails for travel and access to cultural landscapes, including important traditional Ktunaxa travel routes connecting lands west of the Rockies with the Southern Alberta Plains, including routes generally followed by the current Crowsnest Highway corridor. (Firelight Group, 2019, p. 3)

The Ktunaxa Nation explains that trails and travelways continue to be important for the transfer of knowledge and connection to Ktunaxa Nation ancestors and oral history. Further, viable habitation sites and camp areas that ensure future use are important to the Ktunaxa Nation plans for restoration of bison and ultimately harvest (Firelight Group, 2019). In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the Access Management Plan (AMP) that will include the following:
  - access points and roads to be clearly labelled and documented;
  - notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
  - identified sensitive features (*e.g.*, species of management concern, important habitat features) to be flagged or fenced ahead of clearing;
  - signage to be used for identifying areas that are not open for public use; and
  - share information about construction timing.
- Benga will continue to improve the Cultural Site Discovery Contingency Plan for culturally important sites identified during construction and operations.

The Ktunaxa Nation did not provide any specific, additional recommendations.

In addition to a direct change to trails and travelways and associated features, it is expected that the experience of visiting these locations will also change. The Project will cause noise, dust and a visual disturbance. These effects, in turn, affect the cultural and spiritual relationship between the Ktunaxa Nation and their trails and travelways. Benga is not proposing any additional mitigation measures other than those already identified in CR #1 (EIA, CEAR #42) Air Quality and CR #2 (EIA, CEAR #42) Noise where measures to minimize effects are discussed and the measures listed above.

9.3.2.6 Cultural and Spiritual Values

The Ktunaxa Nation considers the Project area and adjacent areas, including Crowsnest Mountain, Crowsnest Pass, Crowsnest Lake and the area of Frank to represent a "deeply important cultural landscape for Ktunaxa citizens," (Firelight Group, 2019, p. 3). The potential for changes to the viewscape and sensory environment associated with direct and indirect Project activities are a primary concern to Ktunaxa Nation for current and future use as well as stewardship of values associated with *qukin ʔakitɬaʔis* (Crowsnest Mountain) and *Kuɬwiaʔki* (Crowsnest Lake). Increased frequency of rail disturbance is also a concern.

Specifically, the Ktunaxa Nation asserts that the Project is likely to attribute residual impacts on Ktunaxa Nation use, rights and interests in the Project area including, but not limited, to:

- impacts on cultural spiritual values, including sense of place and ability to pass on place-specific knowledge related to sacred landforms and Ktunaxa Nation oral history of the Crowsnest Pass. This place-specific knowledge is reliant on the integrity of the viewscape and sensory environment surrounding qukin ʔakitɬaʔis (Crowsnest Mountain), Crowsnest Pass and specifically Kuɬwiaʔki (Crowsnest Lake), Turtle Mountain and Frank and other important areas within and beyond the LSA; and
- impacts on environmental and cultural-spiritual values associated with the integrity of water resources at the headwaters of the Crowsnest River and downstream (Firelight Group, 2019, p. 3).

Healthy water quality influences the Ktunaxa Nation perspectives on contamination, health, wild foods and whether they can reliably depend on preferred places and species (Firelight Group, 2019). The Ktunaxa Nation anticipate that impacts to water in the area are likely to result in impacts on the Ktunaxa Nation use including use of camp and habitation areas adjacent to the Crowsnest River and its tributaries (Firelight Group, 2019).

The Ktunaxa Nation anticipate Project impacts to the water to include: "mobilization of mining contaminants into adjacent waterways by airborne deposition, runoff from the mine site and releases of treated wastewater into the environment," (Firelight Group, 2019, p. 17)

The Ktunaxa Nation Council recommends additional work to "identify mitigations and other measures that can reliably reduce impacts and enhance benefits for the Ktunaxa Nation use, rights and interests," (Firelight Group, 2019, p. 2).

Benga has put forward the following mitigations regarding cultural and spiritual values:

- Benga will work with the Ktunaxa Nation to continue to improve the Access Management Plan (AMP) to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Ktunaxa Nation where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- Where identified by the Ktunaxa Nation, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;

- If avoidance of any TK/TU features is not possible, Benga will work with the Ktunaxa Nation to develop and plan for culturally appropriate mitigation;
- Benga will continue to work with the Ktunaxa Nation to integrate TK in the development of Project management and monitoring plans and in Project activities;
- Benga will support a cultural competency program for its employees and contractors;
- Benga has and will continue to support Ktunaxa cultural events and ceremonies through its Indigenous engagement and initiatives such as its community sponsorship program; and
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations.

In addition to a direct change to cultural and spiritual values and associated features, it is expected that the visual and sensory experience of visiting these locations will also change. The Project will cause a certain change in noise, dust and a visual disturbance. These effects, in turn, could affect the relationship between the Ktunaxa Nation and their cultural and spiritual values.

Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Ktunaxa Nation has additional measures to suggest to mitigate for experience, Benga will incorporate these into future planning.

9.3.3 Residual Effects to Current Use of Lands and Resources for the Ktunaxa Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented.

Based on the potential effects and mitigation measures described, there may be residual effects to current use of lands and resource interests.

The Ktunaxa Nation anticipate that the Project is likely to contribute further adverse residual impacts on the Ktunaxa Nation use, rights and interest in the Project area, including, but not limited to impacts to: cultural-spiritual values, environmental and cultural-spiritual values, use of trails for travel and access, preferred habitation (camp) areas and subsistence harvest areas; ecological values and the Ktunaxa Nation governance, stewardship and relationships with neighbouring Indigenous communities in the Crowsnest Pass region (Firelight Group, 2019).

9.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects described in CR #9 and CR #10 (EIA, CEAR #42) and input provided by the Ktunaxa Nation. In other words, changes to wildlife may have an effect on the hunting activities and therefore, wildlife mitigation measures are directly relevant to the interest of the Ktunaxa Nation. The Project will affect the 10 wildlife VCs of importance to the Ktunaxa including moose, elk, bear and special status wildlife species such as mountain goat and eagles through changes in habitat availability, habitat fragmentation/connectivity, mortality risk, all of which will affect local populations to some degree. With successful application of mitigation, the residual effects of the Project on habitat availability have been described as local to regional in extent, continuous in frequency, reversible, low in magnitude and long-term in duration. Most of the Project-related effects on wildlife will be confined primarily to the Project footprint and sensory disturbances associated with mine construction and operations will be largely limited to the WLSA.

Just as with wildlife, effects to land and resource use (CR #10, EIA, CEAR #42) has been characterized as local in geographic extent, extended in duration, continuous in frequency, reversible to long-term and nil in magnitude.

Given continuity with traditional practices, traditions or customs, it is reasonable to assume that hunting in the Project area might resume in the foreseeable future although areas closer to Ktunaxa communities would likely be preferable. Despite remediation, concerns about residual contamination and confidence in wild foods may also lead the Ktunaxa Nation to hunt elsewhere.

The Project is not anticipated to have an impact on currently vacant bison habitat, including movement corridors, that are likely to become critical to bison and Ktunaxa harvest of bison, once sufficient populations have been restored.

In summary then, the Project is not expected to have measurable effects on species hunted by the Ktunaxa Nation. Similarly, with the implementation of mitigation measures including an AMP and ongoing consultation, the Project is not expected to affect current access patterns. As a result, residual effects to hunting are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to hunting by the Ktunaxa Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

9.3.3.2 Trapping

Benga considers the characterization of residual impacts for trapping to be the same as for hunting above.

Given continuity with traditional practices, traditions or customs, it is reasonable to assume that trapping in the Project area might resume in the foreseeable future although areas closer to Ktunaxa communities would likely be preferable. Concerns about residual contamination and confidence in wild foods may lead the Ktunaxa Nation to trap elsewhere.

9.3.3.3 Fishing

The characterization of residual effects to fishing included consideration of residual effects described in CR #6 (EIA, CEAR #42) and input provided by the Ktunaxa Nation. In other words, changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Ktunaxa Nation. The residual effects to fish and fish habitat fish and fish habitat were characterized as local in geographic extent, extended in duration, continuous in frequency, reversible in the long-term and nil in magnitude. In other words, the Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Ktunaxa Nation. With the implementation of mitigation measures including an AMP and ongoing consultation, the Project is also not expected to affect current access patterns. Finally, the enjoyment of fishing is not to be expected to be affected by noise or visual changes in the landscape. Nonetheless, the Ktunaxa Nation may avoid fishing in visual and auditory range of Project activities.

In summary, the Project is not expected to affect current fishing patterns. As a result, residual effects to fishing are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the changes to fishing by the Ktunaxa Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

9.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of residual effects under vegetation, habitat and input provided by the Ktunaxa Nation. In those chapters of the EIA, the residual effects were characterized as local in geographic extent, long-term in duration, continuous in frequency, reversible and high magnitude. Benga expects that the reclaimed land will ensure a range of communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. The Project will not result in the loss of the resource to the communities, the region, or the province.

In addition, residual effects on land and resource use were described as local in geographic extent, extended in duration, continuous in frequency, reversible to long-term and nil in magnitude. Majority of the land to be developed is privately owned and the lands will be reclaimed to an equivalent capability.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Ktunaxa Nation. With the implementation of mitigation measures including an AMP and ongoing consultation, the Project is not expected to affect current access patterns. As a result, residual effects to plant gathering are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

In totality, the changes to plant gathering by the Ktunaxa Nation are not considered significant, providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

CR #8 (EIA, CEAR #42) characterizes residual effects to vegetation as local in geographic extent, long- term in duration, continuous in frequency, reversible and high magnitude. The Project will have a neutral contribution with respect to valued species and communities. The reclaimed land will support a range of communities with equivalent capabilities to those of the

surrounding lands and that existed prior to Project development. The Project will not result in the loss of the resource to the communities, the region or the province. The confidence rating is high. The effect of the Project is well understood as are the techniques used for revegetation.

Use of proven techniques for revegetation will be supported by adaptive management and monitoring. The probability of occurrence is high given the type of Project and method of coal extraction.

As described in CR #8 (EIA, CEAR #42), while the Project will result in some loss of traditional use vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. The Project-specific residual effects are not likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment. Traditional use information provided by the Ktunaxa Nation did not include any accounts of current plant harvesting methods.

Progressive reclamation within the mine permit boundary to equivalent land capability is the main method used to mitigate the impacts on vegetation and wetlands and therefore on harvesting success for gathering. Project mitigation will aim to reclaim not only the new disturbances from the Project but also areas previously disturbed from historic mining operations. Mitigation measures will include, but are not limited to, the following:

- a re-vegetation program which aims to establish diverse native vegetation communities (closed conifer forests, grassland open forests, mixed forests and treed wetlands) that are common to the pre- disturbed landscape and that will support vegetation for traditional gathering purposes;
- a Conservation and Reclamation Plan which aims to establish vegetation communities that are locally and regionally limited in distribution where conditions allow;
- preservation of adjacent vegetation communities by minimizing the area required for construction and operation of the Project;
- provision of appropriate soil substrate where re-vegetated areas can establish;
- seeding of stockpiled reclamation material with suitable vegetation species mix to ensure long-term stability of the soil piles, which reduces erosion and the potential for weed establishment;
- use of coarse woody debris and direct soil placement techniques to augment mycorrhizal and microbial inoculums;
- direct placement of soil for provision of propagules to enhance opportunity for re-establishment of native species composition and enhanced species richness;

- planting of multiple layers of native vegetation (*e.g.,* trees, shrubs and graminoids) to provide initial structure for wildlife habitat and to enhance biodiversity;
- based on the described selection criteria implement the seed collection, propagation and/or relocation plan for rare species;
- on-going consultation with the Ktunaxa Nation in designing mitigation measures for sustainable management of valued vegetation;
- on Benga private land, lodgepole pine and other culturally important plants be made available to the Ktunaxa Nation potentially affected by the Project for harvesting; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- sharing of information about construction timing; and
- where practicable, utilize locally collected seed to preserve the legacy of species and of place.

9.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary. Although the Ktunaxa Nation have identified that the Crowsnest Pass has been an important access route to what is now Alberta, no specific trails or travelways within the Project footprint have been identified.

The Project footprint will be reclaimed to land use capability equivalent to pre-mining; however, it will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area West of Blairmore Creek and Crown Land to the north of the Project and from either the north or the south along the Gold Creek. With the implementation of the AMP, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Ktunaxa Nation and trails and travelways.

Therefore, the residual effects are:

- moderate magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;

- not reversible; and
- resilient in ecological and social context.

In totality, the changes to trails and travelways used by the Ktunaxa Nation are not considered significant, providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

9.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by the Ktunaxa Nation in their Technical Memo (Firelight Group, 2019).

The residual effects to hunting, trapping, fishing, plant gathering and trails and travelways were deemed to be primarily:

- moderate in magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- resilient in ecological and social context.

With respect to cultural and spiritual values, the residual effects are considered to be similar. With the implementation of mitigation measures including an AMP and ongoing consultation, the Project would still affect Ktunaxa cultural and spiritual values and interests. As a result, residual effects are characterized as:

- moderate in magnitude;
- local in geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- sensitive in ecological and social context.

The changes to cultural and spiritual values of the Ktunaxa Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts.

9.3.4 Significance Determination of Current Use of Lands and Resources for the Ktunaxa Nation Traditional Purposes

No significant adverse effects post-mitigation was identified for Current Use of Lands and Resources for the Ktunaxa Nation Traditional Purposes. Overall, the Project is not anticipated to measurably change the Ktunaxa Nation's ability to continue traditional practices. It is predicted that the effect of the Project on the access to hunting and gathering areas will be not significant as a majority of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability. Benga is committed to ongoing consultation with the Ktunaxa Nation to address concerns, implement additional mitigation measures or identify offsetting measures if required.

9.4 Ktunaxa Nation Physical and Cultural Heritage

9.4.1 Background of Ktunaxa Nation Physical and Cultural Heritage

The Project area and adjacent areas including Crowsnest Mountain, Crowsnest Pass, Crowsnest Lake and the area of Frank represent an important cultural landscape for the Ktunaxa Nation. These places feature in oral history around bison hunting, creation stories, ceremonial practices and relationships. There are several nearby cultural and heritage sites including, for example, habitation sites, place names, teaching areas, ancestral villages, ceremonial sites, vision quest sites (Firelight Group, 2019).

One site-specific cultural site called *maƛuk* (Dirty Water/ Bellevue) was reported in the category of cultural activity within the LSA although it is unclear whether this in a cultural heritage site or an area of use (Firelight Group, 2019).

9.4.2 Potential Effects and Mitigations on Ktunaxa Nation Physical and Cultural Heritage

The Project will intersect or be in proximity to sacred, gathering and habitation sites identified by the Ktunaxa Nation. One site-specific cultural site called *maƛuk* (Dirty Water/ Bellevue) was reported in the category of cultural activity within the LSA although it is unclear whether this in a physical and cultural heritage site or an area of use (Firelight Group, 2019). *ʔakitɬaʔis* (Raven's House or Crowsnest Mountain) is of significance as it not only serves as the headwaters for the Crowsnest watershed, but also is considered the home of the creation being, Raven.

The Historical Resources Impact Assessment (Section E.13, EIA, CEAR #42) addresses potential effects to sites as defined as any work of nature or humans that is of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific, or aesthetic

interest. There are 32 recorded archaeological or historic resources located in the Project area including sites that are valued as cultural heritage sites to Indigenous groups (O'Connor, 2018, p. 33). Of the 32 sites, 10 overlap the Project footprint. Direct effects to historical resources are anticipated for sites within the Project footprint as a result of Project construction. If avoidance is not possible, the Project may damage or disturb sites that are identified as sacred, gathering or habitation sites.

The potential effects described in the sections listed above could result in a change in use or access or disturbance to features associated with sacred, gathering, or habitation sites. Together, these changes will change the cultural value or importance to the value.

The Ktunaxa Nation (Firelight, 2019, p. 15-16) have identified potential effects on the Ktunaxa Nation physical and cultural heritage as:

- Disturbance of important the Ktunaxa Nation cultural-spiritual sites;
- Potential for large scale slope failure;
- Influence on water quality and presence of industrial disturbance as they influence the Ktunaxa Nation use of camping areas; and
- Sensory disturbance, connectivity impacts, habitat loss and degradation of culturally important animals.

Viewscape and sensory environment at key sites would be affected (Firelight Group, 2019). Stewardship practices linked to place-based cultural-spiritual practices would be affected by Project activities (Firelight Group, 2019). In terms of a mitigation, limiting sensory disturbance (*e.g.,* Viewscape, noise, sense of place) supports the Ktunaxa Nation use and connection to these places (Firelight Group, 2019).

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of any unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;
- Consultation will include sharing information with the Ktunaxa Nation about construction timing;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations; and
- Benga will continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions

during construction as required for safety purposes to allow for planning alternate land use locations.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) present that noise, dust and visual impact mitigation measures are being adopted by Benga to minimize any adverse effects.

Where the Ktunaxa Nation has identified additional mitigation measures, these will be discussed with the Ktunaxa Nation in follow-up meetings.

9.4.3 Residual Effects on Ktunaxa Nation Physical and Cultural Heritage

The characterization of residual effects to sacred, gathering and habitation sites includes consideration of residual effects and input provided by the Ktunaxa Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project could still have measurable effects on sacred sites used by the Ktunaxa Nation and the Ktunaxa Nation's use of these sites would be disturbed. After mitigation, residual effects to sacred, gathering and habitation sites are characterized as:

As a result, residual effects to sacred, gathering and habitation sites are characterized as:

- moderate magnitude;
- local geographic extent;
- long-term duration;
- regular frequency;
- reversible; and
- sensitive in ecological and social context.

In totality, the residual effects of changes to physical and cultural heritage of the Ktunaxa Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful. In addition, Benga will implement the following:

- An Indigenous Environmental Stewardship Committee, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and

- An Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

9.4.4 Significance Determination of Physical and Cultural Heritage for the Ktunaxa Nation

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Ktunaxa Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Ktunaxa Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Ktunaxa Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

In summary, the residual effects of the Project on the Káinai Nation are determined to be not significant and shown in Table 9.4.4-1.

Table 9.4.4-1 Summary of Residual Effects to the Ktunaxa Nation

Valued Components	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Trapping	Moderate	Local	Long-term	Continuous	Reversible	Sensitive	Not significant
Fishing	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Plant Gathering	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Trails and Travelways	Moderate	Local	Long-term	Continuous	Not Reversible where trails and travelways are lost	Resilient	Not significant
Cultural and Spiritual Values	Moderate	Local	Long-term	Continuous	Not Reversible	Sensitive	Not significant
Indigenous Physical and Cultural Heritage	Moderate	Local	Long-term	Regular	Reversible	Sensitive	Not significant

10.0 SAMSON CREE NATION CONSULTATION AND ASSESSMENT

10.1 Samson Cree Nation Consultation Summary

Consultation and engagement activities with the Samson Cree Nation have included:

- ongoing and regular phone and e-mail communications;
- meetings to discuss Project updates and seek input on the Project and the environmental assessment; and
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - Draft CEAA EIS Guidelines;
  - Final CEAA Project Description; and
  - Information packages.

Prior to commencement of the Environmental Assessment Process, Samson Cree submitted a Statement of Concern to the AER in April 2014 in relation to Benga's application to amend a Coal Exploration Permit (Samson Cree Nation, 2014). The amendment was for permission to drive on sections of an existing road located on Crown land. In approving the Coal Exploration Permit amendment application, the AER notified the Samson Cree Nation in writing of its determination that Samson Cree Nation did not provide information that demonstrates its members use lands or other natural resources in the Project area (AER, 2014) and that the proposed work activity would entail minor land disturbances and temporary, localized impacts on the land and land users (AER, 2014).

CEAA published the Project's Final Guidelines for the Preparation of an Environmental Impact Statement (Final Guidelines) in June 24, 2015 and concurrently notified potentially affected Indigenous groups of its publication. CEAA identified six Indigenous groups that may be less affected by the Project for consultation including Samson Cree Nation. Benga promptly initiated consultation with Samson Cree Nation with a letter offering information on the Project, requesting information to assist Benga in understanding Samson Cree Nation's uses in the Project area and to discuss any concerns.

Benga followed up in July 2015 with a letter describing a plan for continued consultation on the Project and referencing participation funding opportunities for Samson Cree Nation. Samson Cree Nation responded in early August and provided a Traditional Land Use map and traditional territory boundary to inform Benga of its asserted interests related to the Project. This email indicated that a data sharing agreement would be required for further engagement. In August 2015, Benga provided

an information package seeking feedback on Benga's understanding of Samson Cree Nation's Indigenous interests.

In September 2017, Samson Cree Nation completed a site tour of the Grassy Mountain Coal Project and met with Benga staff to review the Project.

Between August 2016 and April 2019, Benga has regularly provided Project information to the Samson Cree Nation and Benga and the Samson Cree Nation have met to discuss the Project EIA mitigation measures and issues and concerns. Samson Cree Nation has participated actively in Project review through its review of the EIA and submission of a Statement of Concern. Benga has reviewed and responded to the Statement of Concern.

Information provided to Benga after the submission of this Information package will be considered by Benga and incorporated into the Project planning as appropriate.

10.2 Samson Cree Nation Traditional Use and Traditional Knowledge Studies

Benga has not obtained traditional knowledge use or knowledge studies from the Samson Cree Nation.

New information including TK/TU provided to Benga after this update report will be considered by Benga and incorporated into the Project planning as appropriate.

10.3 Current Use of Lands and Resources for the Samson Cree Nation Traditional Purposes

10.3.1 Background of Current Use of Lands and Resources for the Samson Cree Nation Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Samson Cree Nation since the EIA (CEAR #42) was submitted and the Statement of Concerns (Samson Cree Nation, 2014).

10.3.1.1 Hunting

The Samson Cree Nation advised there are hunting blinds, mineral salt licks, kill sites, game trails, moose breeding grounds and water holes throughout the Samson Cree Nation Territory. The Samson Cree Nation hunt grizzly, elk, moose, deer, sheep, rare prairie chickens, sage grouse, sprague's pipits, skunks, lynx, cougars, wolves and wolverines (Samson Cree Nation, 2014).

No site-specific locations, seasonal use, or methods have been identified for hunting in the Project area.

10.3.1.2 Trapping

The Samson Cree Nation advised they have an interest in trapping in the Project area. However, no specific locations, seasonal use, or methods have been identified for trapping in the Project area (Samson Cree Nation, 2014).

10.3.1.3 Fishing

The Samson Cree Nation advised they have a fishing interest in the Project area. However, no site-specific information on fish or fishing areas, fishing seasons, or the importance of fishing in the Project area has been provided. (Samson Cree Nation, 2014).

10.3.1.4 Plant Gathering

The Samson Cree Nation stated that there are important gathering and cultivation sites in proximity to the Project for plants that are used for medicinal, ceremonial and dietary purposes as well as for traditional teachings (Samson Cree Nation, 2014). No site-specific information was provided. Plants cited include tumble weed, sage and sweetgrass.

Samson Cree Nation notes that the Crowsnest Pass area is important for timber harvesting, which is valuable especially for holding ceremonies (Samson Cree Nation, 2014).

10.3.1.5 Trails and Travelways

The Samson Cree moved freely through their traditional territory in pursuit of resources or trade. The Samson Cree Nation advised that trail networks are located throughout their traditional territory and they link traditional land use regions to traditional use sites; however, they did not advise of any trails or travelways of importance or use in the Project area (Samson Cree Nation, 2014).

10.3.1.6 Cultural and Spiritual Values

As with all First Nations in the region, the Samson Cree draw their culture from their traditional territory – the land, the landscape and the animals. There is a kinship with the animals which continues to provide lessons and teachings by which to live. There are many well-known and documented sacred places and gathering areas throughout the Samson Cree Nation territory. These sacred sites are unifying symbols, provide evidence for cultural continuity and establish and reinforce national and personal connections to the landscape.

The Samson Cree Nation expresses this connectivity in describing their connection with the lands within their territory, highlighting how they continue to further their culture and spiritual practices on the lands and water in and around the Rocky Mountain Foothills Region by:

- carrying on Samson's traditional way of life by maintaining its preferred use sites in and around the Program area (Samson Cree Nation, 2014);
- carrying out a variety of practices, traditions and customs within Samson Territory in and around the Program Area (Samson Cree Nation, 2014);
- Cultivating and harvesting traditional herbs and medicines (Samson Cree Nation, 2014); and
- Timber is important to the Samson Cree Nation because it is critical to hold ceremony (Samson Cree Nation, 2014, p. 10).

The Samson Cree Nation assert that their practices, traditions and customs are integral to their distinctive culture and traditional way of life (Samson Cree Nation, 2014). For example, annual ceremonies and other traditional practices are utilized on a seasonal basis (Samson Cree Nation, 2014).

The Samson Cree Nation note the region of the Project holds spiritual importance for its members (Samson Cree Nation, 2014); however, Samson Cree Nation has not identified current or historic use for sacred sites, gathering sites, or habitation sites in the Project area.

The Samson Cree Nation's cultural well-being is impacted by access to lands and their ability to harvest traditional foods, which are also essential for ceremonies and feasts (Samson Cree Nation, 2014). Further, social and cultural opportunities for learning and knowledge transmission rely on these traditional practices. Samson Cree Nation holds ideals about respect for and reciprocity with wildlife and the land (Samson Cree Nation, 2014). Traditional networks and plant harvesting, and cultivation sites hold cultural importance for the Nation (Samson Cree Nation, 2014).

For the Samson Cree Nation, the bear holds high spiritual and ceremonial value, along with timber (Samson Cree Nation, 2014).

10.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for the Samson Cree Nation Traditional Purposes

This section describes the Project effects on current use of lands and resources for traditional purposes for the Samson Cree Nation. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Samson Cree Nation.

10.3.2.1 Hunting

The Samson Cree Nation continues to hunt throughout their traditional territory.

The effects assessments on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #4) are relevant to the potential effects to the Samson Cree Nation hunting. CR #9 (EIA, CEAR #42) addresses direct and indirect effects on key wildlife species and their habitats of species that are hunted by the Samson Cree Nation; these include loss of habitat availability (through direct loss, sensory disturbance and fragmentation), disruption of wildlife movement (through habitat fragmentation, reduced connectivity and creation of barriers), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These effects, in turn, could may affect the cultural and spiritual relationship between the Samson Cree Nation and wildlife.

CR #5 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as moose, elk, deer and bear hunted by the Samson Cree Nation members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Samson Cree Nation can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Samson Cree Nation and wildlife.

To address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and by extension effects on hunters. Key features are:

- continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions during construction as

required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;

- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
  - commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover; and
  - establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation.
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- retain vegetation adjacent to high-activity linear corridors (*e.g.,* access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- Store all toxic materials, including those used for blasting, in secure areas that are inaccessible to wildlife (*e.g.,* buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and

- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of hunters. Benga has proposed mitigation for visual impacts and dust in CR #1 (EIA, CEAR #42) and for noise in CR #2 (EIA, CEAR #42). If the Samson Cree Nation has additional measures to suggest mitigating for hunting experience, Benga will continue to work with the Nation on mitigation measures.

10.3.2.2 Trapping

Potential effects to the Samson Nation trapping are similar to the potential effects on hunting. Adverse Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution, or change in animal behaviour for furbearers important to the Samson Cree Nation.

10.3.2.3 Fishing

The Samson Cree Nation advised they have a fishing interest in the Project area.

Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and Blairmore Creek can be assessed from Highway 40 using existing trails. CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: Detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred fishing method. These effects, in turn, may affect the cultural and spiritual relationship between the Samson Cree Nation and fish.

Mitigation measures Benga has planned to avoid or minimize potential effects to the availability of fishing areas include:

- a Detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan have been proposed (Appendices B1 and B2, Addendum 8, CEAR #89) that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek;
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Samson Cree Nation during construction, operations and reclamation, including discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- engage with the Samson Cree Nation prior to and during mine construction to allow for opportunities for species of interest to be harvested, re-located or otherwise utilized;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Samson Cree Nation has additional measures to suggest mitigating for fishing experience, Benga will continue to work with the Nation on mitigation measures.

10.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Samson Cree Nation. There are important plants gathering and cultivation sites in proximity to the Project that are used for medicinal, ceremonial and dietary purposes as well as for traditional teachings (Samson Cree Nation, 2014).

CR #8 (EIA, CEAR #42) addresses potential effects on key vegetation species and habitat including the species identified by the Samson Cree Nation. Further, a summary of species identified by the Samson Cree Nation with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure.

The potential effects described in these sections of the EIA could result in a change in identified plant species and habitat, change in use or access to identified plant gathering locations, or change in

preferred harvesting method. These effects, in turn, could affect the cultural and spiritual relationship between the Samson Cree Nation and plants. Input provided by the Samson Cree Nation during consultation is considered in the identification of potential effects and proposed mitigation measures.

The EIA details the mitigation measures relating to Vegetation and Wetlands (CR #8, EIA, CEAR #42) and Land and Resource Use (CR #10, EIA, CEAR #42). Reclamation specific mitigation is detailed in the Updated Conceptual Conservation and Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to JRP IR-2.6). In addition, vegetation species identified during the consultation process, including TU species observed in the vegetation LSA vegetation field surveys are included in the updated C&R Plan (Table F.1.9-1). Key plant gathering mitigation includes:

- on-going consultation with the Samson Cree Nation in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants will be made available for harvesting by the Samson Cree Nation potentially affected by the Project; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the Access Management Plan (AMP) for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will consult with the Samson Cree Nation on updates to the Conservation and Reclamation (C&R) plan. The C&R Plan will include the use of native species wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Samson Cree Nation Traditional land use opportunities will be interwoven;
- Benga will support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes; and
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of plant gathering. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Samson Cree Nation has additional measures to suggest mitigating for plant gathering experience, Benga will continue to work with the Nation on mitigation measures.

10.3.2.5 Trails and Travelways

While the Samson Cree Nation have indicated they use trails and travelways throughout their traditional territory, they have not provided information regarding any trails or travelways that may intersect or be in proximity to the Project. Given that the Samson Cree Nation advised they have fishing, trapping, hunting interests in the Project area and have noted the existence of important plant gathering and cultivation sites in proximity to the Project, it is reasonable to assume that trails and travelways are or would be used to access those areas for traditional purposes. As such, it is possible that the Project may affect trails and travelway use by the Samson Cree Nation currently or in the future.

In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the AMP that will include the following;
- notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
- signage to be used for identifying areas that are not open for public use; and
- share information about construction timing.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of using trails and travelways. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Samson Cree Nation has additional measures to suggest mitigating for plant gathering experience, Benga will continue to work with the Nation on mitigation measures.

10.3.2.6 Cultural and Spiritual Values

Changes resulting from the Project may interfere with the Samson Cree Nation's ability to pass on cultural teachings to the next generation in the Project LSA. For example, the loss of a harvesting area means there is one fewer place to teach harvesting practices or share a language unique to the area.

The Samson Cree Nation is concerned with the direct and adverse effects on their cultural sites. This concern is rooted in the access to culturally significant sites and "the high ceremony value" and spiritual connection to the bear (Samson Cree Nation, 2014, p. 10). The Samson Cree Nation describes

being "connected to the land, waters and resources within Samson Territory" where spiritual, identity, culture, heritage, language and traditions are practiced (Samson Cree Nation, 2014, p. 13). Samson Elders are "certain about the close and significant ties to the traditional land use sites and land bases of the traditional culture and way of life for Samson's people" (Samson Cree Nation, 2014, p. 9).

Benga has proposed mitigation measures relevant to sites of cultural and spiritual importance and committed to the following measures to mitigate effects related to cultural and spiritual values:

- Where identified by the Samson Cree Nation, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;
- Benga will continue to work with the Samson Cree Nation to identify ways in which TK can be considered during Project activities and in the development of environmental management plans; and
- Benga will support a cultural competency program for its employees and contractors.

A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction or operations. It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of engaging in activities of cultural or spiritual value. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Samson Cree Nation has additional measures to suggest mitigating for plant gathering experience, Benga will continue to work with the Nation on mitigation measures.

10.3.3 Residual Effects on Current Use of Lands and Resources for Samson Cree Nation Traditional Purposes

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects on the current use of lands and resources valued by the Samson Cree Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Samson Cree Nation and surrounding lands and resources.

10.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects (CR #9, EIA, CEAR #42) and input provided by the Samson Cree Nation. Changes to wildlife may have an effect on the hunting activities and therefore, wildlife mitigation measures are directly relevant to the

interest of the Samson Cree Nation. These effects affect the cultural and spiritual relationship between the Samson Cree Nation and wildlife.

The Project will affect the ten wildlife VCs, including deer, moose, elk and grizzly bear, through changes in habitat availability, habitat fragmentation/connectivity, mortality risk and abundance all of which will affect local populations to some degree. With successful application of mitigation measures, the residual effects of the Project on habitat availability, habitat fragmentation/connectivity, mortality risk and abundance within the Wildlife LSA (WLSA) were deemed not significant (CR #9, EIA, CEAR #42).

Just as with wildlife, Project effects to land and resource use: hunting and trapping and access (CR #10, EIA, CEAR #42) have been characterized as local in geographic extent, extended in duration, continuous (access) or occasional (hunting) in frequency, reversible in the long-term and low in magnitude and not significant.

In summary then, the Project is not expected to have measurable effects on species hunted by the Samson Cree Nation. Similarly, with the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

Measures to be implemented to mitigate these effects are outlined in Section 4.3.2.1 of this report. After implementation of mitigation, residual effects to hunting are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The changes to hunting by the Samson Cree Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

10.3.3.2 Trapping

Given the relationship between hunting and trapping in use and access to wildlife, Benga considered the residual effects the same.

10.3.3.3 Fishing

The characterization of residual effects to fishing includes consideration of residual effects and input provided by Samson Cree Nation. Changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Samson Cree Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Samson Cree Nation and fish.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Samson Cree Nation. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience and enjoyment of fishing can be managed through noise and visual impact management as discussed in CR #1 and CR #2 (EIA, CEAR #42). Nonetheless, the Samson Cree Nation may avoid fishing in visual and auditory range of Project activities.

As a result, residual effects to fishing are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The Project residual effects to fishing by the Samson Cree Nation are not considered significant Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

10.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of residual effects described in CR #8 (EIA, CEAR #42) and CR #10 (EIA, CEAR #42) and input provided by the Samson Cree Nation. In other words, changes to plant habitat may have an effect on the plant gathering activities and therefore plant gathering measures are directly relevant to the interest of the Samson Cree Nation. These effects, in turn, could affect the cultural and spiritual relationship between the Samson Cree Nation and plants.

The Project is expected to remove traditional use plants within the Project LSA. Beyond the Project area, habitats are expected to remain intact. Therefore, the overall availability of habitat is not anticipated to be substantially affected by the Project.

As described CR #8 (EIA, CEAR #42) while the Project will result in some loss of traditional use vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. Neither the Project-specific residual effects, nor the Project's residual effects acting cumulatively with other projects, are likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment.

With the mitigation measures summarized above especially those related to access and experience and pleasure of plant gathering, the Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species used for plant gathering by the Samson Cree Nation. As a result, residual effects to plant gathering are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The residual effects to plant gathering are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

10.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary.

The Project footprint will be reclaimed to land use capability equivalent to pre-mining; however, it will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area west of Blairmore Creek and Crown Land north of the Project and from either the north or the south along Gold Creek. With the implementation of the AMP, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Samson Cree Nation and trails and travelways.

Therefore, the residual effects to trails and travelways are:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The changes to trails and travelways used by the Samson Cree Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

10.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by the Samson Cree Nation (2014). the Samson Cree Nation cultural and spiritual values. The spiritual integrity of the landscape will be changed despite lasting reclamation efforts.

As a result, residual effects to cultural and spiritual values are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- resilient in ecological and social context.

In totality, the changes to cultural and spiritual values used by the Samson Cree Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

10.3.4 Significance Determination of Current Use of Lands and Resources for the Samson Cree Nation Traditional Purposes

No significant adverse significant effects post-mitigation were identified for Current Use of Lands and Resources for the Samson Cree Nation Traditional Purposes. Overall, the Project is not anticipated to measurably change the Samson Cree Nation's ability to continue traditional practices. It is predicted that the effect of the Project on the access to hunting, fishing and gathering will be not

significant as a majority of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability and Benga will continue to consult with the Samson Cree Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

10.4 Samson Cree Nation Physical and Cultural Heritage

10.4.1 Background of the Samson Cree Nation Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Samson Cree Nation since the EIA was submitted and the Statement of Concerns (Samson Cree Nation, 2014). The Samson Cree Nation notes a spiritual importance of the South Saskatchewan Land Use Area (Samson Cree Nation, 2014); however, the Samson Cree Nation has not identified current or historic use of sacred sites, gathering sites, or habitation sites in the Project area. Given that the Samson Cree Nation have shared their concerns for cultural sites (Samson Cree Nation, 2014), it is reasonable to assume that physical and cultural heritage sites are present in the area.

Benga will apply the following key measures to mitigate effects on physical and cultural heritage:

- If avoidance of unnamed pre-contact period sites is not possible based on size, location and complexity, a mitigation excavation will be conducted in advance of Project development;
- Consultation will include sharing information with the Samson Cree Nation about construction timing; and
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction and operations.

It is expected that the change in quality of the experience by Indigenous peoples in the natural environment could potentially be the result of noise, dust and the visual impact of the Project. CR #1 Air Quality (EIA, CEAR #42) and CR #2 Noise (EIA, CEAR #42) present that noise, dust and visual impact mitigation measures are being adopted by Benga to minimize any adverse effects. The mitigation measures proposed for physical and cultural heritage resources are consistent with provincial requirements and measures proposed by the Samson Cree Nation.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project could still have measurable effects on sacred sites used by the Samson Cree

Nation and the Samson Cree Nation's use of these sites would be disturbed. After mitigation, residual effects to sacred, gathering and habitation sites are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- resilient in ecological and social context.

The changes to Physical and Cultural Heritage of the Samson Cree Nation are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

10.4.2 Potential Effects and Mitigations on the Samson Cree Nation Physical and Cultural Heritage

Given the residual effects characterization above, residual effects on physical and cultural heritage for the Samson Cree Nation are not considered significant. Overall, the Project is not anticipated to measurably change the Samson Cree Nation's ability to recognize its physical and cultural heritage. Benga will continue to consult with the Samson Cree Nation to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

Table 10.4.2-1 Summary of Residual Effects on the Samson Cree Nation

Valued Components	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting and Trapping	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Fishing	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Plant Gathering	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Trails and Travelways	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Cultural and Spiritual Values	Low	Local	Long-term	Continuous	Not Reversible	Resilient	Not significant
Indigenous Physical and Cultural Heritage	Low	Local	Long-term	Continuous	Not reversible	Resilient	Not significant

11.0 SHUSWAP INDIAN BAND CONSULTATION AND ASSESSMENT

11.1 Shuswap Indian Band Consultation Summary

Consultation and engagement activities with the Shuswap Indian Band have included:

- ongoing and regular phone and e-mail communications;
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - draft CEAA EIS guidelines;
  - final CEAA Project Description; and
  - information packages.

CEAA published the Project's Final Guidelines for the Preparation of an Environmental Impact Statement (Final Guidelines) in June 24, 2015 and concurrently notified potentially affected Indigenous groups of its publication. The CEAA Guidelines identifies six Indigenous groups that may be less affected by the Project for consultation including the Shuswap Indian Band.

Benga promptly initiated consultation with the Shuswap Indian Band with a letter offering information on the Project and requesting information to assist Benga in understanding the Shuswap Indian Band's uses in the Project area and to discuss any concerns. Benga followed up in July 2015 with a letter describing a plan for continued consultation on the Project and referencing participation funding opportunities for the Shuswap Indian Band. In August 2015, Benga provided an information package seeking feedback on Benga's understanding of the Shuswap Indian Band's Indigenous interests.

Between August 2016 and April 2019, Benga has provided Project information to the Shuswap Indian Band and has provided the opportunity to meet to discuss the Project; however, the Shuswap Indian Band has not responded regarding a meeting date.

Information provided to Benga after the submission of this information report will be considered by Benga and incorporated into the Project planning as appropriate.

11.2 Shuswap Nation Traditional Use and Traditional Knowledge Studies

Benga has not obtained traditional use or knowledge studies from the Shuswap Indian Band.

New information including TK/TU provided to Benga after this update report will be considered by Benga and incorporated into the Project planning as appropriate.

11.3 Current Use of Lands and Resources for the Shuswap Indian Band Traditional Purposes

11.3.1 Background of Current Use of Lands and Resources for the Shuswap Indian Band Traditional Purposes

As noted above, Benga has not received TK/TU or background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) since the EIA (CEAR #42) was submitted.

11.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for the Shuswap Indian Band Traditional Purposes

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding current use of lands and resources for traditional purposes in the Project area has been received from the Shuswap Indian Band or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Shuswap Indian Band's current use of lands and resources for traditional purposes. As such, no further assessment is undertaken. Benga will continue to share information about the Project with the Shuswap Indian Band and information received will be considered in Project planning.

11.4 Shuswap Indian Band Physical and Cultural Heritage

11.4.1 Background of the Shuswap Indian Band Physical and Cultural Heritage

Information regarding physical and cultural heritage in the Project area is not identified in public sources and has not been provided by the Shuswap Indian Band.

11.4.2 Potential Effects and Mitigations on the Shuswap Indian Band Physical and Cultural Heritage

No information regarding physical and cultural heritage in the Project area has been received from the Shuswap Indian Band or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Shuswap Indian Band's physical and cultural heritage. As such, no further assessment is undertaken. Benga will continue to share information about the Project with the Shuswap Indian Band and information received will be considered in Project planning.

12.0 FOOTHILLS OJIBWAY FIRST NATION CONSULTATION AND ASSESSMENT

12.1 Foothills Ojibway First Nation Consultation Summary

Consultation and engagement activities with the Foothills Ojibway First Nation have included:

- ongoing and regular phone and email communications;

- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - draft CEAA EIS guidelines;
  - final CEAA Project Description; and
  - information packages.

CEAA published the Project's Final Guidelines for the Preparation of an Environmental Impact Statement (Final Guidelines) in June 24, 2015 and concurrently notified potentially affected Indigenous groups. Benga promptly initiated consultation with the Foothills Ojibway First Nation with a letter offering information on the Project and requesting information to assist Benga in understanding the Foothills Ojibway First Nation's uses in the Project area and to discuss any concerns.

Benga followed up in July 2015 with a letter describing a plan for continued consultation on the Project and referencing participation funding opportunities for the Foothills Ojibway First Nation. In August 2015, Benga provided an information package seeking feedback on Benga's understanding of the Foothills Ojibway First Nations Indigenous interests.

Between August 2016 and April 2019, Benga has regularly provided Project information to Foothills Ojibway First Nation, and no response was received. Information provided to Benga after the submission of this information report will be considered by Benga and incorporated into the Project planning as appropriate.

12.2 Foothills Ojibway First Nation Traditional Use and Traditional Knowledge Studies

Benga has not obtained traditional knowledge use or knowledge studies from the Foothills Ojibway First Nation.

New information, including TK/TU information provided to Benga in the future will be considered by Benga in Project planning as appropriate.

12.3 Current Use of Lands and Resources for the Foothills Ojibway First Nation Traditional Purposes

12.3.1 Background of Current Use of Lands and Resources for Foothills Ojibway First Nation Traditional Purposes

The Foothills Ojibway First Nation is a non-treaty and non-status band and therefore does not have any Indian reserves (TERA, 2013). Benga Mining has not been provided with information regarding

the location of the Foothills Ojibway First Nation traditional territory. Based on publicly available sources including information from other projects, the eastern Slopes of the Rocky Mountains are main portions of the Foothills Ojibway First Nation traditional territory with lands that fall within Treaty 6 and 8 (Meyer, 2012; Tucker, 2012). It is understood that there are approximately 250 members who identify as the Foothills Ojibway First Nations living in Hinton, Alberta which is the key settlement area (Meyer, 2012).

The Foothills Ojibway First Nation members are descendants of families who did not sign Treaty 6; however, there are family connections with members who did sign Treaty 6 and are associated with the Sun Child and O'Chiese Aboriginal groups (Meyer, 2012). The Foothills Ojibway First Nation is a diverse group including members with Cree and Saulteaux heritage (Meyer, 2012). The language is diverse but mainly Algonquian including Saulteaux and Cree (Meyer, 2012). The Foothills Ojibway First Nation families migrated west from Ontario in the 1500s but continued to move west based on invasion of their traditional territory and a desire to avoid European settlers (Meyer, 2012). In the early 1900s, they settled in the Rocky Mountain House area near Pembina and Brazeau Rivers (Meyer, 2012).

Information regarding traditional or current use, sacred sites or cultural values, recreational use, commercial activity, reliance on country foods and drinking water sources in the Project area is not identified in public sources and has not been provided by the Foothills Ojibway First Nation.

The description of the Foothills Ojibway First Nation traditional territory does not include locations that interact with or are in proximity to Project activities.

12.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for Foothills Ojibway First Nation Traditional Purposes

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding current use of lands and resources for traditional purposes in the Project area has been received from the Foothills Ojibway First Nation or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Foothills Ojibway First Nation 's current use of lands and resources for traditional purposes. As such, no further assessment is undertaken. Benga will continue to share information about the Project with the Foothills Ojibway First Nation and information received in the future will be considered in Project planning.

12.4 Foothills Ojibway First Nation Physical and Cultural Heritage

12.4.1 Background of Foothills Ojibway First Nation Physical and Cultural Heritage

As indicated in the previous section, the Foothills Ojibway First Nation continue to exercise their Aboriginal Interests in hunting, plant gathering and sacred, gathering and habitation sites (TERA, 2008; Meyer, 2012; Tucker, 2012; Trans Mountain, 2013). Information regarding physical and cultural heritage, including sacred sites, cultural and spiritual values and other intangible factors associated with the sites, is not identified in public sources and has not been provided by the Foothills Ojibway First Nation in relation to the Project.

The description of the Foothills Ojibway First Nation traditional territory does not include locations that are interacting with or in proximity to Project activities.

12.4.2 Potential Effects and Mitigations on Foothills Ojibway First Nation Physical and Cultural Heritage

No information regarding physical and cultural heritage in the Project area has been received from the Foothills Ojibway First Nation or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Foothills Ojibway First Nation 's physical and cultural heritage. As such, no further assessment is undertaken. Benga understands that additional information from the Foothills Ojibway First Nation may be forthcoming. Benga will continue to share information about the Project with the Foothills Ojibway First Nation and information received after the submission of this JRP Information Request Package 4 will be considered in Project planning.

13.0 MÉTIS NATION OF ALBERTA REGION 3 CONSULTATION AND ASSESSMENT

13.1 Métis Nation of Alberta Region 3 Consultation Summary

Consultation and engagement activities with the Métis Nation of Alberta Region 3 have included:

- ongoing and regular phone and email communications;
- meetings to discuss Project updates and seek input on the Project and the environmental assessment; and
- provision of key regulatory documents, such as:
  - PTOR;
  - First Nations Consultation Plan;
  - site visits;
  - draft CEAA EIS guidelines;

- final CEAA Project Description; and
- information packages.

CEAA published the Project's Final Guidelines for the Preparation of an Environmental Impact Statement (Final Guidelines) in June 24, 2015 and concurrently notified potentially affected Indigenous groups of its publication. Benga initiated consultation with Métis Nation of Alberta with a letter offering information on the Project and requesting information to assist Benga in understanding Métis Nation of Alberta's uses in the Project area and to discuss any concerns.

Benga followed up in July 2015 with a letter describing a plan for continued consultation on the Project and referencing participation funding opportunities for Métis Nation of Alberta. In August 2015, Benga provided an information package seeking understanding of Métis Nation of Alberta's Aboriginal Interests.

Between August 2016 and April 2019, Benga and the Métis Nation of Alberta Region 3 (MNAR3) have had ongoing dialogue regarding the review of the Application, mitigation measures and issues and concerns. The Métis Nation of Alberta Region 3 has participated actively in Project review.

Information provided to Benga after the submission of this consultation update report will be considered by Benga and incorporated into the Project planning as appropriate.

13.2 Métis Nation of Alberta Region 3 Traditional Use and Traditional Knowledge Studies

The Métis Nation of Alberta has submitted the following traditional land use study:

- Métis Nation of Alberta Region 3, Traditional Land Use Study (TLUS) Report for the Proposed Grassy Mountain Coal Project prepared by Kisik Environmental Services (KES, 2016a).

In addition, Benga obtained a Preliminary Issues Report from the Métis Nation of Alberta (MNA, 2016. Key objectives of the report are to identify traditional knowledge and land uses in the Project area with a focus on areas potentially disturbed by Project activities, to describe issues and concerns and to provide recommendations for mitigation of potential effects. Benga understands that the information gathered in all stages of TK/TU research by the Métis Nation of Alberta is the intellectual property of the Métis Nation and is retained solely by the Métis Nation of Alberta. Therefore, information used by Benga in the EIA and subsequent Addenda is released for use by the Métis Nation of Alberta.

The Métis Nation of Alberta Region 3 Traditional Knowledge and Use (TK/TU) of the Grassy Mountain Area served as an instrument for the Métis Nation of Alberta Region 3 to record traditional knowledge and land uses, to identify potential effects of the proposed Project and to give the Métis Nation of Alberta Region 3 knowledge holders an opportunity to provide ideas for mitigation of

potential effects. This study is a vital component of the consultation process because TK/TU studies enhance the quality of an environmental assessment in terms of confidence in results, avoiding potential effects to the Métis Nation of Alberta Region 3 and incorporating knowledge of the local environment.

13.3 Current Use of Lands and Resources for the Métis Nation of Alberta Region 3 Traditional Purposes

13.3.1 Background on Current Use of Lands and Resources for Métis Nation of Alberta Region 3 Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Métis Nation of Alberta since the EIA (CEAR #42) was submitted, in the TLUS (KES, 2016) and the EIA Review (Solstice, 2016).

13.3.1.1 Hunting

Métis Nation of Alberta members continue to hunt throughout their traditional territory, with a focus on deer, elk, wild turkey, grouse and bear (black and grizzly) (MNA, 2016). Within the RSA, there are elk calving grounds between Grassy Mountain and the Livingstone Range (MNA, 2016). The areas accessed by Métis Nation of Alberta members through the Project footprint include Daisy Creek, Gold Creek, Blairmore Creek and an area north of the Project footprint (MNA, 2016).

Hunting sites were traditionally temporary as Métis Nation members followed the migratory patterns of buffalo which they hunted (MNA, 2011). Wintering camps were constructed in the autumn in proximity to buffalo herds (AMHS, 2015). Traditional hunting events continue to take place throughout the province and some hunting events are organized under the Métis Harvesting Action Plan (2007).

Métis harvest food through hunting on a year-round basis except for restrictions due to conservation closures (MNA, 2007).

13.3.1.2 Trapping

The Métis Nation of Alberta did not provide information regarding trapping activities in the Project area.

13.3.1.3 Fishing

The Métis Nation of Alberta advised they have a fishing interest in the Project area. Métis Nation of Alberta members fish in the Project area including Daisy Creek, Gold Creek and Blairmore Creek (MNA, 2016). Cutthroat trout and habitat associated with Cutthroat trout is identified as a species of interest to the Métis Nation of Alberta (MNA, 2016).

13.3.1.4 Plant Gathering

The Métis Nation of Alberta identified an interest in gathering plants and berries for medicinal and consumption purposes in the Project footprint (MNA, 2016). Plants are gathered in a variety of ecosystems including old growth forests, along watercourses and wetlands, as well as clearings and meadows. The Métis Nation of Alberta has not identified plant or berry species, gathering locations, or preferred method of gathering; however, a summary of species identified by Métis Nation of Alberta for the Project and species occurrence within the LSA is provided in the CR #8 (EIA, CEAR #42).

13.3.1.5 Trails and Travelways

Hunting areas are associated with trails and travelways throughout Alberta, Saskatchewan, Manitoba and the United States (MNA, 2011). The Métis Nation of Alberta moved freely through their traditional territory in pursuit of resources or trade.

Traditionally, Métis accessed trails and travelways for harvesting and trading materials such as buffalo meat, robes, or wolf pelts (AMHS, 2015). In addition, Métis Nation of Alberta members will travel long distances throughout their traditional territory to harvest plants for medicinal and cultural uses (MNA, 2016).

The Métis Nation of Alberta did not identify any trails or travelways or features associated with navigation within the Project LSA. In addition, no information in secondary sources provided information about trails and travelways in the Project LSA.

13.3.1.6 Cultural and Spiritual Values

As with all Nations in region, the Métis Nation of Alberta draw their culture from their traditional territory – the land, the landscape and the animals. There is a kinship with the animals which continues to provide lessons and teachings by which to live. There are many well-known and documented sacred places and gathering areas throughout the Métis Nation of Alberta territory. These sacred sites are unifying symbols, provide evidence for cultural continuity and establish and reinforce national and personal connections to the landscape.

While country foods have always been important for food, subsistence and sustenance, the practice of hunting has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals as medicine, food, tools, clothing, shelter and more is shared while hunting. In additional to this educational context, hunting practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements.

Likewise, fishing has always been important for food, subsistence and sustenance and the activity of fishing has important cultural and spiritual considerations. Intergenerational knowledge about

ceremonies, legends as well as fish use as medicine, food and more is shared while fishing. In addition, to this educational context, the activity of fishing is typically linked to other intangible values with spiritual, artistic and aesthetic elements. For example, fishing typically provides for quiet enjoyment of the landscape or access to water for other uses.

Intergenerational knowledge provides instruction on cultural and spiritual practices such as gathering plants for food and subsistence, ceremonial procedures, legends, using plants as medicine and harvesting berries. In addition to this educational context, plant gathering activities are typically linked to other intangible values with spiritual, artistic, aesthetic and artistic elements.

Wildlife species that hold cultural value to Métis Nation of Alberta include deer, elk, grizzly bear, black bear, wild turkey and grouse (Solstice, 2016; MNA, 2016). Although current use for cultural and spiritual values was not identified in the TLUS, the Métis Nation of Alberta participants noted that the RSA provides habitat for these species. In addition, information pertaining to medicinal plants is passed down through families and generations and is considered culturally important. While specific gathering locations are not identified, Métis Nation of Alberta identified that there are ecosystems that support medicinal plants existing within the Project area.

13.3.2 Potential Effects and Mitigations: Current Use of Lands and Resources for Traditional Purposes - Métis Nation of Alberta Region 3

This section describes the Project effects on current use of lands and resources for traditional purposes for the Métis Nation of Alberta. The Project has the potential for indirect effects due to changes to wildlife, fish and plants and their habitat, or direct effects because of loss of access to a culturally or spiritually important area, habitat or species. The direct effects to culturally or spiritually important areas can have their own indirect effects such as the loss of opportunity to teach cultural practices, for example, around the seasonal round, food sharing and ceremonies.

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by the Métis Nation of Alberta.

13.3.2.1 Hunting

The effects assessment on wildlife (CR #9, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42) are relevant to the potential effects to Métis Nation of Alberta hunting. CR #9 (EIA, CEAR #42) addresses direct and indirect effects on key wildlife species and their habitats of species that are hunted by Métis Nation of Alberta; these include loss of habitat availability (through direct loss, sensory disturbance and fragmentation), disruption of wildlife movement (through habitat fragmentation, reduced connectivity and creation of barriers), increased wildlife mortality risk (through vehicle collisions and human-wildlife conflict) and reduced abundance of wildlife. These

effects, in turn, may affect the cultural and spiritual relationship between the Métis Nation of Alberta and wildlife.

CR #1 (EIA, CEAR #42) addresses potential effects on wildlife forage and water quality resulting from air emissions and CR #12 (EIA, CEAR #42) addresses potential effects on wildlife health. Furthermore, a screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk or adverse effects associated with project emissions on the health of wildlife in the study areas (CR #12, EIA, CEAR #42). Therefore, the Project should not directly affect the health of wildlife such as hunt with a focus on deer, elk, wild turkey, grouse and bear hunted by the Métis Nation of Alberta members.

If mitigation measures were not applied, Project effects on wildlife and their habitats could lead to reduced population size, reduced reproductive success and survival rate, change in wildlife distribution and change in wildlife health. The potential indirect effect on the Métis Nation of Alberta can therefore be characterized as reduced hunting opportunities, reduced hunting success, reduced access to wildlife and concern for the food quality. These effects, in turn, could affect the cultural and spiritual relationship between the Métis Nation of Alberta and wildlife. CR #10 addresses potential effects to land use activities related to hunting.

The main access road (off Highway 3) that will lead to the proposed Project footprint is privately owned by Benga and Benga will adopt a policy that controls access to reduce risk to public safety and to protect project infrastructure. This will limit the Métis Nation of Alberta access during construction and operation of the Project. Potential adverse effects are expected to be reduced at mine closure following reclamation. Benga has produced an Access Management Plan (AMP) to facilitate access for traditional land use activities within the LSA.

To address concerns for changes to hunted species and habitat, hunting locations and how harvesting is accomplished, Benga has proposed a series of management plans and activities aimed at mitigating impacts to wildlife and by extension effects on hunters. Key features are:

- continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;

- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- progressive wildlife habitat reclamation;
- commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover;
- establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation.
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual (AESRD, 2011) and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- engage with the Métis Nation of Alberta during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- retain vegetation adjacent to high-activity linear corridors (*e.g.*, access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- Store all toxic materials, including those used for blasting, in secure areas that are inaccessible to wildlife (*e.g.*, buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of hunters. Benga has proposed mitigation for visual impacts and dust in CR #1 (EIA, CEAR #42) and for noise in CR #2 (EIA, CEAR #42).

The Métis Nation of Alberta provided additional mitigation measures to be applied during construction to protect local wildlife populations:

- Adherence to species-specific time constraints;
- Noise reduction;
- Limit use of chemicals; and
- Incorporate traditional knowledge into reclamation planning.

Benga considers that the Project as proposed is consistent with these recommendations. If the Métis Nation of Alberta has additional measures to suggest mitigating for hunting experience, Benga will consider such measures in the Project planning and execution.

13.3.2.2 Trapping

The Métis Nation of Alberta has not identified an interest in trapping in the Project area. The Project is therefore not expected to have an adverse effect on trapping. As such, trapping is not carried forward for further the assessment. If trapping were to occur, it is assumed that potential effects would be the same as for hunting.

13.3.2.3 Fishing

The Métis Nation of Alberta advised they have a fishing interest in the Project area.

Although there will be no direct effects to Blairmore Creek or Gold Creek from the Project, current access to the portions of the watercourses adjacent to Grassy Mountain is located on Benga private land. At this time, use of this road is not discouraged by Benga; however, during the construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes to access and fish in portions of Blairmore Creek and Gold Creek will need to be *via* other trails in the area. There are existing trails from the south or the north end of the Project to access Gold Creek and Blairmore Creek can be assessed from Highway 40 using existing trails. CR #6 (Addendum 1, CEAR #44) provides an assessment, based on knowledge and information available at the time the assessment was prepared, of the effects of the Project on aquatic habitat in Blairmore and Gold Creek watersheds. The Project is predicted to affect aquatic and riparian habitat and hydrology in Blairmore and Gold Creeks, the estimated losses and gains of which are discussed in Grassy Mountain Coal Project: Detailed Fisheries Offsetting Plan (Appendix B1, Addendum 8, CEAR #89). As a result, the potential effects described in CR #6 (Addendum 1, CEAR #44) could result in a change in fish habitat, change in use or access to fishing locations, or change in preferred

fishing method. These effects, in turn, may affect the cultural and spiritual relationship between the Métis Nation of Alberta and fish.

Mitigation measures Benga has planned to avoid or minimize potential effects to the availability of fishing areas include:

- a Detailed Fisheries Offsetting Plan and Draft Offsetting Effectiveness Monitoring Plan have been proposed (Appendices B1 and B2, Addendum 8, CEAR #89) that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek;
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- engage with the Métis Nation of Alberta during construction, operations and reclamation, including discussion of options to facilitate access for traditional activities, construction timing and reclamation;
- use signage for identifying areas that are not open for public use; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of fishers. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Métis Nation of Alberta. has additional measures to suggest mitigating for fishing experience, Benga will continue to work with the Nation on mitigation measures.

13.3.2.4 Plant Gathering

The Project will intersect or be in proximity to habitat and species that are identified for plant gathering by the Métis Nation of Alberta.

CR #8 (EIA, CEAR #42) addresses potential effects on key vegetation species and habitat including the species identified by the Samson Cree Nation. Further, a summary of species identified by the Métis Nation of Alberta with the occurrence of species within the LSA is available in CR #8 (EIA, CEAR #42). Potential effects of the Project on vegetation resources are predominantly related to clearing of vegetation and physical alteration of the landscape for the Project's mine pit and associated waste rock disposal areas and infrastructure.

The potential effects described in these sections of the EIA could result in a change in identified plant species and habitat, change in use or access to identified plant gathering locations, or change in preferred harvesting method. These effects, in turn, could affect the cultural and spiritual relationship between the Métis Nation of Alberta and plants.

The EIA details the mitigation measures relating to Vegetation and Wetlands (CR #8, EIA, CEAR #42) and Land and Resource Use (CR #10, EIA, CEAR #42). Reclamation specific mitigation is detailed in the Updated Conceptual Conservation and Reclamation Plan (Table F.2.8-1, Appendix 2.6-1, in response to JRP IR-2.6). In addition, vegetation species identified during the consultation process, including TU species (vascular and non-vascular) observed in the vegetation LSA vegetation field surveys are included in the updated C&R Plan (Table F.1.9-1). Key plant gathering mitigation includes:

- on-going consultation with the Input provided by the Métis Nation of Alberta during consultation is considered in the identification of potential effects and proposed mitigation measures in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;
- the implementation of a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- on Benga private land, lodgepole pine and other culturally important plants will be made available for harvesting by the Input provided by the Métis Nation of Alberta during consultation is considered in the identification of potential effects and proposed mitigation measures potentially affected by the Project; and where practicable, utilize locally collected seed to preserve the legacy of species and of place;
- Benga will continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- Benga will consult with the Métis Nation of Alberta on updates to the Conservation and Reclamation (C&R) plan. The C&R Plan will include the use of native species wherever possible to support revegetation of traditional-use species and end land use decisions made in consultation with the Métis Nation of Alberta Traditional land use opportunities will be interwoven;
- Benga will maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation; and
- Benga will consider mitigation suggestions proposed by the Input provided by the Métis Nation of Alberta during consultation is considered in the identification of potential effects and proposed mitigation measures regarding traditional and medicinal plants.

Métis Nation of Alberta provided additional mitigation measures to be applied during construction to protect local plant populations:

- Reduce stripping when possible and retain roots of plants for reclamation;
- Limit use of chemical application;
- Retain riparian species when possible;
- Replace native plant species during reclamation; and
- Allow for harvesting of medicinal and culturally significant plants prior to construction (MNA, 2016).

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of plant gathering. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Métis Nation of Alberta has additional measures to suggest mitigating for plant gathering experience, Benga will continue to work with the Nation on mitigation measures.

13.3.2.5 Trails and Travelways

Given that the Métis Nation of Alberta advised they have fishing and hunting interests in the Project area and have noted the existence of important plant gathering and cultivation sites in proximity to the Project, it is reasonable to assume that trails and travelways are or would be used to access those areas for traditional purposes. As such, it is possible that the Project may affect trails and travelways used by the Métis Nation of Alberta currently or in the future. Several VC sections are relevant to the assessment on trails and travelways such as the assessment sections for land and resource use and historical resources.

In order to address potential effects to trails and travelways, Benga has proposed the following measures:

- Benga will continue to improve the AMP that will include the following;
- notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways;
- signage to be used for identifying areas that are not open for public use;
- share information about construction timing; and
- Benga will continue to improve the Cultural Site Discovery Contingency Plan for culturally important sites identified during construction and operations.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of using trails and travelways. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42).

13.3.2.6 Cultural and Spiritual Values

Changes resulting from the Project may interfere with the Métis Nation of Alberta's ability to pass on cultural teachings to the next generation in the Project LSA. For example, the loss of a harvesting area means there is one fewer place to teach harvesting practices or share a language unique to the area.

Métis Nation of Alberta are concerned that the proposed Project will affect their ability to access Crown lands on which Métis members currently practice cultural activities (MNA, 2016). Specific areas north of and surrounding the Project, Daisy Creek, Gold Creek and Blairmore Creek hold cultural value to Métis Nation of Alberta, which as hunting deer, elk, bear, wild turkey and grouse and gathering medicinal plants (Solstice 2016). Métis Nation of Alberta are also concerned the proposed Project will affect the experience of practicing their cultural traditions due to noise and visual disturbances (Solstice, 2016).

Benga has proposed mitigation measures relevant to sites of cultural and spiritual importance and committed to the following measures to mitigate effects related to cultural and spiritual values:

- Benga will continue to work with the Métis Nation of Alberta to improve the Access Management Plan (AMP) to grant access to non-operational areas of Benga land and Crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Métis Nation of Alberta where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- where identified by the Métis Nation of Alberta, sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint will be marked or otherwise protected prior to land disturbance;
- Benga will continue to work with the Métis Nation of Alberta to interweave TK in the development of Project management and monitoring plans and in Project activities;
- Benga will support a cultural competency program for its employees and contractors;
- Benga has and will continue to support local and Indigenous cultural events and ceremonies through its Indigenous engagement and initiatives such as its community sponsorship program; and
- a Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction or operations.

It is expected that noise, dust and visual impacts of the Project may alter the quality of the experience of engaging in activities of cultural or spiritual value. Benga's proposed mitigation measures are identified in CR #1 Air Quality (EIA, CEAR #42) and in CR #2 Noise (EIA, CEAR #42). If the Samson Cree Nation has additional measures to suggest mitigating for plant gathering experience, Benga will continue to work with the Nation on mitigation measures.

In their recommendations (Solstice, 2016), Métis Nation of Alberta would like Benga to undertake the following measures to mitigate Project effects, where relevant to Métis Nation of Alberta cultural and spiritual values:

- Consult with Métis Nation of Alberta in the dust management plan development and execution;
- Adopt best practices in blasting operations and strategically plan blasting to minimize dust and odour effects on surrounding land;
- Create a community noise complaint process with a mandate to explore potential mitigation;
- Establish a Traditional Land Use Noise Advisory Committee: collaborate with Métis Nation of Alberta to develop appropriate mitigation and monitoring to verify and manage observed effects of Project noise emissions on wildlife health and abundance; and
- Develop a comprehensive AMP in collaboration with Métis Nation of Alberta.

Benga has considered these recommendations and responds as follows:

- Benga commits to consult with Métis Nation of Alberta regarding the dust management plan and the continuing improvement of the AMP.
- Benga considers that its proposed blasting plan is in accordance with best practices.
- Benga will put in place a community noise complaint process.

13.3.3 Residual Effects: Current Use of Lands and Resources for Traditional Purposes - Métis Nation of Alberta Region 3

The assessment of residual effects of the Project on current use of lands and resources for traditional purposes focuses on the potential effects remaining after mitigation measures are implemented. Based on the potential effects and mitigation measures described, there may be residual effects on the current use of lands and resources valued by the Métis Nation of Alberta. These effects, in turn, could affect the cultural and spiritual relationship between the Métis Nation of Alberta and surrounding lands and resources.

13.3.3.1 Hunting

The characterization of residual effects to hunting includes consideration of residual effects (CR #9, EIA, CEAR #42) and input provided by the Métis Nation of Alberta.

The Project will affect the ten wildlife VCs, including deer, moose, elk and grizzly bear, through changes in habitat availability, habitat fragmentation/connectivity, mortality risk and abundance all of which will affect local populations to some degree. With successful application of mitigation measures, the residual effects of the Project on habitat availability, habitat fragmentation/connectivity, mortality risk and abundance within the Wildlife LSA (WLSA) were deemed not significant (CR #9, EIA, CEAR #42).

Just as with wildlife, Project effects to land and resource use: hunting and trapping and access (CR #10, EIA, CEAR #42) have been characterized as local in geographic extent, extended in duration, continuous (access) or occasional (hunting) in frequency, reversible in the long-term and low in magnitude and not significant.

In summary then, the Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species hunted by Métis Nation of Alberta. Similarly, with the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

As a result, residual effects to hunting are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The changes to hunting by the Métis Nation of Alberta are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

13.3.3.2 Trapping

Given the relationship between hunting and trapping in current use and access to wildlife, Benga considered the residual effects the same.

13.3.3.3 Fishing

The characterization of residual effects to fishing includes consideration of residual effects and input provided by Métis Nation of Alberta. Changes to fish and fish habitat may have an effect on the fishing activities and therefore, fishing mitigation measures are directly relevant to the interest of the Métis Nation of Alberta. These effects, in turn, could affect the cultural and spiritual relationship between the Métis Nation of Alberta and fish.

The Project is not expected to have measurable effects on the long-term abundance, distribution and sustainability of species potentially fished by the Métis Nation of Alberta. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns.

It is predicted that the potential effects of the Project on access to fishing areas can be mitigated through access management and the experience and enjoyment of fishing can be managed through noise and visual impact management as discussed in CR #1 and CR #2 (EIA, CEAR #42). Nonetheless, the Métis Nation of Alberta may avoid fishing in visual and auditory range of Project activities.

As a result, residual effects to fishing are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The Project residual effects to fishing by the Métis Nation of Alberta are not considered significant. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

13.3.3.4 Plant Gathering

The characterization of residual effects to plant gathering includes consideration of residual effects described in CR #8 (EIA, CEAR #42) and CR #10 (EIA, CEAR #42) and input provided by the Métis Nation of Alberta. In other words, changes to plant habitat may have an effect on the plant gathering activities, and therefore plant gathering measures are directly relevant to the interest of the Métis Nation of Alberta. These effects, in turn, could affect the cultural and spiritual relationship between the Métis Nation of Alberta and plants.

The Project is expected to remove traditional use plants within the Project LSA. Beyond the Project area, habitats are expected to remain intact. Therefore, the overall availability of habitat is not anticipated to be substantially affected by the Project.

CR #8 (EIA, CEAR #42) and CR #10 (EIA, CEAR #42) characterize residual effects to vegetation as local in geographic extent, long- term in duration, continuous in frequency, reversible, and high magnitude. The mitigation proposes reclaiming the land that will support a range of communities with equivalent capabilities to those of the surrounding lands and that existed prior to development. The residual effects for vegetation are not considered significant.

As described CR #8 (EIA, CEAR #42) while the Project will result in some loss of traditional use vegetation within the vegetation local study area, these losses represent very small proportions of the total amount of these vegetation communities within the vegetation regional study area. Neither the Project-specific residual effects, nor the Project's residual effects acting cumulatively with other projects, are likely to threaten the regional sustainability of traditional use plants or other vegetation resources, wetlands, biodiversity or fragmentation identified in this assessment.

With the mitigation measures summarized above especially those related to access and experience and pleasure of plant gathering, the Project is not expected to have measurable effects on the long-term abundance, distribution, and sustainability of species used for plant gathering by the Métis Nation of Alberta.

As a result, residual effects to plant gathering are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

In totality, the residual effects to plant gathering are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

13.3.3.5 Trails and Travelways

The Project will have residual adverse effects on use of trails and travelways because the Project could result in loss of trails and travelways that are fully or partially within the mine permit boundary.

The Project footprint will be reclaimed to land use capability equivalent to pre-mining; however, it will not be accessible for use as trails and travelways during construction and operations. Access to areas around the Project will be possible using existing trails from Highway 40 to reach the area west of Blairmore Creek and Crown Land north of the Project and from either the north or the south along Gold Creek. With the implementation of the AMP, potential residual effects will be further reduced as Benga will be providing access to adjacent privately owned Benga lands for traditional practices. Some residual effects will remain which will in turn, affect the cultural and spiritual relationship between the Métis Nation of Alberta and trails and travelways.

Therefore, the residual effects to trails and travelways are:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- reversible; and
- resilient in ecological and social context.

The changes to trails and travelways used by the Métis Nation of Alberta are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

13.3.3.6 Cultural and Spiritual Values

The characterization of residual effects to cultural and spiritual values includes consideration of residual effects described in other sections of this report and the input provided by Métis Nation of Alberta.

With the implementation of mitigation measures including access management planning and ongoing consultation, the Project may still affect Métis Nation of Alberta cultural and spiritual values and interests. The spiritual integrity of the landscape will be forever changed despite lasting reclamation efforts.

As a result, residual effects to cultural and spiritual values are characterized as:

- low magnitude;
- local geographic extent;
- long-term duration;
- continuous frequency;
- not reversible; and
- resilient in ecological and social context.

The changes to cultural and spiritual values of the Métis Nation of Alberta are not considered significant providing mitigation measures are implemented and successful. Monitoring and adaptive management where appropriate will be part of ensuring the measures are successful.

13.3.4 Significance Determination of Current Use of Lands and Resources for Métis Nation of Alberta Region 3 Traditional Purposes

No significant adverse effects post-mitigation were identified for Current Use of Lands and Resources for the Métis Nation of Alberta Region 3 Traditional Purposes. Overall, the Project is not anticipated to measurably change the Métis Nation of Alberta Region 3's ability to continue traditional practices. It is predicted that the effect of the Project on the access to hunting, gathering and recreational use areas will be not significant as a majority of the land to be developed is privately owned, the lands will be reclaimed to an equivalent capability and Benga will continue to consult with Indigenous groups to address concerns, implement additional mitigation measures or identify offsetting measures as may be required.

13.4 Métis Nation of Alberta Region 3 Physical and Cultural Heritage

13.4.1 Background of Métis Nation of Alberta Region 3 Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Métis Nation of Alberta since the EIA was submitted, in the TLUS (KES 2016) and the EIA Review (Solstice 2016).

Physical and cultural heritage sites are located throughout Region 3 (AMHS, 2015) which are located outside of the Project RSA.

13.4.2 Potential Effects and Mitigations on Métis Nation of Alberta Region 3 Physical and Cultural Heritage

The Project will not intersect or be in proximity to any sacred, gathering and habitation sites identified by the Métis Nation of Alberta. Physical and cultural heritage sites are not in proximity to the Project and are located outside of the Project RSA. As a result, the Project is not expected to have an effect on physical or cultural heritage of the Métis Nation of Alberta Region 3. Physical and cultural heritage is not assessed further.

A summary of residual effects of the Project to Métis Nation of Alberta is provided in Table 13.4.2-1.

Where the Métis Nation of Alberta has identified additional mitigation measures, these will be discussed with the Métis Nation of Alberta in follow-up meetings.

Table 13.4.2-1 Summary of Residual Effects on Métis Nation of Alberta

Valued Components	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Social Context	Significance
Hunting and Trapping	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Fishing	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Plant Gathering	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Trails and Travelways	Low	Local	Long-term	Continuous	Reversible	Resilient	Not significant
Cultural and Spiritual Values	Low	Local	Long-term	Continuous	Not Reversible	Resilient	Not significant

14.0 MÉTIS NATION OF BRITISH COLUMBIA REGION 4 CONSULTATION AND ASSESSMENT

14.1 Métis Nation of British Columbia Region 4 Consultation Summary

Consultation and engagement activities with the Métis Nation of British Columbia Region 4 have included:

- Ongoing and regular phone and email communications;
- Provision of key regulatory documents, such as:
  - Providing the Project description;
  - First Nations consultation plan; and
  - Information package.

CEAA published the Project's Final Guidelines for the Preparation of an Environmental Impact Statement (Final Guidelines) in June 24, 2015 and concurrently notified potentially affected Indigenous groups of its publication. Benga initiated consultation with Métis Nation of British Columbia with a letter offering information on the Project and requesting information to assist Benga in understanding Métis Nation of British Columbia's uses in the Project area and to discuss any concerns.

Benga followed up in July 2015 with a letter describing a plan for continued consultation on the Project and referencing participation funding opportunities for Métis Nation of British Columbia. In August 2015, Benga provided an information package seeking feedback on Benga's understanding of Métis Nation of British Columbia's Aboriginal Interests. The Métis Nation of British Columbia responded in September 2015 with a description of their history in the Project area and a map depicting use and occupancy data in the vicinity of the Project area. The Métis Nation of British Columbia identifies that there is a gap in TK relevant to the Project area particularly regarding resource harvesting in the area. The Métis Nation of British Columbia stated an interest in continued efforts and opportunities to provide information for the Project.

Information provided to Benga after the submission of this information report will be considered by Benga and incorporated into the Project planning as appropriate.

14.2 Métis Nation of British Columbia Region 4 Traditional Use and Traditional Knowledge Studies

Métis Nation of British Columbia has provided a map of use in the Project area to Benga (MNBC, 2015b). No traditional use or traditional knowledge studies have been submitted.

14.2.1 Background of Current Use of Lands and Resources for Métis Nation of British Columbia Region 4 Traditional Purposes

This section summarizes background information related to the Current Use of Lands for Traditional Purposes VC (and its VC subcomponents) provided by the Métis Nation of British Columbia since the EIA (CEAR #42) was submitted, and the use map (MNBC, 2015b).

The map was not accompanied by any additional detailed information (MNBC, 2015b). Further, none of the uses identified are located within the Project LSA. The information identifies types of land use reported by harvester card holders as part of the annual harvest survey system. The Métis Nation of British Columbia identified that species of interest and activities are located within the vicinity of the Project area (MNBC, 2015b). The types of wildlife identified include whitetail deer, grouse, rocky mountain elk, mule deer, moose, rabbit, bear and trout. Other activities include prospecting for gold and gathering firewood. The Métis Nation of British Columbia indicated they continue to rely on the natural resources as a way of life and cultural connection (MNBC, 2015b). No further information has been provided that identifies historic, current or future use within the Project footprint.

14.2.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for Métis Nation of British Columbia Region 4 Traditional Purposes

The assessment of potential effects of the Project on current use of lands and resources for traditional purposes focuses on the availability of lands and resources identified by Métis Nation of British Columbia. The Métis Nation of British Columbia Region 4 territory overlaps the Project RSA by 417.75 km^2. There is no overlap with the LSA and there are no specific areas of use by the Métis Nation of British Columbia Region 4 that are interacting with Project activities. However, there are areas of use identified in proximity to Project activities within the RSA.

The Project is not predicted to affect the ability of the Métis Nation of British Columbia to continue their Aboriginal rights as there are no identified areas of use within the Project LSA and there are many other areas of use identified outside of the Project LSA and the RSA. As a result, potential effects of the Project are not anticipated for the Métis Nation of British Columbia Region 4. Benga will continue to engage with the Métis Nation of British Columbia throughout the environmental assessment process to provide information and respond to any concerns. No further assessment is undertaken.

14.3 Métis Nation of British Columbia Region 4 Physical and Cultural Heritage

14.3.1 Background of the Métis Nation of British Columbia Region 4 Physical and Cultural Heritage

This section summarizes background information related to the Indigenous Physical and Cultural Heritage VC which has been provided by the Métis Nation of British Columbia since the EIA was submitted. The Métis Nation of British Columbia Region 4 has not provided information that identifies physical and cultural heritage within the Project footprint.

14.3.2 Potential Effects and Mitigations on Métis Nation of British Columbia Region 4 Physical and Cultural Heritage

The Métis Nation of British Columbia Region 4 territory overlaps the Project RSA by 417.75 km^2. There is no overlap with the LSA and there are no specific physical and cultural heritage sites identified by the Métis Nation of British Columbia Region 4 that are interacting with Project activities. However, there are areas of use identified in proximity to Project activities within the RSA. The Project is not predicted to affect the ability of the Métis Nation of British Columbia to continue their Aboriginal rights as there are no identified physical and cultural heritage sites within the Project LSA. As a result, potential effects of the Project are not anticipated for the Métis Nation of British Columbia Region 4. Benga will continue to engage with the Métis Nation of British Columbia throughout the environmental assessment process to provide information and respond to any concerns. No further assessment is undertaken.

15.0 ERMINESKIN CREE NATION CONSULTATION AND ASSESSMENT

The Ermineskin Cree Nation is a signatory to Treaty 6 and is a member of the Four Nations of Maskwacis, Alberta that includes the Samson Cree Nation, Louis Bull First Nation and the Montana First Nation. Combined, the four nations share a community that encompasses 3,127 hectares (7,727 acres). While there are familial and historical overlaps among the four communities, they are separate and unique Indigenous groups with individual identities and interests (Ermineskin Cree Nation, 2019b).

The Nation signed the Treaty 6 in 1876 with Canada along with First Nations in Alberta, Saskatchewan and Manitoba. The Ermineskin Cree Nations traditional land base is shared by all four Maskwacis Cree Nation groups, which is known as “Bear Hills” or “Maskwacheesihk”, and is approximately 25,000 acres spanning between Calgary and Edmonton (Ermineskin Cree Nation, 2019a). The Ermineskin Cree Nation reserve was established in 1885 and now includes two reserves: Ermineskin Cree Nation 138 and Pigeon Lake 138A (shared with the other Maskwacis Cree Nation groups).

Presently, the Ermineskin Cree Nation has 4,856 registered members with 3,283 living on reserve and 1,133 living off reserve (AANDC, 2019a). With a proximity to urban areas and universities as well as their traditional territory being on oil and gas lands, the Ermineskin Cree Nation has economic, educational and social advantages.

15.1 Ermineskin Cree Nation Consultation Summary

Consultation and engagement activities with the Ermineskin Cree Nation have included:

- Ongoing and regular phone and email communications;
- An initiation letter offering information on the Project and requesting information to assist Benga in understanding the Ermineskin Cree Nation's uses in the Project area and to discuss any concerns;
- Meetings to discuss Project updates and seek input on the Project and the environmental assessment; and
- Provision of key regulatory documents, such as:
  - Project description;
  - First Nations consultation plan; and
  - Information packages.

On January 18, 2019, CEAA identified three additional Indigenous groups to be consulted, including the Ermineskin Cree Nation. Benga promptly initiated consultation with the Ermineskin Cree Nation with a letter offering information on the Project and requesting information to assist Benga in understanding the Ermineskin Cree Nation's uses in the Project area and to discuss any concerns. In early meetings with Benga, the Ermineskin Cree Nation indicated they would like to be given the same consideration as the other Indigenous groups being consulted on the Project.

Information provided to Benga after the submission of this information report will be considered by Benga and incorporated into the Project planning as appropriate.

A chronology of key consultation activities from January to April 2019 with the Ermineskin Cree Nation can be found in Table 15.1-1.

Table 15.1-1 Chronology of Key Consultation Activities with the Ermineskin Cree Nation

Date	Method of Communication	Topic of Communication
January 21, 2019	Email	Benga introduced the company and inquired about the Ermineskin Cree Nation's interest in the Project.
February 7, 2019	Meeting	Benga and the Ermineskin Cree Nation met for Introductory meeting.
February 25, 2019	Email	Benga provided one-year in advance notification of plans to clear timber within the Project site and access to the site prior to clearing operations to enable harvesting of Lodgepole pine or other vegetation for cultural purposes.
April 5, 2019	Phone Call	Benga provided lists of potential employment and contracting opportunities for the Ermineskin Cree Nation.

15.2 Ermineskin Cree Nation Traditional Use and Traditional Knowledge Studies

Benga has not obtained traditional use or knowledge studies from the Ermineskin Cree Nation. At the introductory meeting on February 7, 2019, the Ermineskin Cree Nation described a traditional use study that is ongoing and showed a map currently under development that describes use areas around the Province of Alberta as well as historical trails that were identified (Ermineskin Cree Nation, 2019b).

New information, including TK/TU information provided to Benga by the Ermineskin Cree Nation after the submission of this report will be considered by Benga and incorporated into Project planning as appropriate.

15.3 Current Use of Lands and Resources For the Ermineskin Cree Nation Traditional Purposes

15.3.1 Background of Current Use of Lands and Resources for Ermineskin Cree Nation Traditional Purposes

As noted above, Benga has not received TU/TK information from the Ermineskin Cree Nation. Information regarding traditional or current use, sacred sites, cultural and spiritual values, reliance on country foods in the Project area is not identified in public sources and has not been provided by the Ermineskin Cree Nation. The Ermineskin Cree Nation continue to exercise their Aboriginal interests in hunting, trapping, fishing and plant gathering.

15.3.1.1 Hunting

Wildlife is an important part of the Ermineskin Cree Nation's culture and traditional economy as harvesters have deposed that they hunt various species including moose, elk, deer and various bird species including grouse, ducks, geese and prairie chickens (Ermineskin Cree Nation, 2012). Species such as the grizzly bear, marten, fisher, lynx and wolf are culturally important to the Ermineskin Cree Nation (Ermineskin Cree Nation, 2012). Specifically, the grizzly bear is an extremely sacred animal to the Ermineskin Cree Nation (Ermineskin Cree Nation, 2012). Although these species are indicated, Benga does not have information about the Ermineskin Cree Nation hunting in the Project area.

15.3.1.2 Trapping

The Ermineskin Cree Nation harvesters indicated in secondary sources that "they trap numerous species including rabbits, lynx, beaver, weasel and muskrat (Ermineskin Cree Nation, 2012, p. 4); however, there is no information indicating that the Ermineskin Cree Nation members trap in the Project area.

15.3.1.3 Fishing

The Ermineskin Cree Nation Harvesters deposed that "they fish for species including whitefish, trout, grayling, jackfish and pickerel" (Ermineskin Cree Nation, 2012, p. 4); however, there is no information indicating that the Ermineskin Cree Nation members fish in the Project area.

15.3.1.4 Plant Gathering

The Ermineskin Cree Nation harvesters have indicated they gather various berries including blackberries, high bush cranberries, low bush cranberries, raspberries, Saskatoon berries, strawberries, gooseberries, huckleberries and chokeberries and traditional medicines including roots, muskeg tea, sweetgrass, willow, bark and sweet pine (Ermineskin Cree Nation, 2012) gather traditional medicines. However, there is no information indicating this gathering in the Project area.

15.3.1.5 Trails and Travelways

No information was found for trails and travelways used by the Ermineskin Cree Nation.

15.3.1.6 Cultural and Spiritual Values

Information regarding cultural and spiritual values is not identified in public sources and has not been provided by the Ermineskin Cree Nation.

Nonetheless, it is understood that country foods have always been important to Indigenous peoples for food, subsistence and sustenance and the practice of fishing, hunting, trapping and

harvesting also has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals and plants is shared while out on the land (*e.g.,* knowledge regarding medicine, food, tools, clothing, shelter and more is shared while out on the land). In addition to this educational context, traditional practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements, including the quiet enjoyment of the landscape.

15.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for Ermineskin Cree Nation Traditional Purposes

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding current use of lands and resources for traditional purposes in the Project area has been received from the Ermineskin Cree Nation or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Ermineskin Cree Nation's current use of lands and resources for traditional purposes. As such, no further assessment is undertaken. Benga understands that additional information from the Ermineskin Cree Nation may be forthcoming. Benga will continue to share information about the Project with the Ermineskin Cree Nation and information received after the submission of this report will be considered in Project planning.

15.4 Ermineskin Cree Nation Physical and Cultural Heritage

15.4.1 Background of Ermineskin Cree Nation Physical and Cultural Heritage

Information regarding physical and cultural heritage in the Project area is not identified in public sources and has not been provided by the Ermineskin Cree Nation.

15.4.2 Potential Effects and Mitigation on Ermineskin Cree Nation Physical and Cultural Heritage

No information regarding physical and cultural heritage in the Project area has been received from the Ermineskin Cree Nation or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Ermineskin Cree Nation's physical and cultural heritage. As such, no further assessment is undertaken. Benga will continue to share information about the Project with the Ermineskin Cree Nation and information received after the submission of this report will be considered in Project planning.

16.0 LOUIS BULL TRIBE CONSULTATION AND ASSESSMENT

The Louis Bull Tribe is one of the Four Nations of Maskwacis Alberta that also includes the Samson Cree Nation, the Ermineskin Cree Nation and the Montana First Nation. Combined, the four nations share a community that encompasses 3,127 hectares (7,727 acres) and is

surrounded by the Ermineskin Indian Reserve to the east and south east and the County of Wetaskiwin No. 10 to the north and west and County of Ponoka on to the South (Louis Bull Tribe, 2018c, p. 2). The Louis Bull Tribe is located within Maskwacis "within the Central Parkland Natural Subregion, but their traditional territory extends throughout the Mixedwood, Foothills and Fescue/Mixed-grass natural subregions, covering notable portions of central and western Alberta largely within the boundary of Treaty 6. (Solstice, 2018, p.14). Treaty 6 "preserves Louis Bull's rights to fish and hunt throughout the traditional territory" (Louis Bull Tribe, 2019a, p. 4).

The Louis Bull Tribe has two reserves: Louis Bull 138B and Pigeon Lake 138A, which are both Cree speaking communities. The Louis Bull 138B reserve is located 90 km south of Edmonton and neighboring the Ermineskin Cree Nation on the southeast (Louis Bull Tribe, 2018b).

The Louis Bull Tribe shares a common history with the Ermineskin Cree Nation and the Montana First Nation through their membership in the Four Nations of Maskwacis. Louis Bull Tribe members are traveling farther from reserve lands as a result of extensive development to their lands (Louis Bull Tribe, 2018a).

16.1 Louis Bull Tribe Consultation Summary

Consultation and engagement activities with the Louis Bull Tribe have included:

- Ongoing and regular phone and email communications;
- A letter offering information on the Project and requesting information to assist Benga in understanding the Louis Bull Tribe's uses in the Project area and to discuss any concerns;
- Meeting to discuss Project updates and seek input on the Project and the environmental assessments; and
- Provision of key regulatory documents such as information packages.

On January 18, 2019, CEAA identified three additional Indigenous groups to be consulted, including the Louis Bull Tribe. Benga promptly initiated consultation with the Louis Bull Tribe. The Louis Bull Tribe indicated they are interested in participating in the environmental assessment of this Project and communicated their interest to CEAA on December 18, 2019. On February 12, 2019 the Louis Bull Tribe received capacity funding.

Information provided to Benga after the submission of this information report will be considered by Benga and incorporated into the Project planning as appropriate.

A chronology of key consultation activities with the Louis Bull Tribe can be found in Table 16.1-1.

Table 16.1-1 Chronology of Key Consultation Activities with the Louis Bull Tribe

Date	Method of Communication	Topic of Communication
January 18, 2019	Phone Call	Benga introduced the company and inquired about the Louis Bull Tribe's interest in the Project.
February 25, 2019	Email	Benga provided one-year in advance notification of plans to clear timber within the Project site and access to the site prior to clearing operations to enable harvesting of Lodgepole pine or other vegetation for cultural purposes.
March 26, 2019	Meeting	Discussion at Elders Information Session regarding vegetation information. Benga provided vegetation information for review in advance.
April 5, 2019	Email	Benga provided lists of potential employment and contracting opportunities for the Louis Bull Tribe.

16.2 Louis Bull Tribe Traditional Use and Traditional Knowledge Studies

Benga has not obtained traditional use or knowledge studies from the Louis Bull Tribe.

Benga anticipates having meetings to discuss and review the Louis Bull Tribe's interests in the Project area. New information, including TK/TU information provided to Benga after the submission of this report will be considered by Benga and incorporated into Project planning as appropriate.

16.3 Current Use of Lands and Resources for the Louis Bull Tribe Traditional Purposes

16.3.1 Background on Current Use of Lands and Resources for Louis Bull Tribe Traditional Purposes

This discussion focuses on background information that is relevant to the assessment of potential effects of the Project on the Louis Bull Tribe as required by the Alberta TOR and CEAA Guidelines. Information regarding traditional or current use, sacred sites or cultural values, recreational use, commercial activity, reliance on country foods and drinking water sources in the Project area is not identified in public sources and has not been provided by the Louis Bull Tribe.

Benga did not obtain TK/TU studies from the Louis Bull Tribe and was unable to locate any information sources on the Louis Bull Tribe's members use of the land in the Project area. As a result, Benga has relied on information contained in the following three publicly available submissions regarding the Trans Mountain Pipeline project, which does not overlap with Benga's Project area: Louis Bull First Nation Trans Mountain Pipeline Reconsideration Hearing Technical Report (Solstice, 2018); Argument-In-Chief for Louis Bull Tribe (Louis Bull Tribe, 2019a); and, the Opening Statement of the Louis Bull Tribe in the application by the Trans Mountain Pipeline (Louis Bull Tribe, 2018b). Although these submissions provide information on current use, the information is specific to Trans Mountain, it is not clear whether the use and resources described in those submissions also fall within the Benga Project area.

16.3.1.1 Hunting

The Louis Bull Tribe has indicated that moose, deer, cougar, coyotes, wolves and grizzly bears are culturally significant and are harvested for sustenance, pelts and other uses; however, there is no information to support these activities occurring within the Benga Project area (Louis Bull Administration, 2018a, p. 9).

16.3.1.2 Trapping

It was indicated that the Louis Bull Tribe traps beaver and muskrat, although it is unclear if this occurs within the Benga Project area (Louis Bull Administration, 2018a, p.9).

16.3.1.3 Fishing

Louis Bull identified impacts to "fish and loss of fish habitat" within the Trans Mountain Pipeline which indicates that fishing is presently practiced by the Louis Bull Tribe (Louis Bull Administration, 2018a, p.9); however, there is no indication of fishing practices within the Benga Project area.

16.3.1.4 Plant Gathering

The use of cedar, sage, sweetgrass and berries are considered "cultural necessities" for the Louis Bull Tribe as indicated in secondary sources (Solstice, 2018, p. 11). The Louis Bull Tribe members gather medicinal and culturally significant plants throughout their traditional territory and will travel long distances to harvest plants (Louis Bull Administration, 2018). The Louis Bull Tribe members have reported that plants are gathered from several diverse locations including forests, near watercourses and wetlands and in clearings and meadows. This harvesting information is "passed down through families and generations and is considered proprietary by the community. The following are culturally significant flora that were identified by the Louis Bull Tribe: gooseberry, smooth blue aster, plantain, willow species, giant golden rod, strawberry and kinikinik (Louis Bull Administration, 2018a, p. 8).

Although this information indicates which plant gathering occurs, there is no indication of these activities occurring within the Benga Project Area.

16.3.1.5 Trails and Travelways

No information was found for trails and travelways used by the Louis Bull Tribe within the Project area. It is unclear if trails and travelways are used and if they are within the Benga Project area.

16.3.1.6 Cultural and Spiritual Values

Limited information was found regarding the Louis Bull Tribe's cultural and spiritual values. The Louis Bull Tribe's cultural practices such as sundance and sweat ceremonies are maintained by transferring the culture to the younger generations (Louis Bull Tribe, 2018b). Indeed, "familial connections engender and sustain continued traditions of resources exchanged between Louis Bull members and other nations including the trade of plants, herbs and preserved food that are used for ceremony and as medicine" (Louis Bull Tribe, 2018b, p.3).

It is understood that country foods have always been important to Indigenous peoples for food, subsistence and sustenance and the practice of fishing, hunting, trapping and harvesting also has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals and plants is shared while out on the land (*e.g.*, knowledge regarding medicine, food, tools, clothing, shelter and more is shared while out on the land). In addition to this educational context, traditional practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements, including the quiet enjoyment of the landscape.

16.3.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for the Louis Bull Tribe Traditional Purposes

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding current use of lands and resources for traditional purposes in the Project area has been received from the Louis Bull Tribe or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Louis Bull Tribe's current use of lands and resources for traditional purposes. As such, no further assessment is undertaken. Benga understands that additional information from the Louis Bull Tribe may be forthcoming. Benga will continue to share information about the Project with the Louis Bull Tribe and information received after the submission of this JRP Information Request Package 4 will be considered in Project planning.

16.4 Louis Bull Tribe Physical and Cultural Heritage

16.4.1 Background of Louis Bull Tribe Physical and Cultural Heritage

Information regarding physical and cultural heritage in the Project area, other than that which is presented above, is not identified in public sources and has not been provided by the Louis Bull Tribe.

16.4.2 Potential Effects and Mitigations on Louis Bull Tribe Physical and Cultural Heritage

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding cultural and physical heritage has been received from the Louis Bull Tribe or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Louis Bull Tribe's physical and cultural heritage. As such, no further assessment is undertaken. Benga understands that additional information from the Louis Bull Tribe may be forthcoming. Benga will continue to share information about the Project with the Louis Bull Tribe and information received after the submission of this JRP Information Request Package 4 will be considered in Project planning.

17.0 MONTANA FIRST NATION CONSULTATION AND ASSESSMENT

The Montana First Nation is a member of Maskwacis Alberta that also includes the Samson Cree Nation, the Ermineskin Cree Nation and the Louis Bull Tribe. Combined, the four nations share a community that encompasses 3,127 hectares (7,727 acres). The Montana First Nation is a signatory to Treaty 6 signed in 1876 at Fort Carlton and Fort Pitt. There are two reserves, including Montana 139 and Pigeon Lake 138A. The Montana First Nation is located approximately 90 kilometers south of Edmonton and 3 kilometers east of Highway No. 2A (Montana First Nation, 2019. The registered population is 1,065) with 724 members living on reserve and 264 living off reserve (AANDC, 2019a.

The Montana First Nation has a shared history with the other members of the Four Nations of Maskwacis. Traditionally, the First Nations in Maskwacis region were nomadic (Montana First Nation Traditional Land Use Study, 2015).

17.1 Montana First Nation Consultation Summary

Consultation and engagement activities with the Montana First Nation have included:

- Ongoing and regular phone and email communications;
- An initiation letter offering information on the Project and requesting information to assist Benga in understanding the Montana First Nation's uses in the Project area and to discuss any concerns;

- Meetings to discuss Project updates and seek input on the Project and the environmental assessment; and
- Provision of key regulatory documents such as:
  - Project description;
  - First Nations consultation plan; and
  - Information packages.

On January 18, 2019, CEAA identified three additional Indigenous groups to be consulted, including the Montana First Nation. Promptly, Benga contacted the Montana First Nation.

Information provided to Benga after the submission of this information report will be considered by Benga and incorporated into the Project planning as appropriate.

A chronology of key consultation activities with the Montana First Nation can be found in Table 17.1-1.

Table 17.1-1 Chronology of Key Consultation Activities with the Montana First Nation

Date	Method of Communication	Topic of Communication
January 21, 2019	Email	Benga introduced the company and inquired about the Montana First Nation's interest in the Project.
February 8, 2019	Meeting	Benga and the Montana First Nation met for Introductory meeting.
February 9, 2019	Email	Benga provided contact information for the CEAA representatives for the Project.
February 25, 2019	Email	Benga provided one-year in advance notification of plans to clear timber within the Project site and access to the site prior to clearing operations to enable harvesting of Lodgepole pine or other vegetation for cultural purposes
April 5, 2019	Email	Benga provided lists of potential employment and contracting opportunities for the Montana First Nation.

17.2 Montana First Nation Traditional Use and Traditional Knowledge Studies

Benga has not obtain traditional use or knowledge studies from the Montana First Nation.

Benga is in early engagement with the Montana First Nation and anticipates having meetings to discuss and review the Montana First Nation's interests in the Project area. New information, including TK/TU information provided to Benga after the submission of this report will be

considered by Benga and incorporated into Project planning as appropriate. Current Use of Lands and Resources for Montana First Nation Traditional Purposes

17.2.1 Background of Current Use of Lands and Resources for Montana First Nation Traditional Purposes

This discussion focuses on background information that is relevant to the assessment of potential effects of the Project on the Montana First Nation as required by the Alberta TOR and CEAA Guidelines. The Montana First Nation continue to exercise their Indigenous interests in hunting, fishing and plant gathering in their traditional territory. Information regarding current use, sacred sites or cultural values, recreational use, commercial activity, reliance on country foods and drinking water sources in the Project area is not identified in public sources and has not been provided by the Montana First Nation.

17.2.1.1 Hunting

The Montana First Nation Elders shared that in the past, community members depended on muskrat, beaver and squirrels for food whereas presently community members are less dependent on traditional food sources as a result of urban growth and store meat (Montana First Nation Traditional Land Use Study Report, 2015). Notably, Elders reported that hunting legislation and a loss of traditional hunting grounds have also reduced hunting activities in general as community members continue to have to travel further away to hunt (Montana First Nation Traditional Land Use Study Report, 2015). There is no information indicating that the Montana First Nation hunts in the Project area.

17.2.1.2 Trapping

The Montana First Nation used frozen rivers to cover a large region in order to trap beaver, muskrat and mink for fur, then travelled to Edmonton to sell the harvested furs (Montana First Nation Traditional Land Use Study Report, 2015). It was noted by the Montana First Nation Elder that trapping has declined because it does not lucrative (Montana First Nation Traditional Land Use Study Report, 2015). There is no information indicating that the Montana First Nation traps in the Project area.

17.2.1.3 Fishing

The Montana First Nation continues to practice traditional ways of fishing including fishing at beaver dams by breaching part of the downstream base to make the fish jump the barrier into chicken wire baskets (Montana First Nation Traditional Land Use Study Report, 2015). There is no information indicating that the Montana First Nation fishes in the Project area.

17.2.1.4 Plant Gathering

The Montana First Nation Elders explained that they use their entire traditional territory to gather plants and can travel long distances to harvest plants (Traditional Land Use Study Report for the Montana First Nation (2015). It was reported that, although a variety of plants grow in the vicinity of the Montana First Nation reserve, it is a challenge to harvest locally as a result of access to traditional plants and berries. Historically, the Montana First Nation community members would travel south to find medicines that only grow in certain areas. The traditional use report indicates that the "old people" would travel far distances from the mountains to the prairies to gather medicine and roots, including pine, sweet pine (spruce gum) and flat leaf pine (balsam fir) (Montana First Nation Traditional Land Use Study Report, 2015). Notably, an Elder reported that:

- "you cannot just gather the plants and make medicine out of them; the medicinal knowledge must be gifted by someone who possesses the knowledge, which is earned, taught and gifted" (Montana First Nation Traditional Land Use Study Report, 2015).

Such plants and berries gathered are as follows: blueberries, gooseberries, raspberries, Saskatoon berries, chokeberries, pin cherries, cranberries, fungus from willow trees, tiger lilies, lily pads, peppermint tea, muskeg tea, red willow and kinnikinnick (Montana First Nation Traditional Land Use Study Report, 2015).

Poplar sap, spruce sap, rat root and bluebells were gathered for medicinal purposes (Montana First Nation Traditional Land Use Study Report, 2015). Further, Elders shared that they used to travel the mountains with their grandparents to gather these traditional plants and learned their Cree language and culture on the journey (Montana First Nation Traditional Land Use Study Report, 2015). Although these gathering practices have been identified, it is not clear if such activities are conducted in the Project area.

17.2.1.5 Trails and Travelways

The Montana First Nation identified the North Saskatchewan River near Rimbey, Alberta as a travelway during their TLU study for the Trans Mountain Project; however, this river is not within the Benga Project area (Montana First Nation Traditional Land Use Study 2015). No information about trails and travelways in the Project area has been received from the Montana First Nation.

17.2.1.6 Cultural and Spiritual Values

Limited information was found regarding the Montana First Nation's cultural and spiritual values. The Montana First Nation Elders and community members have commented on the "importance of the Cree language, cultural traditions and ceremonies being preserved and

passed on to the youth" (Montana First Nation Traditional Land Use Study Study 2015, p. 25) and have noted that "spirituality and ceremony make the Montana First Nation unique because many of the community members practice spirituality" (Montana First Nation Traditional Land Use Study 2015, p. 34).

It is understood that country foods have always been important to Indigenous peoples for food, subsistence and sustenance and the practice of fishing, hunting, trapping and harvesting also has important cultural and spiritual considerations. Intergenerational knowledge about ceremonies, traditions and customs as well as use of harvested animals and plants is shared while out on the land (*e.g.*, knowledge regarding medicine, food, tools, clothing, shelter and more is shared while out on the land). In addition to this educational context, traditional practices are typically linked to other intangible values with spiritual, artistic and aesthetic elements, including the quiet enjoyment of the landscape.

17.2.2 Potential Effects and Mitigations Measures on Current Use of Lands and Resources for Montana First Nation Traditional Purposes

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding the Montana First Nation's current use of lands and resources for traditional purposes in the Project area has been received from the Montana First Nation or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Montana First Nation's current use of lands and resources for traditional purposes. As such, no further assessment is undertaken. Benga understands that additional information from the Montana First Nation may be forthcoming. Benga will continue to share information about the Project with the Montana First Nation and information received after the submission of this report will be considered in Project planning.

17.3 Montana First Nation Physical and Cultural Heritage

17.3.1 Background of Montana First Nation Physical and Cultural Heritage

Information regarding physical and cultural heritage in the Project area, other than that which is presented above, is not identified in public sources and has not been provided by the Montana First Nation.

17.3.2 Potential Effects and Mitigations on Montana First Nation Physical and Cultural Heritage

Potential effects of the Project are not anticipated to extend beyond the RSA. No information regarding cultural and physical heritage in and around the Project area has been received from the Montana First Nation or is otherwise available in public sources. As a result, Benga cannot determine whether Project activities are expected to interact with the Montana First Nation's

physical and cultural heritage. As such, no further assessment is undertaken. Benga understands that additional information from the Montana First Nation may be forthcoming. Benga will continue to share information about the Project with the Montana First Nation and information received after the submission of this JRP Information Request Package 4 will be considered in Project planning.

18.0 CUMULATIVE EFFECTS

18.1 Cumulative Effects Boundaries

18.1.1 Spatial Boundaries

The RSA for the Indigenous groups cumulative effects assessment was defined as the Project's Wildlife - Grizzly Bear RSA. The RSA comprises the area within which the VCs are affected by the Project that could also be affected by past, present or future physical activities and captures impacts to Indigenous VCs that arise from environmental impacts (*e.g.*, reduced availability of wildlife that in turn might affect Indigenous hunting), as well as direct impacts to Indigenous VCs (*e.g.*, reduced access to harvesting locations due to a project activity). The area is divided by the Crowsnest Mountain Range and the Livingston Range both of which run in a north to south direction. Approximately one quarter of the RSA is to the east of the Livingston Range and is typical foothills and prairie landscape, with the remainder of the RSA being mountain and forest.

18.1.2 Temporal Boundaries

The temporal boundaries included in the Indigenous groups' cumulative effects assessment span from pre-industrial development (*i.e.*, before major human interactions were undertaken in the region) through the Project life cycle including construction, operation, and reclamation and closure. These are described below as:

- Past: From 1881 (to capture the early non-Indigenous human activities in the region such as the initiation of the railway, roads, mining, *etc.*) to the present (when Project baseline studies were initiated);
- Construction Phase: two years from acquisition of all necessary approvals and permits;
- Operation Phase: 23 years; and
- Reclamation and Closure Phase: commences in Year 5 of operations and extends to end of mine (EOM), which is after Year 23 of operations. The final closure phase will commence at the EOM and continue until final reclamation is complete.

Past, present and future physical activities considered in these time frames included the following:

- Certain activities: those activities or actions that have occurred in the past or have received regulatory authorizations but are not yet built or operating;
- Reasonably foreseeable activities: those activities or actions that are currently in a regulatory authorization process and where some information is available from which potential cumulative effects may be anticipated; and
- Hypothetical activities: activities which are not well defined but are probable based on professional judgement and available information. These activities may include continued residential developments, agricultural expansion and other leases and licenses. The potential cumulative effects of such actions are discussed on a conceptual basis only in this cumulative effects' assessment.

18.2 Examining Past, Existing and Future Physical Activities

18.2.1 Past and Existing Physical Activities

Prior to the late 1800s, there was very little development in the RSA. The prairies in the central and eastern portion of the RSA would have supported species associated with grassland such as buffalo, elk and mule deer, whereas species associated with forest such as moose and grizzly bear would have been more abundant to the west (Carlson *et al*., 2018a).

In 1881, the Government of Canada and the Canadian Pacific Railway began to survey a route through the area for the trans-continental railway. Construction was completed and the first trains started running in 1898 with the town of Blairmore being established as the main railway siding in the region.

A trail along the railway was developed and eventually became a designated road with the advent of automobiles. Between 1920 and 1928, this road was upgraded and gravelled to facilitate automobile travel from Lethbridge through to the Pacific Coast. The route which is now Highway 3 was eventually paved and rerouted to its current alignment. Other key highways in the RSA include Highway 22 which is now a significant, paved, north – south corridor on the east side of the RSA and Highway 40 which is not paved and runs north between the Crowsnest and Livingston Ranges.

In the early 1900s, coal was discovered in the Crowsnest region and towns were established along the railway to support coal mines at Coleman, Bellevue and Frank. The communities in the RSA continued to develop primarily along the highway and railroad routes with the primary industry in the area being coal mining. In the 2011 Census, the population of the

Municipal District of Crowsnest Pass was under 6000, representing the majority of the population in the RSA.

Historical coal mining in the region began with the establishment of the first mines in the early 1900s. The mines have since closed with the exception of the Teck Coal Mountain and Elkview operations, which touch the western boundary of the RSA. A number of the historical mining areas remain in a disturbed condition including the significant area of the Frank Slide. One of the historical mining sites, the Grassy Mountain Mine, is situated within the Project footprint and was in operation off and on from 1952 through to 1976. These mining activities have effectively disturbed about one third of the proposed Project Area and have not been reclaimed to date. Environmental practices in the 1900s were not as stringent as today and there is a legacy of mining companies leaving the area before appropriate clean-up as well as implementing practices that were not environmentally sensitive.

Ranching and other agricultural activities developed concurrently with the establishment of the railroad. The area to the east of the Livingston Range, approximately one quarter of the RSA, is the primary area suitable for ranching although pockets of land are arable. This includes several sections that are adjacent to the Project Area and dedicated to the grazing of cattle.

Other activities such as legacy oil and gas exploration, tourism, forestry and off-road vehicle use have facilitated the opening of minor roads and trails throughout the RSA that allow more general access to and development of natural areas.

More recently, in early 2018, the Alberta Government set aside more than 100,000 hectares for the Castle Provincial Park and the Castle Wildland Provincial Park. These areas cover the southern area of the RSA and would be preserved for multiple uses including the pursuit of traditional Indigenous activities. The Castle Wildland area will be designed to have limited access so that it is kept in a natural state that would be conducive to traditional uses.

In summary, since the late 1800s, the RSA has seen significant activity and development that have progressively reduced the quantity and quality of the land available for traditional uses. Qualitatively, about one half of the area has seen development that has affected its suitability for traditional practices. This effect is mitigated somewhat by the more recent designation of the Castle Wildland area where development will be restricted and preservation of that natural environment for uses, including traditional uses, will be favoured.

18.2.2 Certain and Reasonably Foreseeable Projects and Activities

To identify the source of residual effects which may interact cumulatively with residual effects of the Project, other projects or activities have been identified that are likely to be carried out or

that could cause effects to Current Use of Lands and Resources for Traditional Purposes and Indigenous Physical and Cultural Heritage VCs.

The inclusion of a project or activity is based on the following criteria:

1. The Project or physical activity has spatial and temporal boundaries which overlap with the spatial and temporal boundaries as described above; and
2. The Project or physical activity could potentially interact with the Current Use of Lands and Resources for Traditional Purposes and/or Indigenous Physical and Cultural Heritage VCs.

The following future projects and physical activities meet these criteria and are carried forward in the cumulative effect's assessment:

- Teck Coal Baldy Ridge Extension;
- North Coal Ltd. Michel Creek Coking Coal Project;
- Timber Operations (planned and predicted to 2056);
- Alberta Transportation Highway 3 Re-alignment;
- Alta Link Chapel Rock to Pincher Creek Transmission Project;
- Urban developments; and
- Agricultural expansion.

This summarizes all past, existing and future activities considered for the Indigenous cumulative effects' assessment and clarifies those that have been identified to have potential interactions with the Indigenous VCs.

18.3 Consideration of the Views of Indigenous Groups with Regard to Cumulative Effects

This section outlines views of Indigenous groups that pertain to cumulative effects. These views were raised during consultation on the Project from 2014 to May 2019 in meetings, letters and submissions to regulators. Where information was conveyed relating to one of the VCs discussed, it has been included in that section. The issues raised by Indigenous groups have been considered by Benga and discussed with the Indigenous groups. The results of the discussions have been documented and incorporated into tracking tables. In addition to being addressed by Benga, as documented in the tracking tables, these issues are considered in this cumulative effects assessment. More specifically, Indigenous issues and concerns are considered in scoping, the discussion of potential effects, mitigation development and the characterization of residual cumulative effects.

18.3.1 Káinai Nation

In December 2014, a Káinai Nation Elder raised concern about the emotional impacts of discussing the mountainous area (which includes Project location) in terms of what areas Káinai Nation has already lost due to past development (Káinai Nation, 2015).

On February 21, 2015, Káinai Nation raised concerns about coal dust and its effects on wildlife that they harvest because they perceive that it may cause illness as a result from consuming contaminated wildlife. Káinai Nation indicated they associate increased instances of cancer in the community to the sulfur farms in their territory. Káinai Nation also stated that the cumulative effect from resource development projects on fish populations has resulted in certain species being designated as endangered therefore affecting Káinai Nation's ability to harvest these specific species. On June 23, 2015, Káinai Nation raised a concern about direct and indirect effects to water quality imposing a cumulative effect to aquatic life related to effects of nearby farming and sewage.

In their Statement of Concern to the Government of Alberta submitted on January 4, 2016, Káinai Nation identified a potential cumulative effect to hunting due to the Project creating new roads and access points, resulting in greater accessibility and use by non-Indigenous hunters and recreational users (MacPherson Leslie and Tyerman, 2016).

On December 8, 2017, Káinai Nation submitted an additional statement of concern to the Government of Alberta regarding the Project which included the following views on cumulative effects:

> As noted in our Original Statement of Concern, most of the lands which make up Treaty 7 have already been taken up for development or for other purposes. Given that there are fewer and fewer areas where Káinai Nation can still practice its constitutionally protected Treaty rights, Káinai Nation is becoming increasingly dependent on the few areas that can still support the practice of its Treaty rights. As stated by Káinai Nation member Perry Day Chief:
>
> We already have to go so far to hunt and exercise our Treaty rights and now this land is being limited, too. I worry there will soon be nowhere to go and we will have nowhere to exercise our rights. This is our livelihood.
>
> The Project Area is one of the few remaining areas where Káinai Nation members can still go to practice its Treaty rights, as much of the land in and around Grassy Mountain, including the Project Area, has never been developed. As such, Káinai Nation is concerned by the permanent removal of 1520.7 ha of land for the Project. This land includes some of the last remaining areas where Káinai Nation members can go to practice their traditional way of life and exercise their Aboriginal and Treaty rights.

In their TK and Use report, Káínai Nation expressed concerns about further impacts and disturbances to the wildlife population in the area (Káínai Nation, 2015). Káínai Nation recommended that Benga put in place measures to avoid direct and indirect effects to plants and animals to the extent practicable (Káínai Nation, 2015).

Káínai Nation also identified a potential cumulative effect to hunting due to the Project rendering some land inaccessible for hunting. Access to traditional hunting areas is already reduced through past and existing land uses such as private land, protected areas and development (*e.g.*, mining, forestry, urban areas, conversion to agriculture, oil and gas facilities).

On April 9, 2018, Káínai Nation, jointly with Siksika Nation, requested a study that looks at the potential impacts of the mine within the context of southern Alberta cumulative effects. In December 2018, the cumulative effects assessment was completed for Káínai Nation and Siksika Nation (Carlson *et al*., 2018). In summary, past and current developments since European settlement within the regional study area[1] have resulted in loss of natural land cover, which has reduced wildlife numbers, increased hunting and fishing pressure and restricted access to land for traditional purposes. Approximately 80% of the Carlson Study RSA is estimated to be inaccessible for traditional land use, of which 45% is farmland (Carlson *et al*., 2018). This has resulted in an 88% reduction in opportunities to hunt elk and mule deer. The Káínai Nation does not fish in national parks, provincial parks and ecological reserves and these areas were therefore deemed inaccessible for traditional land use (Carlson *et al*., 2018). Furthermore, Káínai Nation does not fish in close proximity to well sites (approximately 500 m), or near industrial sites, settlements, rural residence and other features used for non-TLU purposes due to concerns regarding contamination, safety and overall negative experience on the land (Carlson *et al*., 2018a).

Within the smaller and less developed, focal study area[2] selected by Carlson, opportunities for traditional land use are impacted by the cumulative effects of land use and other drivers such as climate change; an estimated 40% of the focal study area is inaccessible for traditional land use. Within the focal study area, parks and ecological reserves account for 5.4% and development accounts for 18%. Future development within the focal study area is expected to expand due to mining and energy development, which would reduce habitat availability for hunted species (*e.g.*, mule deer and elk) and further reduce access to land for traditional use (Carlson *et al*.,

[1] Not the GBRSA. The regional study area in Carlson et al. (2018) encompasses the majority of southern Alberta from Calgary east to the Saskatchewan border and south to the U.S. border (Figure 1 in Carlson et al., 2018a).
[2] The focal study area is similar in size and location to the GBRSA (Figure 1 in Carlson et al. 2018).

2018). A 50-year future projection estimated hunting opportunities will decline by 7% for mule deer, 10% for elk and by 2% for land access.

In their cumulative effects assessment (Carlson *et al*., 2018), Káínai jointly with the Siksika Nation, provided the following examples of potential regional strategies to mitigate cumulative effects on access to wildlife and recommended these be considered:

- Establishment of a network of provincial, national parks and sanctuaries where hunting is prohibited. These areas provide refugia for wildlife and act as source areas for repopulating adjacent areas where mortality rates may be higher;
- In a sense, Alberta's hunting "constraint" regulations (number of available tags, when and where one can harvest) reflect the basic understanding that hunters with extensive "access" to the regional landscape of a wildlife species can, if unregulated, create a combined mortality rate that is excessive relative to population objectives. The greater the extent to which the hunting community can access wildlife habitat with vehicles (including OHVs), the greater the need for regulatory constraints;
- Implement road sanctuary buffers on selected roads. These buffers are generally applied to roads where hunting is prohibited within 365 m of the road right of way (Carlson *et al*., 2018);
- Prohibition of some forms of transportation (such as OHVs) along selected linear features (roads, seismic lines) during defined times of the day or week (Carlson *et al*., 2018); and
- Integrated landscape management strategies that seek to reduce the quantity of linear footprint that is needed to extract natural resources (Carlson *et al*., 2018).

Benga considers most of these strategies the responsibility of the Alberta Government but will support regional efforts to better manage human access to wildlife within the RSA and will comply will any changes to access that the government imposes. Benga will work with the Indigenous Nations to consider ways to implement strategies over which Benga has some control, such as restrictions in access and use on privately-owned land. CR #9 (EIA, CEAR #42) identifies measures under consideration that should address Káínai Nation's concerns.

18.3.2 Piikani Nation

In the Piikani Nation's July 2015 TK/TU report, concerns were raised about an increase of disturbed areas separate from areas that had already been disturbed by historic mining activities (Piikani Nation, 2015a). The Piikani Nation also raised concerns about the potential for increased animal-vehicle collisions due to the Project and the potential for cumulative effects related to human presence on wildlife migration routes (Piikani Nation, 2015a). To address

these concerns Benga stated that the Project will disturb some previously undisturbed Crown lands and access to Crown lands during construction and operations will be restricted for safety reasons. To the extent possible on Crown land, Benga has incorporated areas that are already disturbed into the construction and operational plans of the Project to try to minimize new disturbance. Benga provided a conceptual AMP in the August 2016 update to the EIA. This information was also provided directly to the Piikani Nation. Access on site will be enforced by mine operations managers and personnel during the construction and operations phase.

In July 2015 the Piikani Nation raised concerns about loss of access to and use of land and resources due to the Old Man River dam near the Piikani Nation reserve and questioned the potential of further loss as a result of the Project (Piikani Nation, 2015a). In the Piikani Nation's Statement of Concern to the Government of Alberta, the Piikani Nation raised concerns of the potential for the Project to interact with other projects within the Crowsnest River watershed which is used for traditional purposes by the Piikani Nation members, including fishing and navigation (Piikani Nation, 2015b). The Piikani Nation review expressed concern about how cumulative effects on aquatic ecology were assessed despite uncertainties of the impact analysis (Piikani Nation, 2016).

The Piikani Nation also identified deficiencies in the cumulative effects assessment in the August 2016 EIA and asked for a detailed discussion of cumulative effects to all VCs. The Piikani Nation requested that Benga address what they believed were deficiencies in the cumulative effect's assessment, including explicit provision of pre- and post-development ecosite phases and reduction in quality. The Piikani Nation identified that this information was critical both for the Project assessment and for discussion of biodiversity offsetting programs. Benga addressed the concern by stating that the assessment scenarios in the EIA and the EIA Update were identified in the Project terms of reference. Much of the Project site area is disturbed through historical and ongoing land use activities, mining, logging, cattle grazing, recreational use and access. Benga's final land use objectives and final reclamation plans include site rehabilitation to a state that is better than the pre-Project conditions. This includes the re-establishment of natural, self- sustaining ecosite conditions capable of supporting a diversity of ecosite phases typical of the site and surrounding natural environment. This discussion is ongoing and Benga continues to work with the Piikani Nation on reclamation planning. Indeed, if the Project proceeds, it will provide an opportunity to ameliorate legacy issues.

In its review of the EIA (Piikani Nation, 2016), the Piikani Nation requested that Benga provide a detailed discussion of how issues and concerns from Indigenous communities in general and the Piikani Nation, specifically, influenced the following aspects of the environmental assessment:

- The identification of local and regional issues of concern;
- The VCs;
- The study area boundaries; and
- The identification of potential Project and cumulative impacts.

The Piikani Nation requested that Benga reassess the potential residual cumulative effects to the Piikani Nation for all applicable VCs. In March 2017, the Piikani Nation requested that Benga provide a cumulative effects assessment describing Project contributions to regional access and describing how public or Indigenous land use would be affected and accommodated throughout the life of the Project. Benga considers this report to be satisfactory in addressing this request.

18.3.3 Stoney Nakoda Nation

On January 15, 2015, the Stoney Nakoda Nation expressed the need to consider the South Saskatchewan Regional Plan (SSRP) and requested confirmation that current legislated standards and land use designations apply. Benga followed up with the Alberta Government and received confirmation that existing legislated standards and land use designations continue to apply to the Project; the assessment of potential Project effects to Land and Resource Use (CR #10, EIA, CEAR #42) considers the SSRP.

In January 2016, the Stoney Nakoda Nation expressed concern about ongoing cumulative effects within the watershed of Whitefish and trout habitat that includes the Highwood River, Pekisko Creek, Willow Creek, Johnson Creek, Oldman River and Livingstone River. Benga has assessed the ongoing cumulative effects on trout within the entire watershed of Crowsnest River in the Aquatic Resources Assessment (Addendum #8).

18.3.4 Tsuut'ina Nation

The Tsuut'ina Nation commented that the cumulative impacts of the Project should be considered in the regulatory review both from the perspective of the incremental effect on Treaty rights and in terms of lands available to Indigenous groups for practicing traditional activities in Treaty 7 area. Reductions in areas to hunt and impacts to wildlife food sources, migration, calving and mating would ultimately impact the Tsuut'ina Nation's citizens' right to hunt (Tsuut'ina Nation, 2018). Therefore, in March 2018, the Tsuut'ina Nation requested that cumulative effects be considered by CEAA. The Tsuut'ina Nation indicated it would like to carry out additional work to understand cumulative effects of the Project and stated that their Traditional Land Use Study work to date (*i.e.,* Tsuut'ina Nation, 2018) does not look at the meaningful ability to exercise their rights.

In April 2018, the Tsuut'ina Nation raised concerns about the reduced harvesting areas used by Treaty 7 Nations due to the increased cost of living and doing business in a highly disturbed area. The Tsuut'ina Nation also raised the specific concern about a cluster of development.

As per section 19(1) of the *Canadian Environmental Assessment Act*, 2012, Benga undertook cumulative effects assessment for the following: hunting and trapping, fishing, plant gathering, trails and travelways and cultural and spiritual values (CR #9, EIA, CEAR #42). Benga understands that the Tsuut'ina Nation work is ongoing and will consider additional information provided by the Tsuut'ina Nation when it is forthcoming.

18.3.5 Siksika Nation

The Siksika Nation raised concerns in the January 4, 2016 Statement of Concern to Government of Alberta related to the ability to practice their traditional way of life and exercise their Indigenous and Treaty rights due to Project development (MacPherson Leslie & Tyerman LLP, 2016).

In August 2017, the Siksika Nation commented that impacts to traditional use expand beyond the Project boundary and therefore so should accommodation. On April 9, 2018, the Káínai Nation requested a combined study with the Siksika Nation that looks at the impact of the mine within the context of southern Alberta regarding cumulative effects. In December 2018, the cumulative effects assessment was completed for the Káínai Nation and the Siksika Nation (Carlson *et al*., 2018). In summary, past and current development since European settlement within the regional study area[3] has resulted in loss of natural land cover which has reduced wildlife numbers, increased hunting and fishing pressure and restricted access to land for traditional purposes. Approximately 80% of the regional study area is estimated to be inaccessible for traditional land use, of which 45% is farmland (Carlson *et al*., 2018). This has resulted in an 88% reduction in opportunities to hunt elk and mule deer (Carlson *et al*., 2018).

The Cumulative Effects Assessment (Carlson *et al*., 2018) concluded that regionally there is a moderate risk to the fish community and a high risk to elk and mule deer related to loss of land cover and high linear footprint densities and that regional accessibility for traditional use is limited to an estimated 20% of the landscape. Loss of land cover was found to be lower in the focal study area, though still below natural conditions resulting in moderate risk to elk and mule deer and associated land use. A 50-year future projection estimated hunting opportunities will decline by 7% for mule deer and 10% for elk and by 2% for land access. Fish community

[3] Not the GBRSA. The regional study area in Carlson et al. (2018) encompasses the majority of southern Alberta from Calgary east to the Saskatchewan border and south to the U.S. border (Figure 1 in Carlson et al. 2018).

was found to be at a moderate risk due to fragmentation and access for fishing and was found to be at a high risk over the next 50 years due to warming. The assessment concluded that "any further decline in opportunities for traditional land use may be of concern given that risk to traditional land use is already assessed as high" (Carlson *et al*., 2018, p. 38).

In their cumulative effects assessment (Carlson *et al*., 2018), the Siksika Nation jointly with Káínai Nation, provided the following examples of regional strategies to mitigate cumulative effects on access to wildlife and recommended these be considered:

- Establishment of a network of provincial, national parks and sanctuaries where hunting is prohibited. These areas provide refugia for wildlife and act as source areas for repopulating adjacent areas where mortality rates may be higher;
- In a sense, Alberta's hunting "constraint" regulations (number of available tags, when and where one can harvest) reflect the basic understanding that hunters with extensive "access" to the regional landscape of a wildlife species can, if unregulated, create a combined mortality rate that is excessive relative to population objectives. The greater the extent to which the hunting community can access wildlife habitat with vehicles (including OHVs), the greater the need for regulatory constraints;
- Implement road sanctuary buffers on selected roads. These buffers are generally applied to roads where hunting is prohibited within 365 m of the road right of way;
- Prohibition of some forms of transportation (such as OHVs) along selected linear features (roads, seismic lines) during defined times of the day or week; and
- Integrated landscape management strategies that seek to reduce the quantity of linear footprint that is needed to extract natural resources.

Benga considers most of these strategies the responsibility of the Alberta government but will support regional efforts to better manage human access to wildlife within the RSA and will comply will any changes to access that the government imposes. Benga will work with the nations to consider ways strategies that Benga has some control over, such as restrictions in access and use on privately-owned land. CR #9 (EIA, CEAR #42) identifies measures under consideration that should address the Siksika Nation's concerns.

18.3.6 Ktunaxa Nation

The Ktunaxa Nation's oral histories and ongoing land use indicate that the Ktunaxa Nation citizens have relied on and to the extent possible, continue to rely on, the area of the Crowsnest Pass, including the Grassy Mountain area (Firelight Group, 2019). A range of practices includes the harvesting of fish, plant, wildlife and mineral resources and use of trails and transportation routes and associated camps and cultural areas (Firelight Group, 2019). The Ktunaxa Nation

understands that there are cumulative and ongoing impacts to the Ktunaxa Nation rights, title and interests such as: extirpation of bison, historic coal mines, urban, road, rail and highway development, forest cutting and management including fire suppression, inhibition of Indigenous rights and use in national park and protected areas, climate change and forest fires (KNC, 2019). The Ktunaxa Nation raised concerns about cumulative effects on the Ktunaxa Nation rights, title and interests as a result of impacts to lands and waters that have already exceeded a threshold of significance and that impacts from other projects in the region will act cumulatively (KNC, 2019). For example, the Teck Baldy Ridge EIA indicated that its residual effects and effects from other reasonably foreseeable activities and environmental change will act cumulatively and that synergistic, additive, or antagonistic interactions between multiple impacts to lands and water are likely but poorly understood (Teck Coal Limited, 2015).

Ktunaxa experience with past mining in the Crowsnest Pass area is one where most or all socio-economic benefits are received by non-Indigenous communities and workers and a disproportionate share of adverse impacts are received by Indigenous communities, including the Ktunaxa Nation. This 'business as usual' approach results in a net adverse impact for Ktunaxa citizens and continued erosion of Ktunaxa use, rights and interests (Firelight Group, 2019).

The Ktunaxa Nation requested that Benga consider the following in relation to cumulative effects (KNC, 2019; Firelight Group, 2019):

- The Project's contribution to the regional airborne deposition of contaminants within the Elk River watershed;
- Concerns about selenium in the Elk River due to coal mining have affected the Ktunaxa Nation citizen's confidence in wild foods. Maintaining healthy water quality and avoiding mining or rail-related contamination (*e.g.*, sulphate and selenium) is a primary concern in relation to the Project and the Crowsnest River watershed;
- Regional movement of wildlife (grizzly bear, wolverine, sheep or other ungulates) that cross between the Elk and Crowsnest watersheds;
- Wildlife habitat (and loss) is not the limiting factor for many species but instead habitat loss interacts synergistically and cumulatively with predation, roadkill, hunting, disturbance, diseases, contaminants, weather and climate change effects;
- Increased rail traffic related to the Project that will increase impacts to multiple sensitive areas within Ktunaxa territory, including sensitive cultural-spiritual values in the headwater areas of Crowsnest Pass;
- Consider how Project impacts at all stages of the Project, including reclamation, are likely to combine with climate change and forest fires to impact indigenous values,

including habitat distribution and connectivity, stream flows integral to rights practice and likelihood of long-term success in achieving end land use goals that include of ecologically and culturally functional landscapes; and

- Project's contribution to cumulative impacts on the Ktunaxa Nation title, rights and interests including potential restoration of bison habitat, impacts on access and enjoyment of preferred hunting, harvesting and habitation areas and cultural-spiritual impacts on Crowsnest Mountain and the headwaters of the Crowsnest River.

Furthermore, while bison are currently extirpated and bison habitat in Project area is currently vacant, the return of plains bison and Ktunaxa harvest of bison in the Project area is planned and reasonably foreseeable (KNC, 2019). The Project is located within an area that is critical to bison restoration planning (KNC, 2019). As a signatory to the Buffalo Treaty, the Ktunaxa Nation Council wishes to ensure the Project provides a reasonable assessment of impacts on bison habitat suitability and capability, that it provides reliable habitat offsetting supportive of bison for the duration of Project impacts and that end land use goals are clearly supportive of long term habitat restoration for bison and Ktunaxa harvest in the area (KNC, 2019). It is reasonably foreseeable that the Ktunaxa Nation and other Indigenous groups harvest of bison and related cultural practices (*e.g.*, transmission of knowledge, resumed use of hunting camps) in the Project area will resume once conditions change as planned under the Buffalo Treaty (KNC, 2019).

Benga acknowledges the concerns raised by the Ktunaxa Nation and has addressed these concerns in this report. Benga will continue to work with the Ktunaxa Nation to identify and implement measures to mitigate Project impacts to Ktunaxa title, rights and interests through Project permitting.

18.3.7 Samson Cree Nation

The Samson Cree Nation expressed a concern that the alienation of further Crown land would result in an effective infringement to the Samson Cree Nation's Indigenous and Treaty rights. Benga acknowledges this concern and will work with the Samson Cree Nation and other nations to develop an AMP for traditional use so that Indigenous and Treaty rights are upheld.

18.3.8 Métis Nation of Alberta Region 3

In the Grassy Mountain Mine EIA Review in July 2016, the Métis Nation of Alberta Region 3 expressed concerns about deficiencies in the wildlife impact assessment, including the lack of discussion regarding potential impacts to wildlife habitat from the relocation of half the golf course and from the AltaLink power line (MNAR3 TLUS 2016). The Métis Nation of Alberta Region 3 requests that Benga commit to developing a biodiversity-management plan in

collaboration with the Piikani Nation, other nations of the Blackfoot confederacy and the Métis Nation (MNAR3 TLUS 2016). Benga acknowledges these concerns and will work with the nations to develop appropriate management plans to mitigate Project impacts on wildlife and wildlife habitat.

The Métis Nation of Alberta also requested that Benga provide an updated assessment of Project and cumulative effects based on the more detailed C&R Plan (MNAR3 TLUS 2016). Benga considers this update to be satisfactory in addressing this concern.

18.3.9 Other Indigenous Groups

18.3.9.1 Shuswap Indian Band

Benga provided the Shuswap Indian Band with the EIA for review and comment in December 2015. As of May 2019, the Shuswap Indian Band has not provided their views or identified concerns regarding the Project or cumulative effects.

18.3.9.2 Foothills Ojibway First Nation

Benga provided the Foothills Ojibway First Nation with the EIA for review and comment in December 2015. As of May 2019, the Foothills Ojibway First Nation has not provided their views or identified concerns regarding the Project or cumulative effects.

18.3.9.3 Métis Nation of British Columbia Region 4

The Métis Nation of British Columbia Region 4 provided a summary of traditional and historical land use within 75 km of the Project footprint, but note that, in their report, the information is incomplete and interviews of Métis members have not been completed (MNBC 2015). Métis Nation of British Columbia did not identify specific concerns regarding the Project or cumulative effects.

18.3.9.4 Ermineskin Cree Nation

As of May 2019, the Ermineskin Cree Nation has not provided their views or identified concerns regarding the Project or cumulative effects.

18.3.9.5 Louis Bull Tribe

As of May 2019, Louis Bull Tribe has not provided their views or identified concerns regarding the Project or cumulative effects.

18.3.9.6 Montana First Nation

As of May 2019, the Montana First Nation has not provided their views or identified concerns regarding the Project or cumulative effects.

18.4 Analysis of Cumulative Effects

The analysis of cumulative effects for Indigenous groups includes the consideration of mitigation measures and consideration of VCs for which residual Project effects are predicted, regardless of whether those residual effects are predicted to be significant. The two VCs are 1) Current Use of Lands and Resources for Traditional Purposes and 2) Indigenous Physical and Cultural Heritage. Potential cumulative effects, characterization of residual cumulative effects, significance, likelihood and confidence are identified for the subcomponents for each VC with consideration of the residual effect interaction with past, present and reasonably foreseeable future physical activities.

18.4.1 Current Use of Lands and Resources for Traditional Purposes

Cumulative effects analysis was completed for the following subcomponents of current use of lands and resources for traditional purposes: Hunting and Trapping; Fishing; Plant Harvesting; Trails and Travelways; and, Cultural and Spiritual Values.

18.4.1.1 Hunting and Trapping

18.4.1.1.1 Potential Cumulative Effects

The Project is expected to act cumulatively for the following effects to hunting and trapping: 1) change in identified hunted/trapped species and habitats; 2) change in use or access to identified hunting locations, traplines and trapping locations and 3) change in preferred harvesting method.

18.4.1.1.2 Change in identified hunted/trapped species and habitat

Cumulative effects on identified hunted/trapped species and habitat are directly linked to cumulative changes in wildlife habitat availability, fragmentation/connectivity, mortality risk and abundance. Three wildlife VCs were identified as important hunted/trapped species by Indigenous groups that provided information on their hunting practices; these are grizzly bear,

moose and elk[4] (CR#9, EIA, CEAR #42). Ongoing cumulative habitat loss would likely result in lost opportunities for traditional hunting and trapping.

18.4.1.1.3 Change in use of or access to identified hunting locations, traplines, or trapping locations

Cumulative effects on the use of or access to identified hunting locations, traplines, or trapping locations can result from cumulative changes in wildlife, access and land use. CR #9 (EIA, CEAR #42) summarizes the cumulative effects concerns identified in the TLUS. Although traplines and trapping locations were not identified by the nations during Project consultation, trapping continues to be a traditional use within the region; therefore, Benga assumes cumulative effects are likely on use of or access to traplines or trapping locations.

Indigenous groups' experience of hunting and trapping may be altered within the RSA. Cumulative noise and visual disturbances may result in reduced use of hunting and trapping locations and experience. As a result, Indigenous groups' use of the area may be reduced.

Other foreseeable future Projects such as forestry and other mining Projects have the potential to act cumulatively with the Project by incrementally reducing the number of wildlife harvesting areas.

The Project's access restrictions within the mine permit area may also affect Indigenous groups' ability to use or access hunting locations, traplines, or trapping locations. This effect would last throughout construction and operations.

18.4.1.1.4 Change in preferred harvesting method

Cumulative effects on the preferred harvesting method can result from cumulative changes in land use and access restrictions, in addition to climate change.

Where Indigenous groups utilize firearms for hunting, the Project's firearm restriction policy would affect their ability to use that harvesting method within the mine footprint. Alternate hunting methods may be possible in parts of the mine footprint that have not yet been disturbed or which have been reclaimed under the AMP. Firearm restrictions are anticipated to be in place for the duration of Project construction and operations.

[4] Siksika Nation, Stoney Nakoda Nation, and Tsuut'ina Nation identified moose and elk only; Káinai Nation, Piikani Nation, Ktunaxa Nation, Samson Cree Nation, Métis Nation of Alberta Region 3, and the Métis Nation of British Columbia Region 4 identified grizzly bear, moose, and elk.

18.4.1.1.5 Mitigation Measures

Benga will work with the nations to consider ways to implement the following regional strategies recommended by the Nations (CR #9, EIA, CEAR #42):

- Implement road sanctuary buffers on selected roads. These buffers are generally applied to roads where hunting is prohibited within 365 m of the road right of way (Carlson *et al*., 2018);
- Prohibition of some forms of transportation (such as OHVs) along selected linear features (roads, seismic lines) during defined times of the day or week (Carlson *et al*., 2018);
- Integrated landscape management strategies that seek to reduce the quantity of linear footprint that is needed to extract natural resources (Carlson *et al*., 2018); and
- Benga will consider allowing access to Benga-owned lands outside the Project footprint within the RSA for traditional use such as hunting and trapping. Benga will work with the Nations to identify key areas and develop an AMP for traditional use.

18.4.1.1.6 Characterization of Residual Cumulative Effects

Cumulative effects from development, change in land use, settlement, access and climate change have already resulted in significant adverse effects on hunting and trapping since European settlement within the RSA. According to Káinai and Siksika Nations, habitat for species that are hunted and trapped is substantially below natural conditions, placing traditional land use already at moderate risk (Carlson *et al*., 2018). The Project footprint overlaps historic disturbances such as mining and contributions of the Project and future development to cumulative effects are predicted to be small (less than 10% further reduction in the next 50 years; Carlson *et al*., 2018).

With the implementation of the reclamation plan following Project closure, the Project footprint is expected to provide habitat for species that are hunted and trapped by Indigenous groups; thereby may improve hunting and trapping opportunities in the long-term. As a result, the Project's contribution to residual cumulative effects on hunting and trapping are characterized as: low magnitude, regional geographic extent, medium-term, continuous frequency, reversible and sensitive in ecological and social context.

18.4.1.1.7 Significance

The cumulative effects on associated VCs (wildlife and wildlife habitat, land and resource use) are not significant. Based on this and the characterization of residual cumulative effects on hunting and trapping, the cumulative effects on hunting and trapping are not significant.

18.4.1.1.8 Confidence

The prediction of residual cumulative effects to hunting and trapping is made with medium confidence given the high confidence in prediction of residual cumulative effects to wildlife and wildlife habitat, but limited information received from Indigenous groups regarding hunting and trapping locations and the current quality of their experience.

18.4.1.2 Fishing

18.4.1.2.1 Potential Cumulative Effects

The Project is expected to act cumulatively with other past, existing and future physical activities with potential effects on fishing: 1) Change in identified fishing species and habitat; and, 2) Change in use or access to identified fishing locations.

18.4.1.2.2 Change in identified fishing species and habitat

Cumulative effects on identified fishing species and habitat are directly linked to cumulative changes in aquatic and riparian fish habitat and water quality. The Fish and Aquatic Resources VC Westslope Cutthroat Trout (WSCT) was identified as a species of interest by Indigenous groups who have provided information about their fishing practices (CR #6, Addendum 1, CEAR #44). Identified fishing species and habitat are the watershed of Whitefish and trout habitat that includes the Highwood River, Pekisko Creek, Willow Creek, Johnson Creek, Oldman River and Livingstone River. Cumulative effects include nearby farming and sewage, forest cover loss, mining and roads and future development such as oil and gas and mining.

18.4.1.2.3 Change in use or access to identified fishing locations

Cumulative effects on use or access to identified fishing locations are directly linked to cumulative changes in land and resource use. Cumulative noise and visual disturbances may result in reduced use of fishing locations and fishing experience. As a result, Indigenous groups' use of the area or quality of the experience using the area may be reduced. In addition, access to fishing locations have been reduced due to increase in area of private lands; the Project will act cumulatively to reduced use and access to fishing locations because portions of the watercourses adjacent to Grassy Mountain are located on Benga private land. During construction and operation phases of the mine, this road will be closed to the general public for safety reasons. As a result, alternative routes will need to be used to access and fish those portions of Blairmore Creek and Gold Creek.

18.4.1.2.4 Mitigation Measures

Mitigation measures for residual Project effects on use of or access to identified fishing species and habitat are described in sections above for each Nation. This includes an Offsetting Plan for

permanent loss of fish habitat. Benga will consider allowing access to Benga-owned lands outside the Project footprint within the RSA for traditional use such as fishing.

18.4.1.2.5 Characterization of Residual Cumulative Effects

After implementation of the mitigations described above and assuming future projects occur as planned, a residual cumulative effect to fishing is expected. The Project will have effects during construction and operations on land access for traditional resource use including fishing. The residual cumulative effects to fishing are low magnitude, regional geographic extent, medium-term, continuous, reversible and resilient in ecological and social context.

18.4.1.2.6 Significance

The cumulative effects on associated VCs (fish and fish habitat, land and resource use) are not significant. Based on this and the characterization of residual cumulative effects on fishing, the cumulative effects on fishing are not significant.

18.4.1.2.7 Confidence

The prediction of residual cumulative effects to fishing is made with medium confidence given the high confidence prediction of no significant effects to fish and fish habitat outside the mine permit boundary (CR #6, EIA, CEAR #42), but limited information received from Indigenous groups regarding fishing locations and the current quality of fishing experience.

18.4.1.3 Plant Gathering

18.4.1.3.1 Potential Cumulative Effects

The Project is expected to act cumulatively with other past, existing and future physical activities with potential effects on plant gathering. Cumulative effects on plant gathering are directly linked to cumulative effects on traditional use plants (CR #8, EIA, CEAR #42), air quality (CR #1, EIA, CEAR #42) and land and resource use (CR #10, EIA, CEAR #42). Potential cumulative effects on plant gathering include loss of availability and abundance of traditional use plants, loss of space to harvest, loss of access to harvesting areas, decline in use and enjoyment of plant gathering and infringement on Indigenous and Treaty Rights.

18.4.1.3.2 Mitigation Measures

Mitigation measures for residual Project effects on plant gathering are described in sections above for each Nation. To address residual cumulative effects, the following measures were identified:

- In their review of the EIA cumulative effects assessment, the Piikani Nation, other nations of the Blackfoot Confederacy and the Métis Nation of Alberta recommended that Benga commit in agreement to develop a biodiversity-management plan in collaboration with the nations (Solstice, 2016); and
- Benga will consider allowing access to Benga-owned lands outside the Project footprint within the RSA for traditional use such as plant gathering. Benga will work with the Nations to identify key areas and develop an AMP for traditional use such as plant gathering.

18.4.1.3.3 Characterization of Residual Cumulative Effects

After implementation of the mitigations described above and assuming future projects occur as planned, a residual cumulative effect on plant gathering is expected. The Project will have effects during construction and operations on land access for traditional resource use including plant gathering. However, traditional use plants will establish following reclamation. As a result, the residual cumulative effects on plant gathering are low magnitude, regional geographic extent, medium-term, continuous frequency, reversible and resilient in ecological and social context.

18.4.1.3.4 Significance

The cumulative effects on associated VCs (traditional use plants, air quality on vegetation, land and resource use) are not significant. Based on this and the characterization of residual cumulative effects on plant gathering, the cumulative effects on plant gathering are not significant.

18.4.1.3.5 Confidence

The prediction of residual cumulative effects to plant gathering is made with medium to high confidence given the effects on vegetation are well understood and reclamation methods proposed are proven to be effective at re-establishing conditions that ensure tradition use plants. Reclamation will be supported by adaptive management and monitoring. However, there was limited information received from Indigenous groups regarding the locations of sites that overlap the Project footprint and the current extent and quality of experience of plant gathering within the LSA.

18.4.1.4 Trails and Travelways

18.4.1.4.1 Potential Cumulative Effects

Cumulative effects on trails and travelways are directly linked to cumulative changes in land and resource use (CR #10, EIA, CEAR #42). The Project is expected to act cumulatively with

other past, existing and future physical activities with potential effects on trails and travelways for specific Nations. The Project will affect access and use of trails and travelways and associated features within the LSA and this will contribute to cumulative effects although traditional trails and travelways have already been affected by past and existing land use.

18.4.1.4.2 Mitigation Measures

Mitigation measures for residual Project effects on trails and travelways are described in sections above for each Nation. Benga will consider allowing access to Benga-owned lands outside the Project footprint within the RSA for traditional use. Benga will work with the Nations to identify key areas and develop an AMP for traditional use.

18.4.1.4.3 Characterization of Residual Cumulative Effects

After implementation of the mitigations described above and assuming future projects occur as planned, a residual cumulative effect on trails and travelways is expected but will have a low magnitude. The Project will contribute to long-term effects on trails and travelways within the footprint; however, alternative trails and travelways have been identified outside but adjacent to the footprint and within Benga's privately-owned lands. The residual cumulative effects on trails and travelways are low magnitude, regional geographic extent, long-term, continuous frequency, reversible and resilient in ecological and social context.

18.4.1.4.4 Significance

The cumulative effects on land and resource use are not significant. Based on this and the characterization of residual cumulative effects on trails and travelways, the cumulative effects on trails and travelways are not significant.

18.4.1.4.5 Confidence

The prediction of residual cumulative effects to trails and travelways is made with medium confidence given the limited information received from Indigenous groups regarding the locations of trails and travelways that overlap the Project footprint and the current extent of use within the LSA.

18.4.1.5 Cultural and Spiritual Values

18.4.1.5.1 Potential Cumulative Effects

The Project area is an area with cultural and spiritual significance. The Project area is where several Indigenous peoples continue to practice their Indigenous and Treaty rights. Past and existing physical activities have already interfered with Indigenous traditional practices. Potential cumulative effects with contributions from the Project and future activities could

result in further interference with the ability to pass culture along to the next generation and the cultural experience could be lost. For example, the loss of a harvesting area means there is one fewer place to teach harvesting practices or share a language that is unique to the area. According to the Káínai Nation TKUA (O'Connor, 2018), potential cumulative interference with or loss of sites that hold cultural and spiritual significance could lead to adverse effects on the psychological well-being of Indigenous people.

18.4.1.5.2 Mitigation Measures

Mitigation measures for residual Project effects on cultural and spiritual values are described in sections above for each Nation. Benga will allow access to Benga-owned lands outside the Project footprint within the RSA for traditional use as an offsetting measure.

18.4.1.5.3 Characterization of Residual Cumulative Effects

After implementation of the mitigations described above and assuming future projects occur as planned, a residual cumulative effect on cultural and spiritual values is expected but of low magnitude. The Project is not likely to contribute to long-term interference with the ability to pass culture along to the next generation. Benga will work with the Nations to identify opportunities for the Nations to use Benga-owned lands adjacent to the Project footprint for traditional use. The residual cumulative effects on cultural and spiritual values are low magnitude, regional geographic extent, long-term, continuous frequency, reversible, and resilient in ecological and social context.

18.4.1.5.4 Significance

The cumulative effects on land and resource use are not significant. Based on this and the characterization of residual cumulative effects on cultural and spiritual values, the cumulative effects on cultural and spiritual values are not significant.

18.4.1.5.5 Confidence

The prediction of residual cumulative effects to cultural and spiritual values is made with medium confidence given the limited information received from Indigenous groups regarding the locations of culturally and spiritually significant sites that overlap the Project footprint and the current extent of use within the LSA.

18.4.2 Indigenous Physical and Cultural Heritage

The Indigenous Physical and Cultural Heritage VC is carried forward to cumulative effects assessment due to the identification of potential residual effects which may interact

cumulatively with other physical activities within the boundaries of this assessment. The following sections present:

- a discussion of the residual effects and the expressed views of Indigenous groups related to each;
- mitigation measures which are proposed to eliminate or reduce effects to the VC; and
- characterization of residual cumulative effects to the VC with consideration of the residual effect interaction with past, present and future physical activities.

18.4.2.1 Potential Cumulative Effects

18.4.2.1.1 Disturbance to physical and cultural heritage

To prevent inadvertent impacts to culturally- important and sacred sites, the Piikani Nation recommends a well flagged buffer around all sacred sites.

The Tsuut'ina Nation is concerned about inadvertent effects to sacred sites. To prevent this, the Tsuut'ina Nation recommends a 100 m buffer around all sacred sites.

Several of the First Nations who conducted Traditional Knowledge and Traditional Use (TK/TU) studies in 2014, 2015 and 2017 identified an interest in performing further assessment work in 2018 to refine recommendations for mitigation of impacts to specific traditional use sites and areas on Crown lands within the Grassy Mountain Project areas. These TK/TU field investigations were funded by Benga and led by First Nations and external reporting and mapping/GIS support was provided by Benga as needed to assist in reporting and mitigation planning. Additional TK/TU studies have been in progress throughout 2018. Findings from the 2018 TK/TU field investigations will be presented by Indigenous groups in reports and submitted to Benga for consideration.

In response to expressed interest in the HRIA completed for the Project, the HRIA results (including findings on archaeological resources and other historic resources) were provided to Treaty 7 First Nations at key community meetings and through guided tours of archaeological sites of interest.

18.4.2.1.2 Change in access to physical and cultural heritage

Indigenous groups provided limited physical and cultural heritage location information. However, where Project construction and operations activities overlap with physical and cultural heritage, access may be limited while active mining areas are not accessible until they are reclaimed and safe. Indigenous groups will continue to have access to lands for access to physical and cultural heritage where and when safety is not compromised.

18.4.2.1.3 Change to cultural value or importance associated with physical and cultural heritage

Indigenous groups' experience of land use within the range of visual and noise changes from the Project may be altered due to Project noise and visual disturbance. As a result, the value and importance of physical and cultural heritage sites to Indigenous groups in the areas may be affected.

18.4.2.2 Characterization of Residual Cumulative Effects

18.4.2.2.1 Disturbance to physical and cultural heritage

After implementation of the mitigations described above and assuming future occur as planned, the Project is expected to have residual cumulative effect of disturbance to physical and cultural heritage. The Project will have effects during Project construction and operations including disturbance to features associated with sacred, gathering, or habitation sites and change in access to physical and cultural heritage. The Project will have effects during Project construction and operations including disturbance to features associated with sacred, gathering, or habitation sites.

18.4.2.2.2 Change in access to physical and cultural heritage

After implementation of the mitigations described above and assuming future mitigations occur as planned, the Project is expected to result in residual cumulative effect on use or access to physical and cultural heritage. The Project will have effects during Project construction and operations on land access for use of physical and cultural heritage sites.

18.4.2.2.3 Change to cultural value or importance associated with physical and cultural heritage

After implementation of the mitigations described above and assuming future Projects occur as planned, the Project is expected to result in residual cumulative effect to the cultural value or importance associated with physical and cultural heritage.

18.4.2.2.4 Significance

The residual cumulative effects on Indigenous Physical and Cultural Heritage are of low magnitude, regional geographic extent, medium-term, continuous frequency, reversible and sensitive in ecological and social context. The cumulative effects on Indigenous Physical and Cultural Heritage are not significant.

18.4.2.2.5 Confidence

The prediction of residual cumulative effects to Indigenous Physical and Cultural Heritage is made with medium confidence given the Historic Resources VC finding of low cumulative effects to historic resources, but with consideration of the limited information received from

Indigenous groups regarding the locations and importance of Indigenous Physical and Cultural Heritage sites and the current quality of their experience.

19.0 FOLLOW UP AND MONITORING

Project-specific follow-up for the potential effects to the Current Use of Lands and Resources for Traditional Purposes and Indigenous Physical and Cultural Heritage VCs has been included for each Indigenous group in this report. At a summary level, Benga is proposing the following actions in terms of monitoring and follow up:

- An Indigenous Environmental Stewardship Committee will be established, to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise;
- An Indigenous monitoring program will be implemented, which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance;
- Benga will continue to work with Indigenous groups to improve the Access Management Plan (AMP) to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- Benga has committed to continuing to work with Indigenous communities to develop the final management plans in coordination with regulatory proceedings, project approvals, and engineering and design schedules;
- A Cultural Site Discovery Contingency Plan will be developed and implemented for culturally important sites identified during construction or operations;
- If avoidance of any TK/TU features is not possible, Benga will work with affected Indigenous groups to develop and plan for mitigation of the site; and
- Benga will support a cultural competency program for its employees and contractors.

Other monitoring and follow up activities will be considered by Benga as they are brought forward by Indigenous groups.

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APPENDIX 4.1-2: CONSOLIDATED INDIGENOUS MITIGATION LIST

Appendix 4.1-2
Consolidated Indigenous Mitigation List

Hunting and Trapping

Benga will:

- continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations and to reduce effects to wildlife;
- minimize the overall disturbance footprint through the mine planning process;
- conduct pre-disturbance surveys along the edges of all areas to be cleared during Project development to determine the occurrence of any important wildlife habitat features;
- retain slash and large woody debris in the salvaged soil to provide microsites for native plant and hide cover for wildlife;
- maintain forested buffers around riparian corridors, high activity linear corridors; preserve remnant forest patches in the development areas to provide habitat;
- commence reclamation early in mine operations by seeding reclaimable areas with plant species favorable to grizzly bear forage and by planting shrub and tree species that provide suitable cover;
- establish a variety of vegetation species and communities suitable for wildlife and encourage structural complexity within the forests during reclamation;
- incorporate the existing legacy mining disturbances into the development and reclamation plans for the Project;
- continue to improve the Waste Management Plan prior to construction and operational activities to minimize the attraction of wildlife;
- enforce a speed limit along the main access road;
- follow best management practices for camps, fences and barriers as described in the Alberta Bear Smart Program Manual and ensure all waste is stored in wildlife-proof containers and disposed of properly;
- incorporate a minimum of six wildlife crossings into the design of the coal conveyor;
- erect wildlife crossing signs to minimize wildlife-vehicle collisions;
- engage with the Indigenous communities during construction, operations and reclamation, including review and input into management and monitoring plans, discussion of options to facilitate access for traditional activities, construction timing and reclamation;

- retain vegetation adjacent to high-activity linear corridors (*e.g.*, access roads, coal conveyor) to reduce the extent of noise and visual sensory disturbances to the extent possible;
- continue to work with the Indigenous communities to identify species of importance for harvesting prior to construction activities;
- conduct nest sweeps prior to any vegetation (tree) clearing in accordance with the appropriate timing windows for the region as provided under the Migratory Bird Convention Act to ensure no nesting eagles are affected;
- Store all toxic materials, including those used for blasting, in secure areas that are inaccessible to wildlife (*e.g.*, buildings, storage areas surrounded by wildlife-proof fencing). In addition, proper handling and storage of industrial materials and debris within the Project footprint will be maintained to minimize potential risks to wildlife; and
- mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears.

Fishing

Benga will:

- continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate fishing locations and access routes;
- implement a Fisheries Offsetting Plan and Offsetting Effectiveness Monitoring Plan that more than offset the habitat losses caused by the Project related to Gold Creek and Blairmore Creek; and
- maintain a 100 m undisturbed forested buffer around Blairmore and Gold Creeks.

Plant Gathering

Benga will:

- conduct on-going consultation with Indigenous communities in designing mitigation measures for plant gathering including sharing information about construction timing and management of valued vegetation;

- implement a re-vegetation program which will target the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support valued vegetation;
- implement a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- provide access to Benga private land outside of the Project for Indigenous harvesting of lodgepole pine and other culturally important plants;
- continue to improve the Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate plant gathering locations;
- consult with the Indigenous communities on updates to the Conservation and Reclamation (C&R) plan;
- will include the use of native species wherever possible in the reclamation plan to support revegetation of traditional-use;
- support an Indigenous Environmental Stewardship Committee, one of whose functions will be to provide advice on environmental stewardship and land use values as they arise;
- support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes;
- maintain a 100 m riparian buffer zone around Blairmore and Gold Creeks to minimize disturbance to riparian vegetation; and
- consider mitigation suggestions proposed by Indigenous communities regarding traditional and medicinal plants.

Trails and Travelways

Benga will:

- continue to improve the Access Management Plan that will include notification of access restrictions during construction as required for safety purposes to allow for planning alternate trails and travelways; and
- share information about construction timing.

Cultural and Spiritual Values

Benga will:

- continue to work with Indiginous communities to improve the Access Management Plan to grant access to non-operational areas of Benga land and crown land being used for the Project. The AMP will control access to authorized persons, will ban fishing by employees and facilitate access to traditional use areas for the Indigenous community where feasible. The AMP will include notification of access restrictions during construction required for safety purposes to allow for planning alternate plant gathering locations;
- mark or otherwise protected identified sites of cultural and sacred importance within 100 m of Project activity and outside the Project footprint prior to land disturbance;
- work with Alberta Culture and Tourism and the Indigenous community to develop and plan for mitigation of identified TK/TU features if avoidance is not possible;
- continue to work with the Indigenous community to identify ways in which TK can be considered during Project activities and in the development of environmental management plans;
- support a cultural competency program for its employees and contractors;
- continue to support local and Indigenous cultural events and ceremonies through its Indigenous engagement and initiatives such as its community sponsorship program;
- develop and implement a Cultural Site Discovery Contingency Plan in consultation with Indigenous communities for culturally important sites discovered during construction or operations;
- support an Indigenous Environmental Stewardship Committee to provide advice on land use values and sites of cultural, spiritual and traditional importance as they arise; and
- support an Indigenous monitoring program which will include monitoring of a suite of culturally defined environmental attributes, including archaeological sites of historical and cultural significance.

Physical & Cultural Heritage

Benga will:

- work with Alberta Culture and Tourism and the Indigenous community to develop and plan for mitigation of identified TK/TU features if avoidance is not possible;
- make minor modifications to the Project footprint to avoid and protect pre-contact sites DjPo-98 and DjPo-130;

- continue to meet with Indigenous communities to discuss management of identified culturally important and sacred sites;
- develop and implement a Cultural Site Discovery Contingency Plan in consultation with Indigenous communities for culturally important sites discovered during construction or operations;
- support an Indigenous Monitoring Program that will include consideration of cultural heritage impacts and monitoring for cultural sites; and
- continue to improve the AMP for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate land use locations.

APPENDIX 4.3-1: WILDLIFE AND FISHERIES IDENTIFIED AS SPECIES OF INTEREST BY INDIGENOUS GROUPS

Table 4.3-1. Wildlife and Fisheries Identified as Species of Interest by Indigenous Groups

Species of Interest	Piikani Nation	Kainai Nation	Siksika Nation	Tsuutina Nation	Stoney Nakoda Nation	Samson Cree Nation	Montana Nation	Ermenskin Nation	Louis Bull Nation	Metis Nation of Alberta	Metis Nation of BC	Ktunaxa Nation	Included in EIA as Valued Component	Reason for Not including Species as a VC for Fisheries or Wildlife
Owl	X												Yes	Canada Lynx, Great Grey Owl, Moose used as representative species for early successional to mature forest-dependent wildlife.
Woodpecker		X											No	Canada Lynx, Great Grey Owl, Moose used as representative species for early successional to mature forest-dependent wildlife.
Wild Turkey		X								X			No	Canada Lynx, Great Grey Owl, Moose used as representative species for early successional to mature forest-dependent wildlife.
Grouse	X					X				X	X		No	Canada Lynx, Great Grey Owl, Moose used as representative) species for early successional to mature forest-dependent wildlife.
Sprague's Pipit						X							No	Canada Lynx, Great Grey Owl, Moose used as representative species for early successional to mature forest-dependent wildlife.
Crow		X											No	Canada Lynx, Great Grey Owl, Moose used as representative species for early successional to mature forest-dependent wildlife.
Eagle (golden, bald)	X	X	X	X									Yes	
Duck (merganser, mallard)		X											No	Columbia Spotted Frog and Western Toad used as representative species for wetland-dependent wildlife
Osprey		X											No	Eagle used as indicator (or surrogate species)
Canada Goose		X											No	Columbia Spotted Frog and Western Toad used as representative species for wetland-dependent wildlife
Hawk		X											No	Eagle used as representative species
Bear (grizzly, black)	X	X		X	X	X				X	X	X	Yes	
Cougar		X		X		X							No	Canada Lynx used as representative species for early successional species.
Lynx				X	X	X							Yes	
Wolf	X	X		X		X							No	Canada Lynx used as representative species for early successional species.

Table 4.3-1. Wildlife and Fisheries Identified as Species of Interest by Indigenous Groups

Species of Interest	Piikani Nation	Kainai Nation	Siksika Nation	Tsuutina Nation	Stoney Nakoda Nation	Samson Cree Nation	Montana Nation	Ermenskin Nation	Louis Bull Nation	Metis Nation of Alberta	Metis Nation of BC	Ktunaxa Nation	Included in EIA as Valued Component	Reason for Not including Species as a VC for Fisheries or Wildlife
Coyote					X								No	Canada Lynx used as representative species for early successional species.
Wolverine						X							No	Canada Lynx used as representative species for early successional species.
Otter	X												No	Columbia Spotted Frog and Western Toad used as representative species for wetland-depended wildlife
Marten					X								Yes	
Mink					X								No	Canada Lynx used as representative species for early successional species.
Skunk						X							No	Canada Lynx used as representative species for early successional species.
Gopher	X												No	Canada Lynx used as representative species for early successional species.
Badger	X												No	Canada Lynx used as representative species for early successional species. As well, an assessment was provided in the response to IR 5.34
Beaver	X		X		X								No	Columbia Spotted Frog and Western Toad used as representative species for wetland-depended wildlife
Muskrat			X										No	Columbia Spotted Frog and Western Toad used as representative species for wetland-depended wildlife
Porcupine	X												No	Canada Lynx used as representative species for early successional species.
Rabbit	X	X	X	X							X		No	Canada Lynx used as representative species for early successional species.
Squirrel	X	X		X	X								No	Canada Lynx used as representative species for early successional species.
Mice/Small Rodents				X	X								No	Canada Lynx used as representative species for early successional species.
Buffalo/Bison	X	X	X	X								X	No	Not originally included, but an assessment has been provided in response to IR 5.35 (Addendum 10)
Moose	X	X	X	X	X	X					X	X	Yes	--

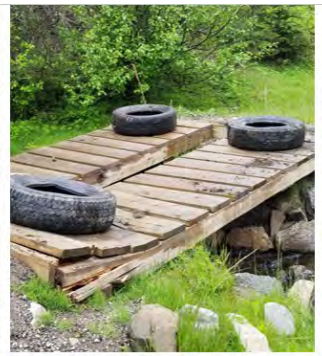
Table 4.3-1. Wildlife and Fisheries Identified as Species of Interest by Indigenous Groups

Species of Interest	Piikani Nation	Kainai Nation	Siksika Nation	Tsuutina Nation	Stoney Nakoda Nation	Samson Cree Nation	Montana Nation	Ermenskin Nation	Louis Bull Nation	Metis Nation of Alberta	Metis Nation of BC	Ktunaxa Nation	Included in EIA as Valued Component	Reason for Not including Species as a VC for Fisheries or Wildlife
Bighorn Sheep	X	X	X	X		X						X	Yes	--
Mountain Goat	X											X	Yes	--
Deer (Mule, Whitetailed)	X	X	X	X	X	X				X	X	X	No	Moose and Elk used as representative species for grassland/successional species
Elk	X	X	X	X	X	X				X	X	X	Yes	--
Frog	X			X									Yes	Western Toad and Columbia Spotted Frog are included in the EIA
Snake	X												No	Not common in the study area.
West-slope cutthroat trout	X	X	X	X	X	X			X	X		X	Yes	--
Rainbow trout	X	X	X	X	X							X	No	Similar to WSCT
Bull trout	X	X	X		X								No	Similar to WSCT
Rocky Mountain whitefish	X	X	X										No	Not found in Gold Creek or Blairmore Creek therefore not studied.
Brook trout	X	X	X		X								No	Similar to WSCT

APPENDIX 4.5-1: ACCESS MANAGEMENT PLAN

RIVERSDALE RESOURCES

Benga Mining Limited Operating as Riversdale Resources



Grassy Mountain Project

Access Management Plan

RIVERSDALE RESOURCES

Benga Mining Limited Operating as Riversdale Resources

Grassy Mountain Project Access Management Plan

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Introduction

Benga Mining Ltd. operating as Riversdale Resources (hereby referred to as Riversdale, or the Company) is committed to being a valued community partner, responsible land owner, and land steward. Part of being a strong community partner, responsible land owner, and land steward includes managing the activities that occur on Company-controlled lands through the Pre-Permitting, Construction, and Operation phases of the Grassy Mountain Coal Project (the Project).

Should the Project be approved, Riversdale would consolidate its private land holdings and surface rights granted through mineral surface leases (MSL) into a contiguous footprint for the purposes of developing the Project. In order to ensure minimum impact to Indigenous access and use of adjacent lands Riversdale has committed to developing an adaptive Access Management Plan (AMP, or the Plan). The AMP will also provide for access to portions of the Project footprint while they are not actively part of the mine when it is safe to do so. The details of this plan are intended to protect indigenous rights while also balancing operational considerations and worker safety.

This Access Management Plan provides the framework for how Riversdale will manage access to Riversdale privately owned lands, and a future Project footprint, through all stages of Project development including Pre- and Post-Project Approval. The AMP is designed to offer a balanced approach whereby the Company manages and makes available lands for traditional purposes, while also balancing the safety and security needs warranted for an active surface mining operation.

Purpose

The purpose of this AMP is to effectively manage existing access requests to private lands within the Project footprint and to mitigate predicted Project effects on access. This AMP also describes the approach for monitoring mitigation effectiveness and to identify actionable adaptive mitigations where needed and practicable.

The structure and procedure for managing access has been developed to address two primary aspects of the Project, 1) active, ongoing requests for TLU and recreational use access onto private lands owned by Riversdale, prior to Project approval, and 2) anticipated access requests for TLU and recreational use on the contiguous Project footprint (comprising public and private properties) post Project approval.

This AMP presents Riversdale`s currently available information regarding the mitigation, monitoring, and adaptive management programs for managing the potential effects of access for traditional and recreational land use as it relates to the Project. The AMP may be amended by Riversdale following additional consultation with regulators, Indigenous communities, and stakeholders.

Goals

Goal 1: Maintain an open and transparent dialogue for traditional and recreational use requests through the duration of the Project.

Goal 2: Minimize the impact of changes to access within, and adjacent to, the Project footprint.

Goal 3: Maintain an effective access management strategy that balances Indigenous Rights, workplace safety, and environmental protection.

Goal 4: Monitor the effectiveness of defined access protocol (including permitting).

Goal 5: Utilize an adaptive management approach to maximizing access opportunities where feasible.

Application

The two types of access supported by this AMP are related to 1) Traditional Land Use (TLU) which includes Aboriginal and Treaty Rights to hunt, fish, gather, and engage in ceremonial activities, and 2) recreational land use. Riversdale will manage industrial or resource use requests (i.e. forestry and non-forestry) of the Project footprint on a case-by-case basis through other agreements which are not captured in this AMP.

This Plan is applicable to all people and groups who wish to access the Project footprint or other Riversdale private lands for traditional or recreational land use purposes. Riversdale will manage access to controlled lands in an equitable and safe manner that protects the rights of Indigenous people, the well-being of our community, and the safety of workers.

Community Input

Riversdale has presented iterations of the AMP to Indigenous communities to solicit feedback and identify opportunities to provide safe access opportunities in conjunction with different management scenarios pre- and post- Project approval. The key feedback and focal points received during AMP discussions and presentations include:

- Allow for safe and reasonable access accommodations to portions of the Project footprint pre-Project approval for TLU.
- There is support for a permit-based access management system to track access requests, avoid scheduling conflicts, ensure privacy, and document lawful permission to access private lands.
- Minimize the potential impacts of intensive hunting and fishing pressure on private property within the Project footprint.
- Indigenous communities confirmed that visitor and site personnel safety and security is the utmost priority for all actions and protocols related to access management.
- Minimize disturbance to riparian areas and other locations of ecological or cultural value.

Limitations

Future versions of the AMP will be updated with content from the Joint Review Panel (JRP) Report, other provincial authorizations and permits, the federal Decision Statement, future stages of Project planning, and feedback from Indigenous communities and regional stakeholders. Version control of this document, and similar management plans, will be tracked for the duration of the Project.

Projections

Riversdale believe that the AMP, and other management plans, will require ongoing review through the duration of the Project. Although the AMP will be a `living document`, specific requirements will be

captured through all version iterations carrying forward beyond Project Approval. Riversdale envisions those key requirements will come from:

- Receipt and review of the JRP Report and Minister`s Decision Statement following the JRP Hearing;
- Receipt and review of the Alberta EPEA approval conditions;
- Review of current applicable municipal, provincial, and federal regulations, guidelines, and legislation to be addressed in the AMP;
- Ongoing dialogue and engagement with regulators, Indigenous communities, and stakeholders;
- Receipt and review of proposed key metrics, performance indicators, threshold values, or other measurable and tangible parameters related to mitigation effectiveness as indicated from our community engagement;
- Consideration for future stages of Project planning, including environmental, commercial, and technical factors.
- Review of the updated AMP with regulators, Indigenous communities, and stakeholders prior to finalization and submission to appropriate regulators as an anticipated condition of an EPEA approval.

Legislation, Regulations, and Approvals

The Legislation, Regulations, and Approvals section of the AMP will be updated as required and will list relevant provincial and federal legislation, regulations, approvals, and other guidance references relevant to security and access management.

Riversdale is required to provide a safe workplace and to protect workers from harm under Section 3 of the Alberta *Occupational Health & Safety Act*.

An MSL under the *Public Lands Act*, issued by the Alberta Energy Regulator (AER), would allow Riversdale to operate and manage the portion of the Project footprint on Crown Lands for the duration of the Project.

Riversdale has the right to protect company-owned property, and company-controlled property from trespassing as enacted by the *Petty Trespass Act* and the *Trespass to Premises Act*, respectively.

Access Overview

For the purpose of access management, the Grassy Mountain Coal Project can be summarized into two major phases; Pre-Approval and Post-Approval, consisting of Construction, Commissioning, and long-term Operation, including reclamation. These phases have a material impact on both ease of accessibility to areas on the Project footprint and the nature of permitted activities that can occur on the Grassy Mountain mine footprint.

Riversdale currently manages company-owned property within the Project footprint to restrict certain types of land uses and trespassing. Riversdale does not have authority to manage access, or land use, on public lands outside of the applied-for Project footprint; therefore, the focus of this AMP is limited to the boundaries of the expected Project footprint.

Training and Communication

Riversdale will provide training to all staff and contractors regarding respectful land use and access management, so they are aware of the elements of the AMP. In this training staff and contractors will learn about Indigenous traditional lands, heritage resources, and the importance of culturally significant features and areas. Recreational land use restrictions for employees and contractors will be emphasized to minimize intensive hunting, fishing, and other recreational pressures around the Project boundary. Staff and contractors will be notified that site monitoring will be ongoing for the life of the Project.

Mitigation

With reference to Riversdale's AMP Goals, the Company will maintain dialogue and solicit feedback from both recreational and traditional land use access requests. By managing access through collaboration, access users benefit from a transparent and consistent access management request protocol, and the Company benefits by having direct control of visitor access to maintain safety and security on the Project site. While Riversdale may not always be able to accommodate all access requests to active construction or operational areas, Riversdale will facilitate access to or through the Project footprint to non-active areas to the extent possible. Riversdale supports the process for Indigenous groups to describe culturally significant elements within the Project footprint. Riversdale will work collaboratively with Indigenous groups to identify and deploy effective mitigations to facilitate access to those culturally significant elements. This will be a critical process during Project construction, mine operation, and mine reclamation.

Monitoring

To determine if the AMP is effective in accommodating traditional and recreational access requests, Riversdale will seek feedback from internal stakeholders, access users, Indigenous groups, and the Safety, Health & Environment department. Riversdale will identify indicators with those feedback groups and track those indicators over time. Potential Indicators include:

- Access permit success rate
- Quantity and frequency of access requests
- Seasonality and duration of access requests
- Overall experience rating from users
- Intensity of access disturbance in specific Project site areas

Adaptive Management Program

Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Riversdale will use a *Plan-Do-Check-Act* management approach to optimize operational safety and access for traditional and recreational users. The findings of the AMP monitoring program will drive adaptive changes to the way Riversdale manages access requests, communicating access permitting requirements, and soliciting feedback from access users.

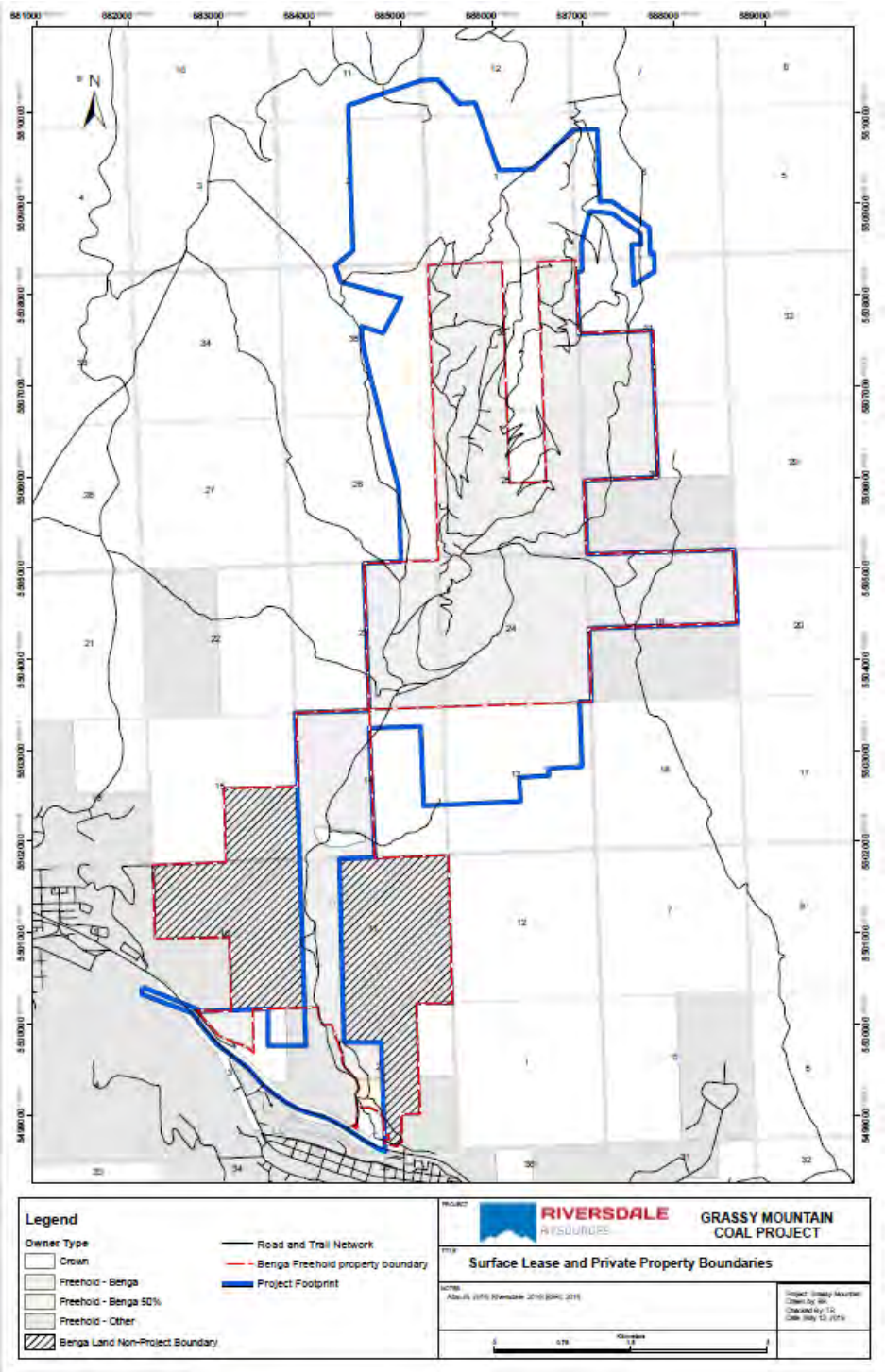

Figure 1. Draft Grassy Mountain Mine Project Footprint

Pre-Approval

During the Pre-Approval phase, Riversdale will maintain landowner property rights over private lands owned by the Company (including Grassy Mountain Road). Riversdale will have no direct control over adjacent crown lands or the trail and road network therein during this period. Requests for access onto Riversdale property are managed through an Access Permit Application process. Riversdale reserves the right to grant or deny access to applicants for both traditional and recreational use requests.

Post-Approval

Should the Project be approved, Riversdale will consolidate its private land holdings and surface rights holdings into a contiguous Project footprint, at which point Riversdale will be in exclusive occupation and access control of the Project footprint for the purposes of developing the Project. Construction activities will begin shortly after Project approval, and the entire Project footprint will fall under active security and access management. All access requests will require advance notice and a formal access request application. Similar to the Pre-Approval stage requests for access onto Riversdale property will be managed through an Access Permit Application process. Access request applications will require advance notification to the Access Management Team. The Access Management Team will assess Permit Applications on a case-by-case basis to determine if a safe route can be established within the timeframe and operational bandwidth available to the Access Management Team. Formal written approval from Riversdale will be required for all access requests prior to accessing the Project site.

Security Access Control

The primary access point to the Grassy Mountain Project is along Grassy Mountain Road, from Provincial Highway 3. Grassy Mountain Road is a private road, maintained by Riversdale, with multiple control structures including swing gates, Texas gates, and extensive signage. A Security Access Control point (SAC) will be installed on the primary access road into the construction work areas. The SAC will consist of a heavy-duty permanently locked gate which will be monitored at all times. The purpose of the SAC will be the primary access control structure through the construction phase of the Project. Only authorized personnel will have access to Grassy Mountain beyond the SAC. As the Construction phase winds down and Riversdale prepares for Commissioning and Operations, a second permanent SAC will be installed along the Overland Conveyor Right of Way and this will serve as the primary access control structure for the mine through its estimated 25-year operational life.

Access Control Areas

The North Access Control Area will have extensive industrial activity from the point of Construction initiation through Operations and reclamation. This large area will have significant permanent access application requirements to ensure the safety for visitors and the personnel working at the mine.

The South Access Control Area will have both permanent and semi-permanent infrastructure installed during the construction phase and operated through the life of the Project. Portions of the South Access Control Area will generally have fewer temporal and spatial restrictions than portions of the North Access Control Area. Access to the South Access Control Area will require coordination with, and approval from, Riversdale's Access Management Team prior to the anticipated access date.

North Access Control Area
- Area north of SAC
- Mine Pit
- Coal Processing Plant
- Industrial Area
- High Traffic – Large Equipment

Security Access Control (SAC) Boundary
- Location of Security team
- Mine Rescue Team
- Controlled 24/7

South Access Control Area
- SAC south to HWY 3
- Conveyor and Access Road
- Traffic – Busses and Trucks

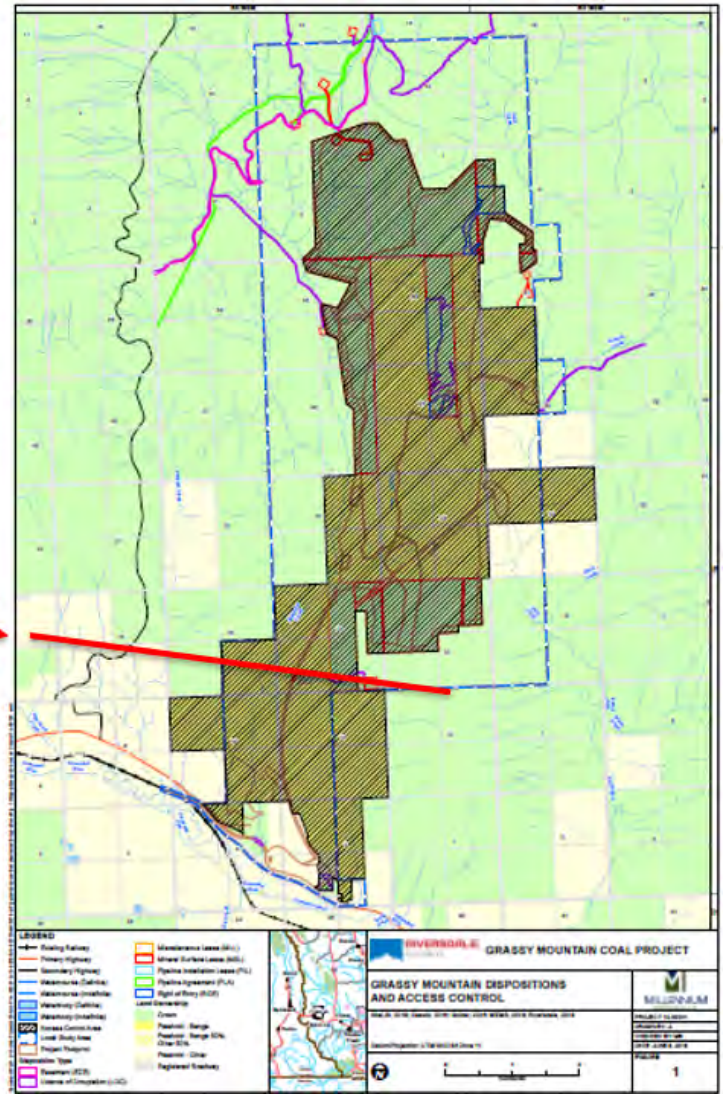

Figure 2. Access Control Areas and Features

Approval Application Process

Should the Project be approved, Riversdale will establish permanent access control measures on the Project footprint and begin proactive access management and security. Workers (both Project employees and Contractors) will be granted permanent site access once they have fulfilled site access requirements (e.g. safety induction training, employee or contractor onboarding, drug and alcohol testing, etc.). Note, this AMP may have linkages to pre-site access requirements, but they are not part of the AMP.

Non-workers (e.g. regulators, Riversdale employees visiting the site on a non-regular basis, traditional, and other land users, etc.) will be granted temporary site access upon completion of a visitor safety induction and will not have to meet worker site access requirements.

Access applications for traditional and recreational use requests will be reviewed on a case by case basis. Circumstances that might compromise non-worker safety, worker safety, or operational security may warrant access restrictions.

Access to the Project footprint will be granted to individuals who agree to comply with site access and safety rules. Access may be revoked for individuals who do not comply with site requirements or rules. Access may also be revoked if site conditions change or become unsafe for non-workers due to operational, or environmental risks. Activities or circumstances that might compromise non-worker safety, and warrant access restrictions, include but are not limited to:

- Active construction work including site personnel, powered mobile equipment, controlled product exposure
- Active areas of the site including the mine (pits, stockpiles, dams, plant, etc.)
- Use of firearms within a setback of active areas of the site
- Upset operating conditions including extreme weather or fire conditions
- Suspected or confirmed use of drugs or alcohol on site
- Repeated infractions of site access rules

Permitted Activities

Riversdale owns private land at the Grassy Mountain site, and other properties throughout the Crowsnest Pass. Many of these properties have had some form of industrial activity in the past, specifically surface and below-ground mining, and as a result many properties also have derelict mining infrastructure that is no longer safe or intended for human occupancy. For this primary safety reason, Riversdale restricts access to select activities and locations where hazards have either been eliminated or controlled. On designated lands where activities are permitted (through Riversdale's Access Permitting System) the following activities may occur:

- Firewood harvesting (standing dead or deadfall only)
- Christmas tree harvesting
- Teepee pole and other structural lumber for ceremonial purposes (generally Lodgepole and Poplar or Cottonwood trees)
- Medicinal or Ceremonial plant collection

- Berry and plant foraging
- Seed collection
- Fishing

Restricted Activities

In consideration for the safety of community members, and workers employed by Riversdale, the following activities are restricted on Riversdale property.

- Hunting (this includes bow hunting, rifle hunting, and the discharge of any firearm) or trapping
- Shooting (this includes archery equipment, all firearms, air powered rifles, airsoft, paintball)
- Camping and overnight occupancy
- Fires, use of explosives or fireworks
- Soil or aggregate collection or disposal
- Waste disposal

Instructions for Requesting Access

Access to the Project site requires permitted approval from Riversdale's Access Management Team. To apply for an Access Permit:

1) Call the Riversdale office at 403 753 5160 **two business days prior** to the planned arrival
2) Ask to speak with the **Access Management Team;** The Access Management Team will review the applicant's plans and provide feedback on whether they are eligible for a permit or not.
3) If eligible, the applicant will be instructed to visit the Riversdale office during regular business hours (Monday to Friday 8:30 am to 5:00 pm) to fill out their permit.

Access permits will be reviewed on a case by case basis; Riversdale reserves the right to deny or revoke access at any time, for any reason. All permit conditions including safety instructions and access periods must be followed by the permit applicant(s).

General Rules and Restrictions

- Tree removal (including live and standing dead trees) during the bird nesting window will require a bird sweep from a qualified professional prior to harvest.
- Riversdale may, at its discretion, restrict or revoke access.
- Riversdale may designate specific areas for certain harvest activities to minimize impact.
- Tree harvesters may be required to demonstrate tree harvesting experience/competency and show appropriate tree harvesting equipment (including personal protective equipment) prior to permit approval.
- Vehicles must be clean and in good working condition prior to entering the Project site.
- Vehicles and trailers intended for hauling materials on the Project site must be in good working order and suitably equipped for the weight and type of load being hauled.

RIVERSDALE

Riversdale Permit ID:

Grassy Mountain Project - Access Permit Application

PLEASE FILL OUT COMPLETELY		RIVERSDALE CONDITIONS
Applicant (Full Name)		
Phone Number		
Emergency Contact (Full Name)		
Phone Number		
Type of Activity:		
Name of ALL Visitors and Organization:		
Dates Requested for Activity:		
Start time:	End Time:	
Location of Activity (note LSD):		

APPLICANT ACKNOWLEDGEMENT		
FULL NAME	SIGNATURE	DATE

By signing this acknowledgement, I declare that I will follow all the Riversdale Resources instructions, conditions of this permit, and any other requirements identified by Riversdale Resources. Additionally, I acknowledge that:

- as the applicant you are responsible for checking in with the Riversdale designate upon entry and exit of the property (additional check ins may be required as a condition of approval)
- this permit may be revoked by a Riversdale employee at any time, with or without cause
- as the applicant you are responsible for the safety and conduct of all persons on this permit
- all municipal, provincial, and federal regulations apply while on Riversdale Resources property
- failure to comply with company rules or permit conditions may result in temporary or permanent restrictions for future access

RIVERSDALE AUTHORIZATION (Please Circle)		
APPROVED	DENIED	
FULL NAME & TITLE	SIGNATURE	DATE
Contact Phone:		
Contact Instructions:		

Figure 3. Example Access Permit Application

Document Control

Riversdale`s Access Management Plan will be evaluated annually and will be maintained and approved by the Safety, Health and Environment Department.

Table 1. Revision Table

Status	Created/Approved By	Date
Version 1 (Draft Pre-Approval)	Tyler Riewe – Senior Manager – SH&E	13 May 2019
Amendment #1		

APPENDIX 4.9-1: HUMAN HEALTH AND WILDLIFE SCREENING RISK ASSESSMENT

MILLENNIUM
EMS Solutions Ltd.

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toll free: 888.722.2563
www.mems.ca

Grassy Mountain Coal Project
Environmental Impact Assessment
Updated Human Health and Wildlife Screening Risk Assessment

Prepared for:
Benga Mining Limited

Prepared by:
Millennium EMS Solutions Ltd.
Suite 325, 1925 18 Avenue NE
Calgary, Alberta
T2E 7T8

Updated July 2019

Executive Summary

The work presented herein is in response to the Joint Review Panel (JRP) information request (IR) 4.9 (JRP IR-4.9) (CEAR #212) which requested provision of a revised version of the original HHRA which integrates information previously provided as Addenda 1 through 9 and all relevant information historically provided in response to other jurisdictional IRs.

All relevant changes have been captured in the Concordance Table provided immediately following this Executive Summary.

INTRODUCTION

Benga Mining Limited (Benga) retained Millennium EMS Solutions Ltd. (MEMS) to conduct a detailed quantitative human health risk assessment (HHRA) for the Grassy Mountain Coal Project (the Project). The HHRA evaluated both current and future human health risks associated with exposures to a variety of contaminants of potential concern (COPC) associated with Project activities. In order to evaluate the likelihood, degree of exposure and the possibility of adverse health effects, MEMS followed a standardized risk assessment process as described by the Government of Alberta, Health Canada, and the United States Environmental Protection Agency (US EPA) Canadian and International Guidance. The basic steps of the HHRA risk assessment process are as follows:

- Problem formulation - identification of COPCs, potentially operative exposure pathways, potential receptors and development of a conceptual site model (CSM);
- Exposure assessment - estimation of the exposure dose for human receptors for each COPC and each operative exposure pathway identified in the problem formulation;
- Toxicity assessment - determination of the relationship between the dose of each COPC to which a person is exposed over a specified duration and the potential for associated adverse health effects; and
- Risk characterization - evaluation of potential risks to human receptors based on the exposure and toxicity assessments, and assessment of the associated uncertainties.

PROBLEM FORMULATION

Contaminants of potential concern (COPCs) were identified through an inventory of expected Project emissions. Through comprehensive mitigation and management, the Project was determined to have no direct effect on water quality; therefore, emission into air were the only Project related chemical source which required detailed exposure risk assessment in the HHRA. Those COPCs identified for the Project included:

- criteria air contaminants (CACs);
- metals;
- polycyclic aromatic hydrocarbons (PAHs); and
- volatile organic compounds (VOCs).

In addition, coal dust, diesel engine emissions and silica were added as COPCs in response to IRs from Alberta Energy Regulator (AER) and Health Canada (IRs: AER-154 [Addendum 5, CEAR #69], HC-1 [Addendum 6, CEAR #70], JRP IR-4.10 [CEAR #212]).

Potential human receptors were identified as people potentially impacted by the Project and included: local residents, communities, and any people spending time near the Project who could be exposed to the COPCs. For the current HHRA, a select number and type of potential human receptors and receptor locations were identified to best represent persons potentially exposed to the predicted Project emissions.

Human receptor types identified for assessment in the HHRA were:

- Indigenous residents;
- agricultural residents;
- other area residents;
- workers; and
- visitors to the area.

A total of 15 HHRA receptor locations were assessed. Thirteen (13) HHRA receptor locations were identified as locations were people lived, harvested country foods, or recreated (*i.e.*, cabins, homes, traditional lands, and recreational areas). In addition, a Local Study Area (LSA) and Regional Study Area (RSA) Maximum Point of Impingement (MPOI) location was also assessed. The MPOI locations serve as a hypothetical worst-case receptor location as they represent the location of the highest predicted air concentrations and thus, the highest potential risk of adverse health effects.

A summary of the applicable exposure pathways for each receptor group is presented in the following table.

Multimedia Exposure Pathways	
Exposure Pathway	**Receptor Groups**
Inhalation of COPCs	Indigenous Other Area Residents

Multimedia Exposure Pathways	
Exposure Pathway	**Receptor Groups**
Direct Contact with COPCs in Soil	Indigenous Other Area Residents
Ingestion of Local Vegetation	Indigenous & Agricultural
Ingestion of Wildlife	Indigenous
Direct Contact and Ingestion of Surface Water	Indigenous
Ingestion of Local Fish	Indigenous

EXPOSURE ASSESSMENT

The exposure assessment involved the estimation of the amount of each COPC that receptors may be exposed to, based on reasonable worst-case assumptions.

Concentrations were evaluated separately for the Project, Baseline, and Application cases and included both emissions associated with the Project and the emissions from other sources within the RSA.

Human exposure was modelled for inhalation of emissions to air (risk evaluation based on acute and chronic inhalation), as well as through multimedia exposure which evaluated secondary exposures through oral ingestion and dermal contact. For purposes of estimating chronic exposures, it was assumed that humans would be continuously exposed for a lifetime (80 years).

TOXICITY ASSESSMENT

Toxicity assessment involves establishing the relationship between the amount of a contaminant to which a person is exposed over a specified duration, and the potential for adverse health effects. The exposure limit, or the amount of chemical identified to be a safe exposure concentration, is the toxicity reference value (TRV). Within the toxicity assessment step of the HHRA, a TRV was identified for all COPCs and all relevant exposure pathways (*i.e.*, inhalation, ingestion and dermal) and exposure durations (*i.e.*, acute and chronic). TRVs were preferentially selected from those published or recommended by the following agencies:

- Health Canada;
- Canadian Council of Ministers of the Environment (CCME);
- Alberta Environment and Parks (AEP);
- Ontario Ministry of the Environment (MOE);

- United States Environmental Protection Agency (USEPA);
- Agency for Toxic Substances and Disease Registry (ATSDR);
- National Institute of Public Health and the Environment (RIVM); and
- World Health Organization (WHO).

In addition, various forms of chemical interaction are possible as receptors are potentially exposed to mixtures of chemicals, and within these mixtures there is the potential for chemical interactions to affect toxicity. Consistent with Health Canada (2010a) recommendations, where chemicals have similar effects on the same target organs, they were assumed to have additive toxicity (*i.e.,* the toxic effects are combined).

As part of the toxicity evaluations, chemicals were assigned to toxicity groups based on critical effects and target organs. Chemicals were also grouped based on their potential to illicit carcinogenic effect (chemicals were evaluated as either carcinogenic or non-carcinogenic).

RISK CHARACTERIZATION

Risk characterization involves the quantification and evaluation of the estimated risks and hazards resulting from exposure to chemicals from the Project.

For non-carcinogenic COPCs, risks are characterized using hazard quotients (HQ). An HQ is the ratio of the predicted exposure (dose) to the TRV. An HQ less than 1.0 indicates that predicted exposures are less than the applied TRV and adverse effects are not expected for any receptors. Due to the potential for some chemicals to exist in multiple environmental media (*i.e.,* soil, water, air, food, and consumer products) an HQ value of less than 0.2 was selected as a conservative human health target for characterizing non-carcinogenic risk from the Project.

For carcinogenic COPCs, the potential risk of adverse health effects was assessed assuming an incremental lifetime cancer risk (ILCR). An ILCR value of 1 per 100,000 was selected as a human health target, consistent with federal and provincial guidance.

CONCLUSIONS OF THE HHRA

The emissions from the Project are not predicted to pose a risk of adverse health effects at the receptor locations accessible to the general public. While risk quotients greater than 1.0 were predicted, they were typically predicted to occur within the Mine Permit Boundary (an area with restricted road access and low likelihood of continuous public presence during construction and operation of the mine), were due to pre-existing baseline emissions or background concentrations assumed for the models with minimal contribution from the Project (*e.g.*, background soil or vegetation concentration),

or were determined to be a result of the conservatism built into the assessment and air dispersion models. Hence, the risk results outside the RSA-MPOI (within the Project Footprint) were not considered to be indicative of a potential for adverse human health effects.

WILDLIFE RISK ASSESSMENT

A screening level wildlife risk assessment (WRA) was also conducted. The results of the screening-level WRA did not indicate a predicted risk of adverse effect associated with Project emissions on the health of wildlife in the study areas. The maximum predicted air concentrations associated with Project emissions do not exceed either the acute or chronic TRVs protective of wildlife, with the exception of $PM_{2.5}$ in the mammalian acute assessment which was only slightly greater than 1.0. Similarly, maximum predicted long-term soil and surface water concentrations did not exceed the soil quality and surface water quality guidelines respectively. Because of the highly conservative assumptions that were used during the wildlife risk assessment, the prediction confidence was considered high.

Details of the wildlife risk assessment methods and results are provided in Appendix H (Screening Wildlife Risk Assessment).

INFORMATION (IR) RESPONSE CONCORDANCE SUMMARY TABLE

As requested in JRP IR-4.9 (CEAR #212), this document is an updated HHRA that integrates all the human health IR responses provided since 2016 from AER, Health Canada and ECCC (Addenda 1 through 9). In order to highlight where in the updated HHRA IR responses were integrated, the concordance table below was constructed to provide a list of the IRs and section numbers in the updated HHRA where IR responses have been added.

Concordance Table Summary

Source Information					Relevant Information and Section(s) Updated in the HHRA
Addendum	CEAA Document #	Supplemental Information Request #	Agency	Date Submitted (mm/dd/yr)	
4	55	17	CEAA	08/12/16 11/27/17	Section 6.1, 6.2, 6.3 and 6.4.
4	55	18	CEAA	08/12/16 11/27/17	Table 5.1-4
5	69	154	AER	02/28/18	Section 6.1.1.4, 6.1.3, 6.2.1.3, 6.2.3; Tables 5.1-1, 5.2-4, 5.3-1, 5.3-2, 6.1-1, 6.1-8, 6.2-1, 6.2-7, 6.7.1.
5	69	157	AER	02/28/18	Section 5.1.3 and 6.4
5	69	158	AER	02/28/18	Refer to updates for Addendum 8, HC-R2-4
5	69	159	AER	02/28/18	Refer to updates for Addendum 5, SIR 170
5	69	169	AER	02/28/18	Refer to updates for Addendum 5, SIR 170
5	69	170	AER	02/28/18	Section 6.2.2; Table 5.3-4, 6.1-9, 6.2-2, 6.3-5, 6.6-1
5	69	171	AER	02/28/18	Section 6.3.2, 6.4.1, 6.4.2; Table 6.3-5, 6.4-1, 6.6-1
5	69	172	AER	02/28/18	Refer to updates for Addendum 5, SIR 170 and 171
6	70	HC-1	Health Canada	04/30/18	Section 6.1.1.4, 6.1.3, 6.2.3, 6.2.1.4, 7.1, 7.2; Table 5.1-1, 5.3-1, 6.1-1, 6.2-1, 6.2-8; Appendices B, C, D
6	70	HC-2	Health Canada	04/30/18	Table 5.3-1, 6.1-1
6	70	HC-3	Health Canada	04/30/18	Section 6.1.1.1; Table 5.3-1, 5.3-2, 6.1-2
6	70	HC-4	Health Canada	04/30/18	Table 5.3-1, 6.1-1

Concordance Table Summary

Source Information					Relevant Information and Section(s) Updated in the HHRA
Addendum	CEAA Document #	Supplemental Information Request #	Agency	Date Submitted (mm/dd/yr)	
6	70	HC-6	Health Canada	04/30/18	Section 6.1.2; Table 5.3-4, 6.1-10, 6.1-11
6	70	HC-8	Health Canada	04/30/18	Section 5.2.1, 5.2.2, 6.3.1, 6.3.3; Table 5.2.1, 5.2-4, 6.3-1, 6.3-2 6.3-3, 6.3-4
6	70	HC-9	Health Canada	04/30/18	Section 5.1.2; Table 5.1-4
6	70	HC-10	Health Canada	04/30/18	Refer to updates for JRP IR-4.11; Appendix B
6	70	HC-11	Health Canada	04/30/18	Table 5.3-3
6	70	HC-13	Health Canada	04/30/18	Refer to updates for Addendum 8, HC-R2-11
6	70	HC-14	Health Canada	04/30/18	Section 5.1.3, 6.5; Table 6.5-1
8 (Part B)	89	HC-R2-1	Health Canada	10/17/18	Appendix B
8 (Part B)	89	HC-R2-2	Health Canada	10/17/18	Section 5.3.1, 6.1.1.1, 6.1.3, 6.2.1 6.2.3; Table 5.3-1, 5.3-2, 6.1-1, 6.1-2
8 (Part B)	89	HC-R2-3	Health Canada	10/17/18	Section 5.3.1, 6.1.1.1, 6.1.3, 6.2.1 6.2.3; Table 5.3-1, 5.3-2, 6.1-1, 6.1-2
8 (Part B)	89	HC-R2-4	Health Canada	10/17/18	Section 6.1.1.1; Table 6.1-5

Concordance Table Summary

Source Information					Relevant Information and Section(s) Updated in the HHRA
Addendum	CEAA Document #	Supplemental Information Request #	Agency	Date Submitted (mm/dd/yr)	
8 (Part B)	89	HC-R2-6	Health Canada	10/17/18	Section 6.3.3, 6.3.1.7; Table 5.1-4, 6.3-2, 6.3-3, 6.3-4
8 (Part B)	89	HC-R2-8	Health Canada	10/17/18	Refer to Updates for JRP IR-4.11; Appendix B
8 (Part B)	89	HC-R2-9	Health Canada	10/17/18	Section 5.4, 6.2.1, 6.2.2, 6.3.1, 6.3.2, 6.4.1; Table 6.2-1, 6.2-9, 6.3-1, 6.3-2, 6.4-1
8 (Part B)	89	HC-R2-10	Health Canada	10/17/18	Refer to Updates for Addendum 8, HC-R2-11
8 (Part B)	89	HC-R2-11	Health Canada	10/17/18	Section 5.4, 6.1, 6.2, 6.3, 6.4; Table 6.1-1, 6.1-6, 6.1-7, 6.1-8, 6.1-9, 6.2-1, 6.2-5, 6.2-6, 6.2-7, 6.2-8, 6.2-9, 6.3-1, 6.3-4, 6.3-5, 6.4-1
10	-	4.10	JRP	07/15/2019	Section 5.2.1.1, 5.2.2.1, 5.3.1.1, 6.1.1.3, 6.2.1.2, 6.2.1.3, 7.1, 7.2; Table 5.1-1, 5.2-2, 5.2-3, 5.2-4, 5.3-1, 6.1-1, 6.1-8, 6.2-1, 6.2-5, 6.2-6, 6.2-7; Appendices B, C, D
10	-	4.11	JRP	07/15/2019	Table 5.3-1, 6.1-1; Appendices B and C

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1.0 INTRODUCTION

The Human Health Risk Assessment (HHRA) describes the nature and significance of potential health risks to the local human population as a result of exposure to chemical contaminants that could be released to the environment from the proposed Grassy Mountain Coal Project (the Project). The HHRA also assessed the potential health risks associated with existing conditions, prior to development of the project, as well as future conditions related to the Project in combination with other planned developments in the region. This section provides a description of the methods used in the HHRA as well as the findings of the assessment.

A screening wildlife risk assessment was also conducted, using the same models and air concentrations as the HHRA and is provided as an appendix to this report (Appendix H Screening Wildlife Risk Assessment).

2.0 SCOPE

2.1 Terms of Reference

The scope of the HHRA was consistent with the final Terms of Reference (TOR) for the Project issued by the Alberta Energy Regulator (AER 2015) and the *Guidelines for the Preparation of an Environmental Impact Statement* issued by the Canadian Environmental Assessment Agency (CEAA 2015). The TOR and CEAA Guidelines are presented in Appendix 1 and 2 (EIA, CEAR #42). Appendix 1, Section 6.1 of the TOR lists the public health-related requirements; those relevant to the human health and addressed by the HHRA are as follows:

- Describe aspects of the Project that may have implications for public health or the delivery of regional health services. Determine quantitatively whether there may be implications for public health arising from the Project.
- Document any health concerns raised by stakeholders during consultation on the Project.
- Document any health concerns identified by Indigenous communities or groups resulting from impacts of existing development and of the Project, specifically on their traditional lifestyle. Include an Indigenous receptor type in the assessment.

The CEAA Guidelines (Appendix 2, EIA, CEAR #42) relevant to human health include consideration of the following for both Indigenous groups and other persons in the study area:

- location of and proximity of any permanent, seasonal, or temporary residences or camps; and,

- effects on the health and socio-economic conditions, including the functioning and health of the socio-economic environment, encompassing a broad range of matters that affect communities in the study area in a way that recognises interrelationships, system functions and vulnerabilities.

2.2 Assessment Focus Based on Public and Indigenous Consultation

Benga has conducted consultations with the surrounding community including residents in the region, other organizations representing local interests and concerns (Section G and Appendix 7c, CEAR #42), and with associated Indigenous groups. The Treaty 7 First Nations consulted for the Project included the Piikani Nation, Tsuut'ina Nation, Stoney Nakoda Nation, Siksika Nation, and the Kainai Nation.

During interviews and workshops conducted for the socio-economic study, concerns were raised about air and water quality and the potential impact the Project may have on the health of people living downwind and downstream (Piikani Nation 2015a; 2015b) (Section H, Table H.3.8-1 and Appendix 7c, CEAR #42). Similar observations were made about the ecological connections between wildlife and plants species and human health (Piikani 2015b). According to the Kainai TK/TU Report, several Elders recommended an emergency preparedness plan in the event of leaks, spills, or other disasters to address concerns about effects on water quality and species dependent on clean water sources (Section H, Table H.3.8-1 and Appendix 7c, CEAR #42).

Below are excerpts from discussions during the interviews and workshops as provided by the TK/TU assessment (Section H and Appendix 7c, CEAR #42):

- *Piikani Elders raised concerns about physical health, especially related to dust and fires since the prevailing winds are from the west through Crowsnest Pass (blowing toward Brocket). They also identified occupational risk of mining as an issue. In particular, Elders have been experiencing lung problems recently with many resulting health issues. They are already experiencing this from other projects, including Turner Valley and the gas wells, related to the westerly wind from the mountains to the plains* (Piikani Nation 2015a).
- *…the main concern is water quality because the water from the mine flows into the Old Man River and there are endangered fish species in Blairmore and Gold Creeks (i.e., cutthroat trout)* (Piikani Nation 2015a).
- *That has a chain effect: if you alter their migration and then alter their food source, then with the mining activities, their health might be affected. In the long run, people will use these animals and then their heath will be affected. The hooved animals. There needs to be regulations for clean water too* (Piikani Nation 2015b).

During consultation with the Treaty 7 First Nations, plant and animal species around Grassy Mountain which have historical medicinal, spiritual, and country food purposes were identified. The plant species identified included: lodgepole pine, sweet pine, birch, aspen, cottonwood, wild licorice, horsetail, juniper, bearberry, tree lichen, yarrow, rose hip, raspberries, thimbleberries, teaberry, bear root, hawthorn berry, scouring rush, Saskatoon berry, dogberry, mountain sage, sweetgrass, mountain holly fern, cranberry, and mushrooms. Animal species identified around Grassy Mountain included: trout, moose, elk, deer, cougar, wolf, badger, porcupine rabbit, buffalo, otter, squirrel, grizzly bear, lynx, woodpecker, grouse, wild turkey, crows, and golden eagle.

Sufficiently concise information was obtained through the consultation process which supported the development of a reasonably robust assessment on plants and animal species used by Indigenous groups in and around Grassy Mountain. Information pertaining to traditional food sources such as type, quantity and area of hunt and harvest is personal and sensitive information; it can be both culturally insensitive and inappropriate to require precise mapping or species identification from those communities included in the assessment. Information obtained from the consultation process is considered adequate for the purposes of this HHRA and additional survey or questioning would add unnecessary burden on the local population without adding substantially more information to the assessment as presented herein.

3.0 SUMMARY OF EXISTING CONDITIONS

3.1 Current Health Status in the Region

The Project is situated within the Alberta Health Services, South Zone. In 2006, Alberta Health and Wellness published the *Report on the Health of Albertans* (AHW 2006), which examined the relative health status of people living in various areas of the province based on 2003 data. The report compared the health of all Albertans in terms of a number of health determinants, including: self-perceived health status; tobacco use; cancer screening; body weight; nutrition; disability and functional limitations; alcohol and drug use; and physical activity. The study also examined mental health and non-communicable diseases. The available statistical data did not provide the data specific to smaller populations within the area (*e.g.*, specific towns or Indigenous communities). Similar but more recent data (from 2011-2012) are presented by Statistics Canada (2013); however, due to the reorganization of Alberta's health regions, the data are not directly comparable. Through the reorganization, the former Chinook and Palliser regions have been combined and re-named as the South Zone; consequently, the Project is now defined by the South Zone regional data, as it is situated within the former Chinook region.

A number of factors, or health determinants, influence an individual's overall health, including environmental quality, lifestyle choices, socio-economic factors and genetics. The health determinants reported by Alberta Health and Wellness and Statistics Canada are reflective of a number of these factors and provide a general picture of population health. The health determinants considered relevant to this HHRA that are descriptive of the current health status of persons in the South Zone are summarized briefly in the following paragraphs.

Self-Perceived Health Status

Approximately 60% of the population in the Chinook region reported their health as very good or excellent, compared to approximately 64% of Albertans, in 2003. Similar values were reported for the South Zone (59.0%) and Alberta (62.1%) in 2011-2012.

Body Weight

Similar percentages of the population were considered overweight and obese in the Chinook region and in Alberta in 2003. In 2011-2012, similar percentages of the population were considered overweight in the South Zone compared to the Alberta population; however, a significantly higher percentage was classified as obese in the South Zone (23.5%) compared to the Alberta population (18.9%).

Lifestyle Factors

The incidence of smoking was lower in the Chinook region (approximately 20%) compared to the Alberta population (approximately 23%) in 2003. Tobacco use in 2011-2012 was reported to be 26.6% in the South Zone and 21.6% in Alberta as a whole. The incidence of heavy drinking (5 or more drinks on one occasion, 12 or more times per year) was similar in the Chinook (2003) and South (2011-2012) regions compared to Alberta overall. The prevalence of treated substance abuse in the Chinook region was significantly higher than the provincial average (1.1 compared to 0.7 per 100 in 2003).

Fewer individuals in the Chinook region (32%) consumed more than five servings of fruits and vegetables daily compared to the overall province (36%) in 2003, with similar results between the South Zone (35.8%) and the overall province (39.6%) in 2011-2012. The percentage of individuals describing themselves as physically active or moderately active was similar in the South region compared to the province as a whole in both 2003 and 2011-2012.

Socio-Economics

The level of unemployment and percentage of people considered to be of low income was similar in the South Zone compared to that of the province as a whole in 2011-2012.

Non-Communicable Diseases

In 2011-2012, the incidences of colorectal cancer and breast cancer were slightly higher in the South Zone compared to the province, but the incidences of lung cancer and prostate cancer were lower in the South Zone than the across the province. The overall cancer rate (all cancers) was lower in the South Zone (377.5 per 100,000 population) compared to the province (394.8 per 100,000 population).

Of the major respiratory illnesses, the incidences of asthma, chronic bronchitis and chronic obstructive pulmonary disease (COPD) were lower in the Chinook region in 2003 compared to Alberta overall. Asthma and COPD were less slightly more prevalent in the South Zone than across Alberta in 2011-2012.

Of the cardiovascular diseases, the prevalence of ischaemic heart disease and hypertension was lower in the Chinook region compared to Alberta in 2003; however, the prevalence of cerebrovascular disease was higher in the Chinook region in 2003.

Rates of diabetes were higher in the Chinook region than in Alberta as a whole in 2003, but were slightly lower in the South Zone than the province in 2011-2012. Rates of arthritis were elevated in the Chinook region in 2003 and in the South Zone in 2011-2012, compared to provincial rates.

Mental health disorders were higher than the provincial average in the Chinook region; however, anxiety and depression were less prevalent in the Chinook region in 2003 compared to the province. In 2011-2012, the hospitalization rate and patient days for mental illnesses were higher in the South Zone compared to Alberta.

4.0 ASSESSMENT APPROACH

4.1 Valued Component

Human health was identified as the Value Component (VC) for the HHRA. The measurable parameters used to assess the potential impact on this VC are the results of the detailed quantitative health risk assessment conducted in this HHRA.

4.2 Assessment Cases

In accordance with the AEP guidance (ESRD 2013a), the HHRA considered the following assessment cases:

Baseline Case: The Baseline Case includes potential health risks associated with emissions from existing and approved developments in the region, as well as other non-industrial sources.

Application Case: The Application Case includes potential health risks associated with existing and approved developments in combination with emissions from the Project (*i.e.*, Baseline Case plus Project).

Planned Development Case (PDC): The PDC considers potential health risks associated with the combined emissions from existing and approved developments, the Project and planned future developments in the region, based on projects announced up to September 2013 (*i.e.*, Application Case plus future projects). However, as the Air Quality Assessment did not identify any planned projects in the area, a PDC Case was not required for the current assessment.

In order to correctly assess the potential risk associated with carcinogenic chemicals, air concentrations for Project only emissions were also predicted (Consultant Report #1a, Air Quality Assessment, CEAR #42). Thus, the HHRA included assessment of a Baseline Case, Application Case and Project only emissions.

4.3 Temporal Considerations

The anticipated operational life of the Project is 24 years. The timeframe over which potential health risks were evaluated ranged from short term or acute exposures, to long term or chronic exposures. Acute exposures are considered to extend over time periods ranging from hours to days, whereas chronic exposures encompass time periods of years. Even though the life of the Project is shorter than the lifetime of a typical individual, chronic exposures in this assessment were conservatively assumed to occur over a period of 80 years, the assumed human lifetime duration recommended by Health Canada (2010a).

4.4 Spatial Considerations

The Project is located in southwest Alberta near the Crowsnest Pass. The spatial area considered by the HHRA was based on the potential extent of air quality effects arising from the Project, as determined by the emissions source characteristics and air quality processes, together with the locations of nearby communities and other human activities. As such, the

spatial boundaries of the HHRA are the Local Study Area (LSA) and Regional Study Area (RSA) as defined in the Air Quality Assessment (Consultant Report #1a, CEAR #42).

The LSA is a 10 km by 15 km area centred on the facility. It was selected to include key local receptors but also to exclude most regional emissions sources in order to differentiate Project impacts from the effects of regional projects.

The RSA is a 30 km by 35 km area, centred near the northern boundary of the LSA. The RSA was selected to include the communities of Maycroft, Blairmore, Frank, Bellevue, and Hillcrest as well as any other emissions in the area. The LSA and RSA are shown on Figure A.1 in Appendix A.

4.5 Evaluation of Significance

The Project related valued component (VC) for HHRA was identified as human health. Evaluating the potential effects of the Project for the VC requires the clear identification of management objectives. For HHRA, the results of the detailed quantitative risk assessment, which quantified the potential exposure and risk of adverse health effects associated with the Project activities, were used to determine significant impact.

The potential impact and evaluation of significance was conducted using the following attributes:

- **Magnitude:** Predicted health risks were calculated as hazard quotients (HQs) or incremental lifetime cancer risk (ILCR) quotients based on a comparison of predicted exposures to safe toxicological reference values (TRV). Magnitude ratings were classified as "nil", "low", "moderate", or "high" based on the quantitative health risk results. A magnitude rating of "nil" was assigned when the predicted HQ value is less than 1.0 or the ILCR value is less than $1.0x10^{-5}$; "low" when predicted HQ is greater than 1.0 and less than 5.0 or the ILCR value is greater than $1.0x10^{-5}$ and less than $5.0x10^{-5}$; "moderate" when predicted risks were greater than an HQ of 5.0 and less than 10 or an ILCR value is greater than $5.0x10^{-5}$ and less than $1.0x10^{-4}$; and" high" when the predicted risks were greater than an HQ of 10 or an ILCR value of $1.0x10^{-4}$. When the predicted health risk results were below the TRVs (a magnitude rating of "nil") the potential impact of the Project on the VC was automatically defined as "not significant" and further assessment of the remaining attributes was not required. Health risks with a magnitude ranking of "low", "moderate", or "high" were assessed for all the attributes described below.

- **Geographic Extent:** If the expected measurable changes are limited to the area immediately surrounding the Project within the LSA, the geographic extent was interpreted as being "local". If the expected measurable changes extend beyond the immediate project area, and are within the RSA, they were considered "regional". If the expected changes extend beyond the RSA they may be interpreted as being "provincial".
- **Duration:** The expected measurable change was characterized depending on when, during the life of the mine, Project emissions were predicted to occur. This attribute was defined as "short" when emissions occurred within the development phase only; "long" when emission occurred during the operation of the facility; "extended" when emissions continued immediately after closure; and, "residual" when emissions occurred after facility closure.
- **Frequency:** The HHRA assessed potential exposure for acute ("periodic") and chronic ("continuous") durations. While emissions will occur for the full duration of the Project, changes in air quality will have temporal variability due to the natural fluctuations in meteorology (wind speed, wind direction, temperature), and short and long-term variability in emissions based on operational patterns. The conditions resulting in the highest predicted air concentrations only occur under a limited set of conditions that only persist for short durations. Within the multimedia assessment, deposition to soil and surface water is a chronic ("continuous") duration.
- **Reversibility:** The predicted health risks are associated with the Project air emissions, therefore contribution to ambient concentration and direct deposition to receptors ceases when Project emissions cease. In the case of exposure to carcinogens, it is conservatively assumed that the predicted health risks would be irreversible. For non-carcinogens the reversibility of health effects depends on the critical toxic effect. For example, irritation would be considered a reversible effect, while developmental impacts would be considered irreversible.
- **Project Contribution/Direction**: Direction addresses the expected change, without regard to its magnitude. The direction is interpreted as being adverse (*i.e.*, negative) if there are any increases in air quality parameters, neutral if there is no change, and positive if air quality parameters decrease.
- **Probability of Occurrence:** The conservative nature of the assumptions used in the risk assessment regarding human exposure patterns and toxicity are intended to provide a worst-case scenario that is not necessarily representative of actual human activity

patterns or susceptibility to the project emissions. Most emissions occur continuously, but the combination of maximum project emissions and meteorological conditions conducive to worst case predicted concentrations may not occur. The indicator "probability of occurrence" integrates all these issues and qualitatively determines the extent to which predicted adverse health effects may occur where "low" is unlikely, "medium" is possible or probable, and "high" is certain.

- **Confidence:** A confidence ranking of "low", "medium" or "high" was determined based on a review of the representativeness of predicted air concentrations, receptor characterisation and exposure parameters, and the toxicological data.
- **Significance:** An integrated assessment of the impact for each health risk parameter based on individual descriptors, summarizing the significance of Project impacts. "not significant" is defined as effects predicted to be within the range of natural variability and determined in the HHRA to pose no risk of adverse health effects. "Significant" is defined as an adverse health effect associated with exposure to Project emissions.

5.0 ASSESSMENT METHODS

The HHRA was conducted using standard methods endorsed by regulatory agencies; specifically, the risk assessment followed the Alberta Health and Wellness (2011) Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta. Additional guidance published by Health Canada (2010a,b) and United States Environmental Protection Agency (US EPA 2005) was also consulted. The risk assessment used reasonable worst-case assumptions to ensure that risk estimates would be conservative.

The risk assessment included four main steps:

- Problem formulation: where contaminants of potential concern (COPCs), potential receptors and operative exposure pathways are identified. Determination of which COPCs could accumulate in other media (soil, water, food) was also conducted at this stage.
- Exposure assessment: including evaluation of concentrations of volatile COPCs in air to which receptors could be exposed, and an estimation of exposure through secondary exposure via other media.
- Toxicity assessment: where potential adverse effects of COPCs are identified and relationships between exposure and potential toxic effects established.
- Risk characterization: where the results of the exposure and toxicity assessments are used to determine the potential for adverse effects.

5.1 Problem Formulation

The problem formulation is the initial phase of a human health risk assessment. It is used to determine which chemicals, receptors, exposure scenarios and exposure pathways are considered in the risk assessment.

5.1.1 Chemical Inventory

Project Emissions to Air

Contaminants of potential concern (COPCs) were identified through an inventory of expected Project air emissions, as described in the Air Quality Assessment (Consultant Report #1a, CEAR #42). The Project was assumed to have no direct effect on water quality (Consultant Report #3 – Hydrogeology, Consultant Report #4 – Surface Water Quality, CEAR #42); therefore, emission into air were the only Project related chemical source which required detailed exposure risk assessment in the HHRA.

The COPCs identified for the project included:

- criteria air contaminants (CACs);
- metals;
- polycyclic aromatic hydrocarbons (PAHs); and
- volatile organic compounds (VOCs).

The HHRA evaluated the potential health risks for all of the identified COPCs for which adequate toxicological data was available. A list of the chemicals included in the HHRA is presented in Table 5.1-1.

Table 5.1-1 Chemicals of Potential Concern (COPCs)

Chemical Group	Chemicals	
Criteria Air Contaminants	• Carbon Monoxide (CO) • Nitrogen Dioxide (NO_2)	• Sulphur Dioxide (SO_2) • Particulate Matter <2.5 µm ($PM_{2.5}$) and <10 µm (PM_{10})
Metals	• Aluminum • Antimony • Arsenic • Barium • Beryllium • Cadmium • Chromium II, III • Chromium VI	• Lead • Manganese • Mercury • Molybdenum • Nickel • Selenium • Thallium • Uranium

Table 5.1-1 Chemicals of Potential Concern (COPCs)

Chemical Group	Chemicals	
	• Cobalt • Copper	• Vanadium • Zinc
Polycyclic Aromatic Hydrocarbons (PAH)	• Acenaphthene • Acenaphthylene • Anthracene • Benz[a]anthracene • Benzo(a)pyrene • Benzo(b)fluoranthene • Benzo(g,h,i)perylene • Benzo(k)fluoranthene • Chrysene	• Dibenzo(a,h)anthracene • Fluoranthene • Fluorene • Indeno(1,2,3-cd)pyrene • Naphthalene • Phenanthrene • Pyrene
Volatile Organic Compounds (VOCs)	• Acetaldehyde • Acrolein • Benzene • Formaldehyde	• Propylene • Toluene • Xylenes
Other[1]	• Coal Dust • Silica (and silicates)	• Diesel Particulate Matter (DPM)

[1]Coal Dust, Silica (and silicates) and DPM were included as COPCs in response to Alberta Energy Regulator (AER), Health Canada (HC) and the Joint Review Panel (JRP) Information Requests (IRs), including: AER-154 (Addendum 5, CEAR #69), HC-1 (Addendum 6, CEAR #70), JRP IR-4.10 (CEAR #212).

Assessment of acute and chronic inhalation was completed for all COPCs with relevant TRVs. A multimedia exposure assessment, which included exposure through secondary oral and dermal contact pathways, was only completed for a subset of the identified COPCs. The screening process for the multimedia assessment was based on guidance from the US EPA (2003) and California EPA (1994) using physical/chemical properties of the COPCs. Following this guidance, only those COPCs with low volatility indicating potential to be present in media other than air and those COPC which may bioaccumulate in plant or animal tissue over time were included.

Those chemicals that met one or more of the following criteria were selected as COPC for the multimedia assessment:

- Molecular weight >200 g/mol;
- Henry's Law constant $<1.0 \times 10^{-5}$ atm-m^3/mol;
- Vapour pressure $<1.0 \times 10^{-3}$ mm Hg; and

- Log octanol-water partition coefficient (log K_{ow}) >3.5 (indicating a potential to bioaccumulate).

All metals were assumed to persist in the environment and therefore were automatically included in the multimedia assessment. The results of the multimedia COPC screening are summarized in Table 5.1-2.

Table 5.1-2 Physical-Chemical Properties of COPCs

COPC	Molecular Weight (g/mol)	Vapour Pressure (mm Hg)	log K_{ow} (unitless)	Henry's Law Constant ($atm \cdot m^3/mol$)
	>200 g/mol	**<1.0x10^{-3} mm Hg**	**>3.5**	**<1.0x10^{-5} atm-m^3/mol**
PAHs				
Acenaphthene	1.54E+02	2.20E-03	**3.92E+00**	1.80E-04
Acenaphthylene	1.52E+02	6.70E-03	**4.00E+00**	1.10E-04
Anthracene	1.78E+02	**6.50E-06**	**4.54E+00**	5.60E-05
Benz[a]anthracene	**2.28E+02**	**2.10E-07**	**5.91E+00**	**1.20E-05**
Benzo(a)pyrene	**2.52E+02**	**5.50E-09**	**6.13E+00**	**4.60E-07**
Benzo(b)fluoranthene	**2.52E+02**	**5.00E-07**	**5.80E+00**	**6.60E-07**
Benzo(g,h,i)perylene	**2.76E+02**	**1.00E-10**	**6.50E+00**	**3.30E-07**
Benzo(k)fluoranthene	**2.52E+02**	**9.70E-10**	**6.00E+00**	**5.80E-07**
Chrysene	**2.28E+02**	**6.20E-09**	**5.60E+00**	**5.20E-06**
Dibenzo(a,h)anthracene	**2.78E+02**	**9.60E-10**	**6.75E+00**	**1.40E-07**
Fluoranthene	**2.02E+02**	**9.20E-06**	**5.22E+00**	**8.90E-06**
Fluorene	1.66E+02	**6.00E-04**	**4.18E+00**	9.60E-05
Indeno(1,2,3-cd)pyrene	**2.76E+02**	**1.30E-10**	**7.53E+00**	**3.50E-07**
Naphthalene	1.28E+02	8.50E-02	3.37E+00	4.40E-04
Phenanthrene	1.78E+02	**1.20E-04**	**4.57E+00**	4.20E-05
Pyrene	**2.02E+02**	**4.50E-06**	**5.18E+00**	1.20E-05
VOCs				
Acetaldehyde	4.41E+01	9.00E+02	4.50E-01	6.70E-05
Acrolein	5.61E+01	2.70E+02	1.00E-01	1.20E-04
Formaldehyde	3.00E+01	3.90E+03	3.50E-01	**3.40E-07**
Benzene	7.81E+01	9.48E+01	-	5.40E-03
Propylene	4.21E+01	7.5E+03	2.2E+02	9.6E-04
Toluene	9.21E+01	2.84E+01	-	6.64E-03
Xylenes	1.10E+02	7.99E+00	-	5.18E-03

* –Values from Health Canada (2010b) and US EPA HHRAP Companion Database
BOLD – parameter assessed using the multimedia model

5.1.2 Identification and Characterization of Receptors

Several groups were identified that could potentially be impacted by the Project. Local residents, communities, and any people spending time near the Project could be exposed to COPCs. For the current HHRA, a select number and type of potential human receptors and receptors locations were identified to best represent persons potentially exposed to the predicted Project emissions.

5.1.2.1 Human Receptor Locations and Groups

Within a typical HHRA, potential human receptors can be divided into general groups:

- Indigenous residents;
- agricultural residents;
- other area residents;
- workers; and
- visitors to the area.

With the exception of workers, these receptor groups could include any age; consistent with Health Canada (2010a), characteristics are defined separately for infant, toddler, child, teen, and adult receptors.

The HHRA does not assess occupational health for workers at the Project. Occupational health is assessed through compliance with Occupational Health and Safety (OH&S) standards and is outside the scope of this HHRA.

The current HHRA considered the entire LSA and RSA, and assessed the maximum chemical concentrations predicted by the air quality assessment for specific locations within the LSA and RSA. The RSA and LSA boundaries were the same as those defined for the Air Quality assessment (Appendix A, Figure A.1). To ensure that the locations of any sensitive receptors or where people would likely spend the most time were captured, specific locations within the LSA and RSA were identified for evaluation in the HHRA. These included the potential for local residential communities, Indigenous residential areas, Indigenous land use areas (such as hunting and plant gathering) and recreational areas.

The human receptor locations were identified from the Benga community liaison, the Traditional Knowledge/Traditional Land Use, Land and Resource Use and Socio-Economic disciplines based on the results of each disciplines' community consultation programs. Each discipline was requested to identify, from the information available to them, all locations where

there is a residence, seasonal cabin, recreational area (*e.g.*, campground), or significant hunting or fishing areas located within the RSA boundary and LSA boundaries.

Through discussions with the Benga community liaison, all known communities, rural residences and seasonal cabins, and recreation areas within the municipal districts of Pincher Creek, Crowsnest Pass and Ranchland's were identified and over 500 potential HHRA receptor locations were identified (Figure A.2). As a result of this large number, the receptor locations selected for the HHRA were narrowed down by requesting additional information from Benga who in turn went back to the municipalities and local knowledge so that the best representation of each of the five general receptor groups could be captured for the assessment.

During the Project construction and operation phases, access to the area within the Project Footprint will be prohibited to the public. Access on mine related roads and trails will not be allowed for hunting, fishing or food gathering. However, as there are currently a number of privately-owned cabins located on the Eastern edge of the Mine Permit Boundary, four of the HHRA receptor locations were selected to represent potential exposure in that area (Residential locations #10, 11, 12, and 13).

Through ground-truthing field work and discussions with the Treaty 7 First Nations (Section H and Appendix 7c), seven main areas were identified as hunting and plant gathering areas (Figure A.3). For the purposes of the HHRA, the centre of each area was identified as a potential Indigenous HHRA receptor location. As the area within the Project will be inaccessible during construction and operation of the mine, no hunting and gathering areas were assessed within the permit boundary. Only one area was identified as outside of the future Project (on the Western edge); this was selected to represent an Indigenous hunting and food collection area for the HHRA (location R9, Figure A.4). Although location R9 was identified as a potential area for collection of country foods, it was also conservatively assumed to be a hypothetical Indigenous residential location.

From the information collected, 13 HHRA receptors were selected (Table 5.1-3, Figure A-4). In addition, both the LSA-MPOI and RSA-MPOI were also included in the HHRA as hypothetical worst-case receptor locations, as they represent locations of the highest predicted air concentrations and thus, the highest potential risk of adverse health effects. Thus, a total of 15 HHRA receptor locations were assessed. The following receptor types were assessed in the HHRA:

- Residential receptor – assumed at all HHRA locations except for R9 (Indigenous) R1(camp ground);
- Indigenous receptor – conservatively assumed at all receptor locations; and,

- Recreational receptor – assumed at R1 (camp ground).

Other than proposed Project related operations, no other industrial activities requiring work camps were identified within the RSA; therefore, a worker receptor type was not required in the HHRA. The HHRA did not assess potential health impact for future workers at the Project, as it was assumed all occupation health and safety regulatory requirements would be followed to protect these receptors.

Table 5.1-3 Receptor Locations

Receptor Name	Location Number	UTM-E [m]	UTM-N [m]
Lost Lemon Campground	R1	683,303	5,498,852
Trapper's Cabin #1	R2	685,018	5,514,269
Residential #1	R3	678,712	5,501,481
Residential #2	R4	693,350	5,519,213
Residential #3	R5	693,409	5,515,330
Coleman	R6	680,262	5,501,388
Frank	R7	687,770	5,497,670
Blairmore North	R8	684,940	5,498,786
Indigenous (traditional land use) [a]	R9	683,782	5,504,555
Residential #4	R10	687,336	5,507,081
Trapper's Cabin #2	R11	687,682	5,510,209
Residential #5	R12	688,191	5,503,649
Residential #6	R13	687,984	5,505,267
Blairmore Centre	R14	684,745	5,498,200
RSA-MPOI [b]	RSA-MPOI	-	-
FL-MPOI [c]	FL-MPOI	-	-

[a] Indigenous
[b] Regional study area- maximum point of impingement (MPOI)
[c] Fenceline-MPOI

5.1.2.2 Receptor Characteristics

Inhalation exposures are evaluated using predicted air concentrations and no other characteristics of receptors are required. For multimedia exposures, however, the amount of exposure is dependent on characteristics such as diet and the intake rates of exposure media. Receptor characteristics were based on recommendations from Health Canada (2010a,b); dietary composition was based on data on Indigenous food consumption patterns (Health Canada 2010a,b, Wein *et al.*, 1990). Local consultation with Indigenous communities was used along

with surveys to identify vegetation and wildlife common to the area. The following plant and animal species have historically been collected within the RSA by Treaty 7 First Nations communities for consumption as country foods (Section H and Appendix 7c):

- plant: wild licorice, bear root, Labrador tea, indian potato, tamarack, tree lichen, red water grass, yellow aven, bearberry, horsetail, juniper, tree lichen/moss, yarrow, rose hip, raspberries, blueberries, thimbleberries, mushrooms; and
- animal: trout, moose, buffalo, deer, elk, sheep, rabbit squirrel, wild turkey.

Receptor characteristics selected to best represent each receptor are summarized in Table 5.1-4.

Table 5.1-4 Human Receptor Characteristics[1]

Parameter	Infant	Toddler	Child	Teen	Adult	Worker
Age	0 - 6 mo.	7 mo. - 4 y	5 - 11 y	12 - 19 y	≥ 20 y	≥ 20 y
Body weight (kg)	8.2	16.5	32.9	59.7	70.7	70.7
Soil ingestion rate (g/d)	0.02	0.08	0.02	0.02	0.02	0.1
Water ingestion rate (L/d)	0.3	0.6	0.8	1	1.5	1.5
Air inhalation rate (m3/d)	2.2	8.3	14.5	15.6	16.6	33.6
Ingestion of Plants						
Plant ingestion rate (g/d)	0	67	98	120	137	0
Root vegetable ingestion rate (g/d)	0	105	161	227	188	0
Berry ingestion rate (g/d)[2]	0	12	20	25	33	0
Labrador tea ingestion rate (g/d)[2]	0	1	1	3	3	0
Cattail ingestion rate (g/d)[2]	0	1	1	3	3	0
Ingestion of Wild Game and Fish[3]						
Moose ingestion rate (g/d)	0	27	39	55	84	0
Grouse ingestion rate (g/d)	0	14	21	29	45	0
Hare ingestion rate (g/d)	0	12	18	25	39	0
Caribou ingestion rate (g/d)	0	16	24	33	51	0
Deer ingestion rate (g/d)	0	16	24	33	51	0
Fish ingestion rate (g/d)	0	95	170	200	220	0
Dermal Exposures						
Surface area – hands (cm^2)	320	430	590	800	890	890
Soil loading to hands (g/cm^2-event)	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04

Table 5.1-4 Human Receptor Characteristics[1]

Parameter	Infant	Toddler	Child	Teen	Adult	Worker
Surface area – other (cm^2)	1460	2580	4550	7200	8220	2500
Soil loading to other surfaces (g/cm^2-event)	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
Ingestion of Breast Milk by Infants						
Breast milk ingestion rate (g/d)	664	0	0	0	0	0

[1] Values from Health Canada (2010a) unless otherwise stated
[2] Derivation of the berry, Labrador tea, and cattail ingestion rates was described in HC-9 (Addendum 6, CEAR #70).
[3] For Indigenous receptors; overall wild game ingestion rate based on Health Canada (2010b), proportion by wild game species estimated for region based on Wein *et al.*, 1990. Calculated wildlife ingestion rates for the adult scenario were provided in HC-9 (Addendum 6, CEAR #70).

5.1.3 Exposure Pathway Identification

For the human receptors to be exposed to emissions from the project, they must come into contact with COPCs. Direct inhalation of air was assumed to be the primary exposure pathway; however, several secondary pathways were also identified for the multimedia assessment:

- COPCs in air can be deposited onto soil in the surrounding area. Receptors may then be exposed by direct contact with soil, inadvertent ingestion of soil, and inhalation of dust.
- COPCs could accumulate in local vegetation, through direct deposition from air or uptake from affected soils. Receptors may then be exposed by ingestion of local vegetation.
- COPCs in soil, plants, and water can be ingested by local wildlife. Receptors may then be exposed by ingestion of local wild game.
- The Project is not expected to have any direct effect on water quality or aquatic health (Consultant Report #3 – Hydrogeology, Consultant Report #4 – Surface Water Quality and Consultant Report #5 – Fisheries, CEAR #42). However, as COPCs in air can be deposited onto surface water, exposure through ingestion of surface water, contact with surface water while swimming, and ingestion of fish were considered in order to conservatively estimate total potential exposure.

The end of mine plan includes creation of one End Pit Lake (EPL) located at the north east portion of the mine plan Appendix A (Figure A.1).

As a component of the HHRA, the EPL has been assessed for potential risk to future users of the Site (post-reclamation). Contact with surface water while swimming is not expected as the lake will be reclaimed for visual appeal rather than for recreational use; the slopes around the EPL

will be reclaimed to a maximum slope angle of 23° and will include a highwall feature on the west side with slopes of 55° to 60°. Fish ingestion is also not expected to occur as local fish species do not thrive in lentic (*i.e.*, still, fresh water) environments and important habitat features such as shoals will not be incorporated into the design of the EPL. While unlikely, consideration for receptor exposure due to ingestion of surface water originating from the EPL was considered as a part of the HHRA (IR HC-14, Addendum 6, CEAR #70]). A detailed discussion regarding the potential for human health risk in relation to the EPL is provided in Section 6.5 of this report. A summary of the applicable exposure pathways for each receptor group is presented in Table 5.1-5.

Table 5.1-5 Multimedia Exposure Pathways

Exposure Pathway	Receptor Groups
Direct Contact with COPCs in Soil	Indigenous Other Area Residents
Ingestion of Local Vegetation	Indigenous Agricultural
Ingestion of Wildlife	Indigenous
Direct Contact and Ingestion of Surface Water	Indigenous
Ingestion of Local Fish	Indigenous

5.1.4 Conceptual Site Model

A conceptual site model (CSM) is provided in Appendix A (Figure A.5). This CSM illustrates an overview of the results of the problem formulation.

5.2 Exposure Assessment

The exposure assessment involved the estimation of the amount of each COPC that receptors may be exposed to, based on reasonable worst-case assumptions.

5.2.1 Inhalation

Inhalation exposure is evaluated using the results of air dispersion modelling conducted as part of the Air Quality assessment. Maximum predicted short-term (acute) and annual (chronic) average concentrations were used, except for SO_2 and NO_2 where the 9th highest concentrations were evaluated and $PM_{2.5}$ for which the 99th percentile concentrations were evaluated, consistent

with regulatory practices (ESRD 2013b). Concentrations were predicted both over a grid covering the LSA and RSA and at specific receptor locations as described above.

In response to IRs HC-2 and HC-3 (Addendum 6, CEAR #70) a comparison of predicted SO_2, NO_2 and $PM_{2.5}$ air concentrations to the Canadian Ambient Air Quality Standards (CAAQS) was also conducted. The 1-hour SO_2 predicted air concentration was calculated as the annual 99th percentile of the daily maximum 1-hour average concentrations; 1-hour NO_2 was calculated as the annual 98th percentile of the daily maximum 1-hour average concentrations, and the 24-hour $PM_{2.5}$ was calculated as the 98th percentile of the daily 24-hour average concentrations.

Concentrations were evaluated separately for the Project, Baseline, and Application cases. Concentrations included both emissions associated with the project and the emissions from other sources within the RSA. Details of the air dispersion modelling for each COPC are provided in the Air Quality Assessment.

For purposes of estimating exposure, it was assumed that humans would be continuously exposed for the averaging periods being evaluated.

COPCs included in the acute and chronic inhalation exposure assessment are provided in Table 5.2-1.

Table 5.2-1 Chemicals of Potential Concern (COPCs) – Acute and Chronic Inhalation

Chemical Group	Chemicals		
Metals	• Aluminum • Antimony • Arsenic • Barium • Beryllium • Cadmium • Chromium (II, III and VI)	• Cobalt • Copper • Lead • Manganese • Mercury[1] • Molybdenum • Nickel	• Selenium • Thallium • Uranium • Vanadium • Zinc
Polycyclic Aromatic Hydrocarbons (PAH)	• Acenaphthene • Acenaphthylene • Anthracene • Benzo(a)anthracene • Benzo(a)pyrene • Benzo(b)fluoranthene	• Benzo(g,h,i)perylene • Benzo(k)fluoranthene • Chrysene • Dibenzo(a,h)anthracene • Fluoranthene	• Fluorene • Indeno(1,2,3-cd)pyrene • Naphthalene • Phenanthrene • Pyrene
Volatile Organic Compounds (VOCs)	• Acetaldehyde • Acrolein • Benzene	• Propylene • Formaldehyde	• Toluene • Xylenes
Other	• Coal Dust	• Silica (and silicates)	• Diesel Particulate Matter

[1]Includes assessment of methylmercury due to transformation potential.

5.2.1.1 Coal Dust, Silica and DPM

Assessment of coal dust and silica was included in response to JRP IR-4.10. Coal dust and silica concentrations in air were based on the modelled particulate matter concentrations as provided in the Air Quality Assessment and modified using their respective percent contributions.

Coal Dust

Coal is a heterogenous, carbonaceous rock formed by natural decomposition of plant matter at an elevated temperature and pressure over millions of years within the earth's crust (IARC 1997). Owing to its formation process the proportion of minerals and elements in coal can vary (Ruch *et al*. 1974); the predominant constituent of coal is carbon. The maximum predicted daily material balance for coal production for the project is provided in Table 5.2-2.

Table 5.2-2 Summary of Maximum Daily Material Balance for the Project

Chemical Group	Annual Activity
Waste Volume (tonnes)	109,169,500
Coal Total (tonnes)	6,836,000
% Coal	5.89%

Based on a predicted composition of % coal being handled, the concentration of coal-dust present in the particulate matter calculated in air is as follows:

Predicted coal dust concentration:

$$Coal_{concentration} = [PM] \times 0.0589$$

Where:

$Coal_{concentration}$ = concentration of coal dust predicted in air (µg/m^3)
PM = particulate matter (total) in air (µg/m^3)
5.89% = predicted percentage of particulate matter attributable to coal

Silica

The silicone dioxide (SiO_2) group (silica) includes a group of compounds identical in composition but with different atomic arrangements. There are two sub-categories within the group: crystalline (quartz and cristobalite) and non-crystalline (amorphous silica) (Cotton and Wilkinson 1988; Moore 1999). This HHRA focuses on the crystalline form of silica (quartz and

cristobalite) which is the form considered to cause toxic effect in humans; amorphous silica has a low human health hazard potential (OECD 2004). Both forms are present in bituminous and subbituminous coal at varying concentrations (typically between 1.7 and 73%) (Bragg 2009). In addition, the National Air Pollutants Surveillance Network (NAPS) has published an extensive list of measured silicon concentrations in $PM_{2.5}$ and PM_{10} in ambient air at 24 different urban locations (NAPS 2010). The PM data was representative of several sources including dusts from paved and unpaved roads, construction activities, agricultural activities, and other anthropogenic sources. Using the information collected by NAPS (2010) Environment Canada and Health Canada (2013) calculated a median $\%SiO_2$ from the 24 ratios of Si to PM, and a molar ratio of 2.14 (to convert Si levels to SiO_2 levels). The median $\%SiO_2$ quantities represent all forms of silica (crystalline and non-crystalline) and are therefore an upper bound (conservative) approximation of the crystalline silica content in PM_{10} (5.22%) and $PM_{2.5}$ (2.52%) (Environment Canada and Health Canada 2013). The percent silica (quartz/cristobalite content [$\%SiO_2$]) from coal mining, and other sources (*e.g.,* paved and unpaved roads, construction operations, etc.) is summarized in Table 5.2-3.

Table 5.2-3 Percent Silicate Concentration Estimate by Release Source[1]

Source	% SiO_2		Reference
	PM_{10}	$PM_{2.5}$	
Coal mining (bituminous and sub-bituminous)	1.7 to 73		Bragg (2009)
Other sources[2]	5.22	2.52	NAPS (2010)

[1]modified from Environment Canada and Health Canada (2013).

[2]paved roads, unpaved roads, construction operation, mobile sources, incineration, fuel combustion, open source waste, prescribed burnings and other industrial sources as identified in Environment Canada and Health Canada (2013).

To date, an exact calculation of the percent silica composition produced by the Project is unavailable. However, predictions of the silica concentration present in air can be calculated based on dust attributable to coal extraction and those considered a result of another source contribution.

Predicted Silica Concentration (Project):

$$Silica_{project} = ([PM] \times 0.0589 \times \%SiO_2)_{coal} + ([PM] \times 0.9411 \times \%SiO_2)_{Other\ sources}$$

Predicted Silica Concentration (Baseline):

$$Silica_{baseline} = ([PM] \times \%SiO_2)_{Other\ sources}$$

Predicted Silica Concentration (Application):

$$Silica_{application} = Silica_{project} + Silica_{baseline}$$

Where:

$Silica_x$	=	*concentration of silica predicted in air ($\mu g/m^3$)*
PM	=	*particulate matter concentration in air (PM_{10} or $PM_{2.5}$) ($\mu g/m^3$)*
%SiO_2	=	*% silica based on source (coal or other) and PM size estimate (unitless)*
0.0589 (5.89%)	=	*predicted percentage of particulate matter attributable to coal sources*
0.9411 (94.11%)	=	*predicted percentage of particulate matter attributable to non-coal Sources*

DPM

The diesel combustion emission factors for $PM_{2.5}$ (used in the calculation of DPM) were based on mining equipment, plant equipment and haul trucks and were obtained from the NONROAD Engine Model (US EPA 2010). The DPM emission factors for the regional rail and project locomotive were taken from US emission standards for railway locomotives.

DPM Concentration:

Emission (g/hr) = LF * EF * PR * EN

Where:

LF	=	*Load Factor (Consultant Report #1 – Appendix A - Table A5.1, CEAR #42)*
EF	=	*Emission Factor (g/hp-h) (Consultant Report #1 – Appendix A - Table A5.1, CEAR #42)*
PR	=	*Engine Power Rating (hp) (Consultant Report #1 – Appendix A - Table A3.3, CEAR #42)*
EN	=	*Number of Engines (Consultant Report #1 – Appendix A - Table A3.3, CEAR #42)*

5.2.2 Multimedia Exposure

The multimedia exposure assessment evaluated secondary exposure through oral and dermal routes. The processes involved are only relevant for chemicals that can potentially accumulate in media other than air; many of the COPC associated with Project emissions are too volatile to be present in soil, water or food.

As discussed in Section 5.1.1 above, the multimedia COPC screening was based on molecular weight, Henry's law constant, vapour pressure and log K_{ow}. The results of the screening are summarized in Table 5.2-4.

Table 5.2-4 Chemicals of Potential Concern (COPCs) – Multimedia Exposure

Chemical Group	Chemicals		
Metals	• Aluminum • Antimony • Arsenic • Barium • Beryllium • Cadmium • Chromium (II, III and VI)	• Cobalt • Copper • Lead • Manganese • Mercury[1] • Molybdenum • Nickel	• Selenium • Thallium • Uranium • Vanadium • Zinc
Polycyclic Aromatic Hydrocarbons (PAH)	• Acenaphthene • Acenaphthylene • Anthracene • Benzo(a)anthracene • Benzo(a)pyrene	• Benzo(b)fluoranthene • Benzo(g,h,i)perylene • Benzo(k)fluoranthene • Chrysene • Dibenzo(a,h)anthracene	• Fluoranthene • Fluorene • Indeno(1,2,3-cd)pyrene • Phenanthrene • Pyrene
Volatile Organic Compounds (VOCs)	• Formaldehyde		
Other	• Silica (and silicates)		

[1]Includes assessment of methylmercury due to transformation potential.

The multimedia assessment included consideration of background/ambient concentrations of COPCs in the Baseline and Application cases, combined with predictive modelling based on Project air emissions.

The multimedia modelling equations published by US EPA (2005) were used to predict the concentrations of COPCs present in soil, surface water, plants, and wild game. Deterministic calculations were used based on predicted air concentration and deposition rates, published physical-chemical properties of the COPCs, expected physical conditions within the study area, and physical characteristics of human receptors. Reasonable worst-case assumptions were used in the calculations. Complete details on the model inputs, equations, and a sample calculation are provided in Appendix E (Multimedia Model Equations and Sample Calculations). The

multi-media model predicted total exposure doses as mg/kg body weight/day for each receptor age group and location, each of which were carried forward into the risk characterization (Appendix F - Detailed Multimedia Model Results).

An HHRA baseline sampling program was conducted July 22-31, 2014 and September 5-9, 2014. The HHRA baseline sampling program included the collection and chemical analysis of vegetation and soil samples. Within the program, efforts were made to collect berries and leaves typically consumed through local harvesting; the results were dependant on the time of year samples were collected and the availability of specific species in the areas sampled. Complete results from the soil and vegetation sampling program are provided in Appendix G (Baseline Sampling Program). A total of 21 soil samples and 25 vegetation samples were collected from the soils and vegetation LSAs (Appendix G, Figure G-1), respectively, and were analyzed for metals and PAHs. Where there was a sufficient number of samples, the 95th percentile background soil concentrations were applied to the baseline and application scenarios (AHW 2011). These concentrations were included in exposure calculations for the HHRA. Where media concentrations were measured as below detection limit, the input value used for the exposure modelling was the highest of either half the detection limit, or the concentration predicted via deposition and uptake in the multi-media model.

5.2.2.1 Coal Dust

Owing to its formation process the proportion of minerals and elements in coal can vary (Ruch *et al*. 1974). From a toxicological standpoint, it is the chemical constituents of coal that are of interest – in particular, metals and PAHs.

Measurements used in the determination of metal emissions from fugitive dust included representative information of all layers of material handled including coal (CR#1, CEAR #42). The air quality results for individual metal constituents are therefore considered representative of Project emissions.

PAH concentrations in coal were not analytically assessed; however, bioavailability of PAH constituents in coal is very limited and independent of both coal properties and PAH content (Meyer *et al*. 2013).

A study by Yang *et al*. (2008) evaluated the sorbent capability of coal and coal-derived particles for PAHs in soil collected from a floodplain in Germany. The floodplain is in the vicinity of large-scale mining activities, such that coal and coal-derived particles from transportation activities, mining, and industry were present. The coal and coal-derived particles in the soil exhibited a very large sorption capacity for PAHs followed by a slow desorption process. That is, PAHs in conjunction with coal were found to have a decreased bioavailability potential, as coal has dominant geosorbent properties. Similar findings were discussed by Talley *et al*. (2002)

who demonstrated the binding and bioavailability of PAHs assessed from Milwaukee Harbour sediments were strongly bound to coal particles and were not bioavailable. Due to the limited bioavailability of PAHs from coal, concentrations of PAHs used in the evaluation of human health risk are those calculated from combustion source emissions.

Independent analysis of the chemicals within fugitive dust (*e.g.*, individual metals) is a more accurate method of exposure assessment and modelled results are inclusive of coal contribution. Therefore, "coal-dust" as a COPC is reflected in the modelled data and does not require independent assessment as it pertains to multimedia exposure (oral pathway).

5.3 Toxicity Assessment

The toxicity assessment involves establishing the relationship between the amount of a chemical to which a person is exposed over a specified duration, and the potential for adverse health effects. The exposure limit, or the amount of chemical identified to be a safe exposure concentration is the toxicity reference value (TRV). Within the toxicity assessment step of the HHRA, TRVs are identified for all COPCs and exposure pathways.

Chemicals are typically divided into two categories for the purposes of human health risk assessment: threshold and non-threshold chemicals. Threshold chemicals, which are generally non-carcinogens, are chemicals for which it is believed a certain minimum dose (the "threshold") must be exceeded before adverse effects are expected to occur. The inhalation toxicity of threshold chemicals is evaluated using a tolerable concentration (TC), also often referred to as a reference concentration (RfC). The TC represents an average concentration to which a person could be exposed over the time period of interest without any expectation of adverse health effects after accounting for uncertainties in the understanding of the chemical's toxicity and variability in the population. For oral toxicity, the tolerable daily intake (TDI), also referred to as the reference dose (RfD), represents an average level of exposure at which no adverse effects are expected. Threshold effects can be evaluated for acute exposures (*e.g.*, 10 minute, 1 hour or 24 hour average concentrations) or chronic durations (years to lifetime exposure).

Non-threshold chemicals, which are generally genotoxic and mutagenic carcinogens, are not believed to have a threshold below which no effects would occur. Instead, toxicity is expressed based on the risk of developing cancer for a particular level of exposure. Non-threshold effects are evaluated over a lifetime since the risk of developing cancer is generally assumed to be related to the lifetime cumulative exposure. A slope factor (SF) represents the relationship between an oral exposure dose and the risk of developing cancer, while a unit risk (UR) represents the relationship between an inhalation exposure concentration and the risk of developing cancer. The toxicity can also be expressed as a risk-specific dose (RSD) and risk-

specific concentration (RSC), which are the lifetime average dose and concentration associated with a 1 in 100,000 lifetime cancer risk. Regulators, including AEP and Health Canada, consider a 1 in 100,000 incremental cancer risk (an increase in cancer risk of 1 in 100,000 above background) to be essentially negligible.

For both threshold and non-threshold effects, toxicity exposure limits are expressed herein as Toxicity Reference Values (TRVs) (TC or RSC for inhalation; RfC or RSD for oral exposure). Detailed toxicological profiles with the rational for the selection of all TRVs are provided for the COPCs in Appendix B (Toxicological Evaluations). A summary of the TRV used in the HHRA for all routes of exposure are provided in Tables 5.3-1 to 5.3-3.

5.3.1 Chemical Screening

All chemicals potentially emitted from the project were identified as potential COPCs. Some of these chemicals were grouped prior to conducting the toxicity assessment. Where insufficient toxicity data were identified for particular chemicals, they were grouped with other similar chemicals and assigned surrogates believed to conservatively represent the group. Those COPC assessed using surrogates are identified in Tables 5.3-1 through 5.3-3.

The TRVs were identified for both acute and chronic inhalation exposures. For those chemicals evaluated under the multimedia assessment, chronic oral TRVs were also identified. The TRVs were obtained from recognized regulatory agencies, including:

- Alberta Environment and Parks (AEP);
- Health Canada;
- United States Environmental Protection Agency (US EPA);
- World Health Organization (WHO);
- Agency for Toxic Substances and Disease Registry (ATSDR);
- California Office of Environmental and Human Health Assessment (OEHHA);
- Texas Commission on Environmental Quality (TCEQ);
- Netherlands National Institute for Public Health and the Environment (RIVM); and
- Other agencies where appropriate for specific chemicals.

The basis for each available TRV was evaluated to select the most appropriate value, giving consideration to consistency with Alberta approaches, scientific defensibility, incorporation of the most current information, and conservatism.

Selected TRVs are summarized in Table 5.3-1, Table 5.3-2, and Table 5.3-3. The detailed toxicity assessments for all COPCs are provided in Appendix B.

Table 5.3-1 Toxicity Reference Values (TRVs) – Acute Inhalation

Grouping	Chemical	Averaging Time	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
CAC	CO	1 hour 8 hour	15,000 6,000	Alberta Alberta	hypoxia hypoxia
	NO_2 [1]	1 hour 1 hour	188 79	US EPA CCME	respiratory irritation -
	SO_2 [1]	10 min 1 hour 1 hour	500 450 170	WHO Alberta CCME	respiratory irritation -
	$PM_{2.5}$	24 hour	27	CCME	population mortality and morbidity
	PM_{10}	24 hour	50	WHO	population mortality and morbidity
PAH	Acenaphthene	1 hour	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)
	Acenaphthylene	1 hour	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)
	Anthracene	1 hour	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)
	Benzo(a)anthracene	-	*not available*	-	-
	Benzo(a)pyrene	-	*not available*	-	-
	Benzo(b)fluoranthene	-	*not available*	-	-
	Benzo(g,h,i)perylene	-	*not available*	-	-
	Benzo(k)fluoranthene	-	*not available*	-	-
	Chrysene	-	*not available*	-	-
	Dibenzo(a,h)anthracene	-	*not available*	-	-
	Fluoranthene	-	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)

Table 5.3-1 Toxicity Reference Values (TRVs) – Acute Inhalation

Grouping	Chemical	Averaging Time	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
	Fluorene	1 hour	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)
	Indeno(1,2,3-cd)pyrene	-	*not available*		
	Naphthalene[2]	24 hour	22.5	OMOE	health
	Phenanthrene	1 hour	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)
	Pyrene	1 hour	570	ACGIH	eye irritation (surrogate: aromatic C9-C16 group)
VOCs	Acetaldehyde	1 hour	470	OEHHA	eye, nasal and respiratory irritation
	Acrolein	1 hour	2.5	OEHHA	eye, nasal and respiratory irritation
	Benzene	1 hour	30	AEP	-
	Propylene	-	*not available*	-	-
	Formaldehyde	1 hour	50	ATSDR	eye and nasal irritation
	Toluene	1 hour	15,000	TCEQ	eye and nasal irritation, neurological effects
	Xylenes	1 hour	7,400	TCEQ	eye and respiratory irritation, neurological effects
Metals	Aluminium	1 hour	20	TCEQ	-
	Antimony	1 hour	5	TCEQ	-
	Arsenic	1 hour	0.2	OEHHA	developmental
	Cadmium	24 hour	0.03	ATSRD	nasal and respiratory
	Chromium III	1 hour	12	TCEQ	respiratory
	Cobalt	-	*not available*	-	-
	Copper	1 hour	100	OEHHA	respiratory
	Mercury	1 hour	0.6	OEHHA	nervous system
	Nickel	1 hour	0.2	OEHHA	immune

Table 5.3-1 Toxicity Reference Values (TRVs) – Acute Inhalation

Grouping	Chemical	Averaging Time	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
	Vanadium	1 hour	30	OEHHA	respiratory
Other	Coal Dust	24 hour	50	WHO	population mortality and morbidity (surrogate: PM_{10})
	Silica (and silicates)	24 hour	47	TCEQ	respiratory inflammation
	Diesel Particulate Matter (DPM)	2 hour	10	Health Canada	respiratory

[1] Includes assessment of NO_2 and $SO_{2.5}$ to CCME CAAQS in response to IR HC-2 and HC-3 (Addendum 6, CEAA #70, April 30 2018). The health basis of the CCME CAAQS have not been published.

[2] The OMOE TRV for naphthalene was used in response to JRP IR-4.11.

Table 5.3-2 Toxicity Reference Values (TRVs) – Chronic Inhalation

Grouping	Chemical	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
CAC	CO	not available		
	NO_2 [1]	40 23	WHO CCME	respiratory illness -
	SO_2 [1]	*defer to acute*		
	$PM_{2.5}$	8.8	CCME	population mortality and morbidity
	PM_{10}	20	WHO	population mortality and morbidity
PAH	Acenaphthene	50	MA DEP	kidney and liver (surrogate: aromatic C9-C16 group)
	Acenaphthene	50	MA DEP	kidney and liver (surrogate: aromatic C9-C16 group)

Table 5.3-2 Toxicity Reference Values (TRVs) – Chronic Inhalation

Grouping	Chemical	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
	Acenaphthylene	50	MA DEP	kidney and liver (surrogate: aromatic C9-C16 group)
	Anthracene	50	MA DEP	kidney and liver (surrogate: aromatic C9-C16 group)
	Benzo(a)anthracene	BaP group	Health Canada	lung tumours
	Benzo(a)pyrene	0.009	OEHHA	lung tumours
	Benzo(b)fluoranthene	BaP group	Health Canada	lung tumours
	Benzo(g,h,i)perylene	BaP group	Health Canada	lung tumours
	Benzo(k)fluoranthene	BaP group	Health Canada	lung tumours
	Chrysene	BaP group	Health Canada	lung tumours
	Dibenzo(a,h)anthracene	BaP group	Health Canada	lung tumours
	Fluoranthene	BaP group 50	Health Canada MA DEP	lung tumours kidney and liver (surrogate: aromatic C9-C16 group)
	Fluorene	50	MA DEP	kidney and liver (surrogate: aromatic C9-C16 group)
	Indeno(1,2,3-cd)pyrene	BaP group	Health Canada	lung tumours
	Naphthalene	3 0.3	US EPA OEHHA	nasal irritation nasal tumours
	Phenanthrene	BaP group 50	Health Canada MA DEP	lung tumours kidney and liver (surrogate: aromatic C9-C16 group)
	Pyrene	50	MA DEP	kidney and liver (surrogate: aromatic C9-C16 group)

Table 5.3-2 Toxicity Reference Values (TRVs) – Chronic Inhalation

Grouping	Chemical	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
VOCs	Acetaldehyde	3.7 9	OEHHA US EPA	nasal tumours nasal irritation
	Acrolein	0.35	OEHHA	nasal and respiratory irritation
	Benzene	1.3 9.8	US EPA ATSDR	leukemia immunological and hematological
	Formaldehyde	2 9	OEHHA/HC OEHHA	nasal tumours eye, nasal, respiratory irritation
	Propylene	3000	OEHHA	metaplasia, hyperplasia and Inflammation
	Toluene	5,000	US EPA	neurological
	Xylenes	200	ATSDR	eye and nasal irritation, neurological effects
Metals	Aluminium	5	US EPA	Neurological
	Antimony	0.2	US EPA	respiratory effects
	Arsenic	0.0016	Health Canada	Lung cancer
	Barium	1.0	RIVM	cardiovascular
	Beryllium	0.02 0.004	US EPA	sensitization
	Cadmium	0.001	Health Canada	lungs
	Chromium III	0.14	TCEQ	respiratory
	Chromium VI	0.00013	Health Canada	respiratory
	Cobalt	0.006	US EPA	respiratory
	Copper	1	RIVM	respiratory and immunological
	Lead	0.15	US EPA	-

Table 5.3-2 Toxicity Reference Values (TRVs) – Chronic Inhalation

Grouping	Chemical	Exposure Limit (µg/m³)	Agency	Toxicity Endpoint
	Manganese	0.09	OEHHA	nervous system
	Mercury	0.03	OEHHA	nervous system
	Molybdenum	12	RIVM	body weight
	Nickel	0.0035	Health Canada	lung, lung cancer
	Selenium	20	OEHHA	selenosis
	Uranium	0.04	ATSDR	-
	Vanadium	0.1	ATSDR	respiratory
Other[2]	Coal Dust	0.9	TCEQ	undefined (based on PM4)
	Silica (and silicates)	2	TCEQ	silicosis
	Diesel Particulate Matter (DPM)	5	Health Canada	respiratory, histopathological and/or function changes

[1] Includes assessment of NO_2 and SO_2 to CCME CAAQS in response to IR HC-2 and HC-3 (Addendum 6, CEAA #70, April 30 2018).

[2] "Other" COPC were included in the HHRA in response to IR AER-154 (Addendum 5, CEAA # 69, February 28 2018) and JRP IR-4.10.

Table 5.3-3 Toxicity Reference Values (TRVs) - Chronic Oral Exposure Limits

	Chemical	Exposure Limit (mg/kg bw/d)	Agency	Toxicity Endpoint
PAHs and VOCs	Acenaphthene	0.060	US EPA	liver
	Acenaphthylene	0.060	US EPA	liver
	Anthracene	0.3	US EPA	NOAEL
	Benzo(a)anthracene	BaP equivalent	-	gastrointestinal tumours
	Benzo(a)pyrene	0.0000014	US EPA	gastrointestinal tumours
	Benzo(b)fluoranthene	BaP equivalent	-	gastrointestinal tumours

Table 5.3-3 Toxicity Reference Values (TRVs) - Chronic Oral Exposure Limits

	Chemical	Exposure Limit (mg/kg bw/d)	Agency	Toxicity Endpoint
	Benzo(g,h,i)perylene	BaP equivalent	-	gastrointestinal tumours
	Benzo(k)fluoranthene	BaP equivalent	-	gastrointestinal tumours
	Chrysene	BaP equivalent	-	gastrointestinal tumours
	Dibenzo(a,h)anthracene	BaP equivalent	-	gastrointestinal tumours
	Fluoranthene	BaP equivalent	-	gastrointestinal tumours
	Fluorene	0.040	US EPA	kidney, liver, spleen
	Indeno(1,2,3-cd)pyrene	BaP equivalent	-	gastrointestinal tumours
	Phenanthrene	BaP equivalent	-	gastrointestinal tumours
	Pyrene	0.030	US EPA	kidney
	Formaldehyde	0.150	Health Canada	kidney and GI
Metals	Aluminium	0.143	WHO	-
	Antimony	0.0002	Health Canada	Serum glucose and haematuria
	Arsenic	0.0000056	Health Canada	cancer (bladder, lung, liver)
	Barium	0.2	US EPA	kidney
	Beryllium	0.002	US EPA	gastrointestinal
	Cadmium	0.0005	US EPA	kidney
	Chromium III	1.5	US EPA	-
	Chromium VI	0.0009	ATSDR	gastrointestinal
	Cobalt	0.0014	RIVM	cardiovascular
	Copper	0.091 (0 - 4 yrs)	Health Canada	liver and gastrointestinal

Table 5.3-3 Toxicity Reference Values (TRVs) - Chronic Oral Exposure Limits

	Chemical	Exposure Limit (mg/kg bw/d)	Agency	Toxicity Endpoint
		0.111 (5 - 11 yrs) 0.126 (12 - 19 yrs) 0.141 (20+ yrs)		
	Manganese	0.047	US EPA	nervous system
	Mercury	0.0003	US EPA	kidney
	Molybdenum	0.005	US EPA	uric acid levels
	Nickel	0.011	OEHHA	perinatal mortality
	Selenium	0.005	US EPA	selenosis
	Thallium	0.00001	US EPA	hair follicle atrophy
	Uranium	0.0006	Health Canada	kidney
	Vanadium	0.002	RIVM	developmental
	Zinc	0.3	US EPA	ESOD activity
Other	Silica (and silicates)	Not considered toxic via the oral exposure route (see Section 5.3.1.1)		

5.3.1.1 Silica

Silica via the oral exposure route is relatively non-toxic. The European Food Safety Authority (EFSA 2009) concluded that the use of silicon dioxide in food supplements (up to 1,500 mg SiO_2/day) is of no safety concern. Silica was not considered as a COPC through Multimedia Exposure (oral route).

5.3.2 Mixtures

Receptors are potentially exposed to mixtures of chemicals, and in these mixtures there is the potential for chemical interactions to affect toxicity. Consistent with Health Canada (2010a) recommendations, where chemicals have similar effects on the same target organs, they were assumed to have additive toxicity (*i.e.,* the toxic effects are combined).

As part of the toxicity evaluations, chemicals were assigned to toxicity groups based on critical effects and target organs. These groups are summarized in Table 5.3-4. All COPCs within a toxicity group were assumed to have additive toxicity.

Table 5.3-4 Toxicity Endpoint Groups[1]

Exposure Pathway and Duration	Toxicity Endpoint	COPC
Acute Inhalation	Eye Irritant	Acenaphthene, Acenaphthylene, Anthracene, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Pyrene, Acetaladehyde, Acrolein, Formaldehyde, Toluene, Xylenes
	Nasal Irritant	Acetaldehyde, Acrolein, Formaldehyde, Toluene, Cadmium
	Respiratory Irritant[2]	$PM_{2.5}$, NO_2, SO_2, Acetaldehyde, Acrolein, Xylenes, Chromium (III), Copper, Vanadium, Silica (and silicates)
	Neurological	Mercury, Toluene, Xylenes
Chronic Inhalation	Eye Irritant	Formaldehyde, Xylenes
	Respiratory	Acrolein, Antimony, Beryllium, Formaldehyde, Chromium (III), Cobalt, Copper, Vanadium
	Nasal Irritant	Acetaldehyde, Acrolein, Formaldehyde, Naphthalene, Xylenes
	Neurological	Aluminium, Lead, Manganese, Mercury, Selenium, Toluene, Xylenes
	Kidney and Liver	Acenaphthene, Acenaphthylene, Anthracene, Fluoranthene, Fluorene, Phenanthrene, Pyrene
	Nasal Tumours	Napthalene, Acetaldehyde, Formaldehyde
	Lung Tumours	Benzo[a]pyrene group, Arsenic, Beryllium, Cadmium, Chromium (VI), Nickel
Chronic Oral	Gastrointestinal	Beryllium, Total Chromium, Formaldehyde, Copper
	Liver	Acenaphthene, Acenaphthylene, Fluorene, Aluminum, Antimony, Copper, Selenium, Fluoranthene

Table 5.3-4 Toxicity Endpoint Groups[1]

Exposure Pathway and Duration	Toxicity Endpoint	COPC
	Kidney	Barium, Cadmium, Formaldehyde, Fluoranthene, Fluorene, Mercury, Pyrene, Uranium
	Reproductive	Aluminium, Lead, Nickel, Vanadium
	Gastrointestinal Tumours	Benzo[a]pyrene group

1 Toxicity endpoint groups were updated in response to IR AER-170 (Addendum 5, CEAR #69,).
2 $PM_{2.5}$ was added to the respiratory irritant toxicity endpoint group in response to IR HC-6 (Addendum 6, CEAR #70).
3 Silica (and silicates) was added to the respiratory irritant toxicity endpoint group in response to JRP IR-4.10.

5.4 Risk Characterization

Risk characterization is the stage where the results of the exposure and toxicity assessments are combined to evaluate potential risks to human receptors.

Risks are characterized using hazard quotients (HQ) for non-carcinogenic COPCs. An HQ is simply the ratio of the predicted exposure to the appropriate exposure limit (TC/RfC or TDI/RfD). An HQ less than 1.0 indicates that predicted exposures are less than the TC or TDI and adverse effects are not predicted for any receptors.

In response to IR HC-R2-11 (Addendum 8 [Part B], CEAR #89) the potential risks of adverse health effects were compared to a more conservative HQ of 0.2 instead of 1.0 so as to account for potential exposures from background sources not included in the HHRA (*e.g.*, store bought foods and consumer products). This was conducted for all COPC except for CACs and silica. CACs and silica were compared to a target HQ of 1.0 as the risk of exposure due to inhalation was of primary concern and background (baseline) exposure was included for consideration of exposure.

For non-threshold chemicals, the potential risk of adverse health effects was assessed using an incremental lifetime cancer risk (ILCR). The ILCR was calculated by multiplying the predicted exposure by the appropriate slope factor or unit risk. An ILCR of less that $1x10^{-5}$ indicates that the predicted risks are less than 1 in 100,000 a value considered "essentially negligible" by both Alberta and Federal health agencies (AHW 2011; Health Canada 2010a,b)1.

1 The original HHRA (2016) included an ILCR quotient calculated as a ratio of the predicted exposure to the appropriate exposure limit (RSD or RSC). An ILCR quotient less than 1.0 indicates that the predicted incremental lifetime cancer risk is less than the "essentially negligible" target of 1 in 100,000. In response to IR HC-R2-9 (Addendum 8 [Part B], CEAR #89) the carcinogenic risks

Due to the number of conservative assumptions purposefully built into the HHRA, an HQ greater than 0.2 (1.0 for CACs and silica) or an ILCR value greater than 1×10^{-5} does not automatically indicate a potential risk of adverse health effects. Instead, it is an indication that additional in-depth assessment is required for the individual risk result. The additional assessment includes a review of the conservative assumptions made in the toxicity and exposure assessment steps of the HHRA. The purpose of the review is to determine whether the result represents a potential risk of adverse health effects or simply are the result of the conservative assumptions made during the HHRA calculations.

6.0 RESULTS AND DISCUSSION

The HHRA assessed potential health risks at 15 receptor locations, including the maximum point of impingement in the Regional Study Area (RSA-MPOI). Predicted HQs and ILCR results are presented herein for the RSA-MPOI as this represents the highest levels of predicted human exposure. Results for the remaining receptor locations were all lower than the RSA-MPOI and are included for reference in Appendix C (Acute Inhalation Results), Appendix D (Chronic Inhalation Results), and Appendix F (Detailed Multimedia Model Results).

6.1 Acute Inhalation

6.1.1 HQ Results

The HQs for acute inhalation are presented for the RSA-MPOI locations in Table 6.1-1. The RSA-MPOI results are representative of the worst-case acute exposure scenarios exposure; therefore, results from all other HHRA locations are lower. The complete list of HQs for all receptor locations assessed in the HHRA are provided in Appendix C (Acute Inhalation Results). These results are independent of the receptor group since they are evaluated based on concentrations only and the toxicity limits are the same for all age groups and receptor types.

were recalculated as ILCR (predicted exposure is multiplied by the appropriate slope factor or unit risk) with an acceptable threshold of 1×10^{-5}. It is important to note that both methods result in the same magnitude of predicted risk.

Table 6.1-1 Predicted Hazard Quotients for the Acute Inhalation Assessment

Parameter	Averaging Time (h)	RSA-MPOI		
		Project	Baseline	Application
Criteria Air Contaminants				
Carbon Monoxide	1	3.8E-01	1.3E-01	3.9E-01
	8	4.2E-01	2.3E-01	4.2E-01
Nitrogen Dioxide	1	***1.5E+00***[1]	6.5E-01[1]	***1.5E+00***[1]
	1	***3.5E+00***[2]	***1.5E+00***[2]	***3.5E+00***[2]
Sulphur Dioxide	10 min	1.4E-01	2.7E-02	1.5E-01
	1	9.2E-02[1]	1.3E-02[1]	9.2E-02[1]
	1	2.4E-01[2]	3.3E-02[2]	2.4E-01[2]
$PM_{2.5}$	24	***1.9E+00***	4.8E-01	***1.9E+00***
PM_{10}	24	***5.9E+00***	4.2E-01	***6.3E+00***
Non-Criteria Air Contaminants				
Aluminium	1	1.6E-03	4.4E-04	1.6E-03
Antimony	1	3.4E-05	8.1E-06	3.4E-05
Arsenic	1	***4.3E-01***	1.2E-01	***4.4E-01***
Cadmium	1	2.4E-04	7.2E-05	2.5E-04
Chromium	1	7.8E-04	2.2E-04	8.0E-04
Copper	1	2.4E-04	7.2E-05	2.5E-04
Mercury	1	4.1E-05	9.2E-06	4.1E-05
Nickel	1	2.2E-02	4.9E-03	2.2E-02
Selenium	1	1.1E-05	2.4E-06	1.1E-05
Vanadium	1	1.1E-03	3.1E-04	1.1E-03
Benzene	1	4.1E-02	1.1E-02	4.2E-02
Toluene	1	2.9E-05	8.2E-06	3.1E-05
Xylenes	1	4.1E-05	1.1E-05	4.3E-05
Acetaldehyde	1	8.4E-05	2.4E-05	8.8E-05
Acrolein	1	5.0E-03	1.4E-03	5.1E-03
Formaldehyde	1	2.5E-03	6.9E-04	2.6E-03
Acenaphthene	1	1.3E-05	3.6E-06	1.3E-05
Acenaphthylene	1	2.5E-05	7.1E-06	2.6E-05
Anthracene	1	3.4E-06	9.5E-07	3.5E-06

Table 6.1-1 Predicted Hazard Quotients for the Acute Inhalation Assessment

Parameter	Averaging Time (h)	RSA-MPOI		
		Project	Baseline	Application
Fluoranthene	1	1.1E-05	3.1E-06	1.2E-05
Fluorene	1	3.5E-05	9.8E-06	3.7E-05
Naphthalene	24	7.3E-04	9.0E-04	1.1E-03
Phenanthrene	1	1.1E-04	3.1E-05	1.2E-04
Pyrene	1	1.0E-05	2.9E-06	1.1E-05
Coal Dust[3]	24	***3.5E-01***	-	**-**
Silica (and silicates)[4]	24	5.7E-01	2.5E-04	5.7E-01
Diesel Particulate Matter (DPM)	2	***3.1E+00***	***2.2E+00***	***3.4E+00***

1 HQs were calculated using the US EPA (respiratory irritant) as per Albertan HHRA guidance requirements. These HQ results were carried forward as part of the multiple COPC assessment for respiratory irritation (Section 6.1.1).

2 In response to IR HC-3 (Addendum 6, CEAR #70) HQs were calculated using the CCME (CAAQS) as a TRV.

3 Coal Dust HQ results were calculated based on PM_{10} (Section 5.2.1.1) exposure concentration modified for % contribution of coal. Baseline and application case HQ result were not predicted as %contribution of coal to background PM is unknown.

4 Silica HQ results were calculated using maximum predicted silica concentrations in both $PM_{2.5}$ and PM_{10} (Section 5.2.1.1). The highest predicted HQ results were those modelled on PM_{10} predictions and an assumed % silica in coal of 73%, a highly conservative assumption.

As shown in the Table 6.1-1, risk results for three CACs (the 1-hour average NO_2 concentrations (derived using the US EPA TRV and the CCME CAAQS); 24-hour $PM_{2.5}$; and, PM_{10}) were greater than an HQ of 1.0. Arsenic, coal dust and DPM HQ results were greater than a target HQ of 0.2 at the RSA-MPOI location.

A detailed review of the risk results was conducted for NO_2, $PM_{2.5}$, PM_{10}, arsenic, coal dust and DPM.

6.1.1.1 Criteria Air Contaminants

An assessment was conducted for those CACs with HQs greater than 1.0 at the RSA-MPOI; the HQs for NO_2, $PM_{2.5}$, PM_{10} for the remaining human receptor locations and are shown below in Tables 6.1-2 through 6.1-4.

Nitrogen Dioxide

Risk results calculated using the more conservative CCME CAAQS for NO_2 are presented in Table 6.1-2. HQs were predicted to be greater than 1.0 at 11 of the 15 HHRA locations. With the exception of the RSA-MPOI location, all exceedances were only slightly greater than 1.0. In

their assessment of potential risk associated with ambient exposure to NO_2, Health Canada conducted a detailed review of the available data (Health Canada 2016a). Health Canada concluded that potential effects have been demonstrated at concentrations lower than the ambient standards previously used for air quality assessment and that there was no clear evidence of a threshold dose below which no adverse health effects were reported. For this reason, CAAQS were recommended by Health Canada (Health Canada 2016a) and established by CCME in 2017. The health basis and calculations of the CCME CAAQS have not been published; therefore, an assessment of the basis for the selected CAAQS as protective of health could not be conducted.

Table 6.1-2 Predicted NO_2-1 hour Hazard Quotients at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
Derived Using the CCME CAAQS			
RSA-MPOI	***3.5E+00***	***1.5E+00***	***3.5E+00***
FL-MPOI	***1.3E+00***	8.5E-01	***1.4E+00***
R1	7.1E-01	***1.1E+00***	***1.1E+00***
R2	4.6E-01	4.3E-01	7.5E-01
R3	3.2E-01	***1.2E+00***	***1.2E+00***
R4	1.6E-01	4.2E-01	5.7E-01
R5	2.5E-01	4.2E-01	6.5E-01
R6	4.2E-01	***1.3E+00***	***1.3E+00***
R7	3.5E-01	***1.1E+00***	***1.1E+00***
R8	1.0E+00	***1.5E+00***	***1.5E+00***
R9	***1.1E+00***	5.8E-01	***1.1E+00***
R10	1.0E+00	4.6E-01	***1.1E+00***
R11	***1.1E+00***	4.4E-01	***1.2E+00***
R12	7.0E-01	5.0E-01	9.0E-01
R13	7.7E-01	4.8E-01	9.3E-01
R14	6.7E-01	***1.2E+00***	***1.2E+00***

Of the locations situated within the Mine Permit Boundary (RSA-MPOI, R10) the predicted exceedances were attributed to Project activities. Locations within the Project Footprint are

restricted from the general public (RSA-MPOI) during construction and operation activities and locations within the Mine Permit Boundary will have limited access. In all other instances, project emissions are either lower than background contributions (R1, R3, R6, R7, R8 and R14) and have no material effect on Application case predictions, or are marginally elevated as compared to the CAAQS and are situated along the Mine Project Boundary (R9 and R11).

As per HHRA guidance (AHW 2011; Health Canada 2010a), additional assessment of all HQ results great than 1.0 was conducted to determine whether they indicated a potential human health risk. For the NO_2 assessment, this included the evaluation of five-year, time series data for all locations with an HQ greater than 1.0. The time series data predicted 1-hour maximum concentrations for a period of five years; resulting in a total of 43,824 1-hour periods in 5 years[2]. Appendix C, Figures C.1 to C.11 provides the detailed results of the time series data for each location with an HQ greater than 1.0.

Overall, the predicted number of times that the CAAQS TRV was exceeded per year is low and for most receptor locations (with the exception of receptor locations FL-MPOI, RSA-MPOI, R6 and R8), the TRV is exceeded less than 2.85% of the time. Table 6.1-3 provides a summary of health effects caused at increasing concentrations of NO_2.

Table 6.1-3 CAAQS and Adverse Human Health Effects Caused at Varying Concentrations of NO_2

Concentration ($\mu g/m^3$)	Effect	Source
42	CAAQS	CCME (2014)
188	No effect	WHO (2000)
226	Slight functional impairment during exercise (asthmatics)	
940	Chest tightness and laboured breathing with exercise in 7 of 13 asthmatics tested. Slight burning of the eyes, slight headache eye irritation and headache.	NRC (2012)
22,560	Burning sensation in nose and chest	
47,000	Bronchiolitis and focal pneumonia with spontaneous recovery	

[2] Note that the actual concentration from which to compare the CAAQS is the 98%ile of the 3 year average, however, the guideline value has been conservatively applied to all of the 1-hour maximum predicted NO_2 concentrations.

Comparison of the 1-hour NO_2 concentrations for RSA-MPOI, FL-MPOI, R1, R3, R6 through R11 and R12 to those concentrations which illicit an adverse effect (Table 6.1-3) are provided in Figure C.1 through Figure C.11 in Appendix C, respectively. These results indicate that with the exception of the RSA-MPOI none of the receptor locations reported concentrations greater than 188 $\mu g/m^3$ and all receptor locations (included RSA-MPOI) reported 1-hour NO_2 concentrations below 226 $\mu g/m^3$ which is the concentration reported to cause slight functional impairment in sensitive individuals during exercise (Table 6.1-3).

These results indicate that a sensitive individual would be unlikely to experience any adverse respiratory symptoms (shortness of breath, wheezing) at any of the receptor locations; however, in the unlikely event an incident occurred, the effect would be transient and occur only at the RSA-MPOI. Non-sensitive individuals would not be affected.

At the RSA-MPOI, the no effect level of 188 $\mu g/m^3$ was exceeded 0.26% of the time (Appendix C, Figure C.1). The maximum predicted 1-hr concentration in 5-years is 671 $\mu g/m^3$, which is lower than the concentration of NO_2 known to cause an adverse health effect in exercising asthmatics (940 $\mu g/m^3$) but is elevated above the concentration known to cause slight functional impairment (226 $\mu g/m^3$). The number of times the 1-hr concentration is predicted to exceed a value of 226 $\mu g/m^3$ is 10 times per year (approximately 0.12% of the time). The RSA-MPOI is located within the Project Footprint, thus is not expected to be accessible to the general population. Owing to the fact that the mine site area is restricted from the public during construction and operation activities and therefore potential for exposure is negligible, combined with the conservative nature inherent in the air modelling methodology, acute exposure to project related NO_2 is not considered to pose a risk of adverse human health effects.

At all other locations, predicted air concentrations are lower than the no effects limit provided by WHO (2000) and were elevated as compared to the CAAQS guidelines for relatively short durations of time (Appendix C, Figure C.2 to C.11).

The following was considered in the evaluation of potential risk of adverse effect associated with predicted NO_2 exposure:

- Current evidence suggests that the dose-response curve for NO_2 is likely to be close to linear; therefore, any exposure has the potential to illicit potential adverse health effects (Health Canada 2016a).
- The CAAQS for NO_2 is the most conservative TRV identified for HHRA.
- Predictive air concentration modelling is inherently conservative.
- Exceedances predicted to occur at publicly accessible locations (south of the mine site boundary) are primarily due to estimated background contributions.
- Modelled background air concentrations are overly conservative.
- Timeseries indicates that the predicted occurrences are infrequent.

Examination of the multiple lines of evidence indicates that although there are predicted exceedances of the NO_2 CAAQS, the potential risk of adverse health effects is low.

Particulate Matter ($PM_{2.5}$)

For $PM_{2.5}$ the HQ was slightly greater than 1.0 at the RSA-MPOI only; all other locations were less than 1.0 (Table 6.1-4). The $PM_{2.5}$ location is also within the Project footprint and is assumed inaccessible by the general public (Consultants Report #1a, Figure 5.4-4). These results indicate that the potential risk of adverse health effects is low.

Table 6.1-4 Predicted $PM_{2.5}$-24 hour Hazard Quotients at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***1.9E+00***	4.8E-01	***1.9E+00***
FL-MPOI	4.3E-01	3.5E-02	4.3E-01
R1	2.2E-02	1.8E-01	2.0E-01
R2	2.7E-02	1.5E-03	2.9E-02
R3	1.4E-02	1.1E-01	1.1E-01
R4	8.5E-03	6.8E-04	9.1E-03
R5	1.2E-02	9.4E-04	1.3E-02
R6	1.4E-02	3.4E-01	3.4E-01
R7	1.4E-02	1.6E-01	1.6E-01

Table 6.1-4 Predicted $PM_{2.5}$-24 hour Hazard Quotients at all Assessed Receptor Locations			
R8	5.3E-02	4.1E-01	4.4E-01
R9	8.1E-02	1.4E-02	8.9E-02
R10	2.5E-01	4.5E-03	2.5E-01
R11	1.2E-01	2.5E-03	1.3E-01
R12	4.2E-02	7.8E-03	4.8E-02
R13	6.1E-02	5.9E-03	6.5E-02
R14	1.6E-02	4.2E-01	4.2E-01

Particulate Matter (PM_{10})

For PM_{10}, HQs greater than 1.0 were predicted at the RSA-MPOI, the FL-MPOI, R10 (Residential #4), R6 (Coleman), and R8 and R14 (Blairmore North and Centre) (Table 6.1-5). At the locations within the Mine Permit Boundary (the RSA-MPOI, FL-MPOI, and R10) Project related emissions were the primary contributor of the HQ results.

Table 6.1-5 Predicted PM_{10}-24 hour Hazard Quotients at all Assessed Receptor Locations			
Receptor	**Project**	**Baseline**	**Application**
RSA-MPOI	***5.9E+00***	4.2E-01	***6.3E+00***
FL-MPOI	***1.7E+00***	4.8E-01	***2.1E+00***
R1	4.7E-02	7.6E-01	7.7E-01
R2	5.9E-02	4.2E-01	4.8E-01
R3	4.9E-02	6.1E-01	6.2E-01
R4	2.3E-02	4.2E-01	4.4E-01
R5	3.8E-02	4.2E-01	4.6E-01
R6	4.2E-02	***1.1E+00***	***1.1E+00***
R7	3.4E-02	7.4E-01	7.4E-01
R8	6.6E-02	***1.3E+00***	***1.3E+00***
R9	2.5E-01	4.4E-01	6.7E-01
R10	6.8E-01	4.3E-01	***1.1E+00***
R11	3.1E-01	4.2E-01	7.4E-01

Table 6.1-5 Predicted PM_{10}-24 hour Hazard Quotients at all Assessed Receptor Locations			
R12	1.2E-01	4.3E-01	5.4E-01
R13	1.7E-01	4.3E-01	5.9E-01
R14	3.6E-02	***1.2E+00***	***1.2E+00***

At R10, PM_{10} exceedances were only marginally above 1.0 and were similar to those predicted for a person living in Blairmore and Coleman. However, as Project emissions were the primary contributor to predicted exposures additional assessment of the results was conducted. A time series assessment was completed by the Air Quality team using five years of atmospheric data from 2002 through 2006. A time series assessment provides the predicted 24-hour maximum concentrations of PM_{10} for everyday of the five years modelled in the air dispersion assessment. The data were evaluated to determine the frequency of predicted exceedances over the five years. When the daily predicted maximum concentrations of PM_{10} at R10 were compared to the TRV, it was determined that a total of 4 exceedances over five years were predicted for the Application case (Appendix C, Table C-5); one in 2004, two in 2005 and one in 2006, resulting in an average of 0.8 days a year. Thus, indicating that there is a potential risk of exposures exceeding the safe TRV at the R10 on average only 0.8 days per year over the life of the Project.

Subsequent to the assessment of this location, the cabin located at R10 (within the Mine Permit Boundary) was purchased by Benga and is therefore no longer a potential human exposure location.

It should be noted that the TRV for PM_{10} (Appendix B, Section 32.0) is based on $PM_{2.5}$ toxicity that assumes a $PM_{2.5}$:PM_{10} ratio of 0.5, with a recommendation to adjusting the PM ratio to reflect local conditions when data is available (WHO 2005). The applied PM ratio of 0.5 is conservative when compared to the current Project, which had a predicted average $PM_{2.5}$:PM_{10} ratio of 0.25 with a maximum value of 0.37 for the Application case acute inhalation calculations. Due to the marginal nature of the HQ exceedances for PM_{10}, the lack of HQ exceedances for $PM_{2.5}$, and the conservative assumption built into the TRV, acute exposure to PM_{10} is not considered to pose a risk of adverse human health effects at R10. In addition, $PM_{2.5}$ is a better indicator of potential risk to human health; as discussed, the results of the $PM_{2.5}$ assessment indicate that the potential risk of adverse health effects is low (Section 6.1.1.1 and Table 6.1-4).

Predicted PM_{10} concentrations at receptor locations outside of the Mine Permit Boundary (R6 [Coleman], R8 [Blairmore North], and R14 [Blairmore Centre]) were primarily a result of existing baseline conditions, with predicted maximum concentrations from project emissions being less than 10% of baseline values at each location (R6 ([6.1%], R8 [7.6%] and R14 [4.5%, respectively]). PM_{10} time series data (Appendix C, Table C-5) was evaluated to determine seasonal contributions of the Project

emission to Application case emissions at receptors R6, R8, and R14. Seasons were defined using the northern meteorological divisions as follows:

- Spring – March through May;
- Summer – June through August;
- Fall – September through November; and
- Winter – December through January.

Project contributions to Application Case emissions are summarized below for all days where exceedances of acute air quality targets are predicted (Table 6.1-6). Project contribution was generally consistent seasonally and was minimal compared to overall emissions.

Table 6.1-6 Project Contribution to Air Quality Exceedances

Location	Number of Predicted Exceedances (2002-2006)	Average Project Contribution (%)[1]	Maximum Project Contribution (%)[1]
R6-Spring	1	0.3	0.3
R6-Summer	3	0.0	0.0
R6-Fall	8	0.6	2.5
R6-Winter	0	0.0	0.0
R8-Spring	18	4.0	7.1
R8-Summer	26	4.7	8.1
R8-Fall	29	4.3	6.8
R8-Winter	0	-	-
R14-Spring	14	1.3	4.4
R14-Summer	27	0.9	2.4
R14-Fall	24	1.1	4.1
R14-Winter	0	-	-

1 – calculated as percentage of Application Case emissions for guideline exceedances only

Examination of the multiple lines of evidence indicated that although there are predicted exceedances for PM_{10}, the potential risk of adverse health effects is low.

6.1.1.2 Arsenic

The maximum 1-hr predicted total arsenic concentration was elevated at one location (RSA-MPOI) when compared to an HQ of 0.2 (Table 6.1-7). The HQ results for all other locations were well below 0.2. The RSA-MPOI location is adjacent the mine edge and is not accessible by the public. As the predicted HQ is below 1.0 and the location of the predicted maximum is inaccessible to the general public, the elevated arsenic concentration at this location is considered to present negligible risk for adverse human health effect.

Table 6.1-7 Predicted Arsenic - 1 hour Hazard Quotients at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***4.3E-01***	1.2E-01	***4.4E-01***
FL-MPOI	3.1E-02	9.0E-03	3.1E-02
R1	3.3E-02	4.0E-02	5.3E-02
R2	4.0E-03	8.5E-04	4.5E-03
R3	5.3E-03	2.9E-02	2.9E-02
R4	1.4E-03	3.9E-04	1.7E-03
R5	1.9E-03	5.7E-04	2.2E-03
R6	6.9E-03	5.3E-02	5.3E-02
R7	4.9E-03	3.3E-02	3.3E-02
R8	5.2E-02	1.0E-01	1.2E-01
R9	1.5E-02	5.1E-03	1.6E-02
R10	1.4E-02	1.6E-03	1.4E-02
R11	1.5E-02	1.0E-03	1.6E-02
R12	7.8E-03	2.7E-03	8.6E-03
R13	5.9E-03	1.9E-03	6.2E-03
R14	1.5E-02	8.7E-02	8.7E-02

6.1.1.3 Coal Dust

The maximum 24-hr predicted coal dust HQ was greater than 0.2 and less than 1.0 at the RSA-MPOI location only (Table 6.1-8). The HQ results for all other locations were well below 0.2. The RSA-MPOI location is adjacent the mine edge and is not accessible by the public. As the predicted HQ is

below 1.0 and the location of the predicted maximum is inaccessible to the general public, an elevated coal dust concentration at this location is considered to present negligible risk for adverse human health effect.

Baseline and Application case predictions were not completed as particulate matter contribution from baseline is not modelled from sources considered to contain coal dust (*e.g.*, public roads, and vehicle emission).

Table 6.1-8 Predicted Coal Dust Hazard Quotients at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***3.5E-01***	-	**-**
FL-MPOI	9.9E-02	-	-
R1	2.8E-03	-	-
R2	3.5E-03	-	-
R3	2.9E-03	-	-
R4	1.4E-03	-	-
R5	2.3E-03	-	-
R6	2.5E-03	-	-
R7	2.0E-03	-	-
R8	3.9E-03	-	-
R9	1.5E-02	-	-
R10	4.0E-02	-	-
R11	1.8E-02	-	-
R12	7.1E-03	-	-
R13	1.0E-02	-	-
R14	2.1E-03	-	-

6.1.1.4 Diesel Particulate Matter

For acute inhalation exposure to DPM, HQs were predicted to be greater than 0.2 at all receptor locations, except for R4 and R5 (Table 6.1-9). For those locations within the Project Footprint (Project and Application RSA-MPOI), at the Permit Boundary (FL-MPOI) and outside of the Permit Boundary (R9, R10, R11, R12, and R13), the Project emissions were predicted to contribute the majority of the

HQ results. At R1 (Lost Lemon Campground), R3, R6 (Coleman), R7 (Frank), R8 (Blairmore North), and R14 (Blairmore Centre), the HQ results are almost entirely a result of Baseline emissions.

Table 6.1-9 Predicted DPM-2 hour Hazard Quotients at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***3.1E+00***	***2.2E+00***	***3.4E+00***
FL-MPOI	***1.4E+00***	***2.8E-01***	***1.4E+00***
R1	***2.7E-01***	***1.2E+00***	***1.2E+00***
R2	2.0E-01	3.0E-02	2.0E-01
R3	1.4E-01	***1.1E+00***	***1.1E+00***
R4	1.4E-01	2.3E-02	1.6E-01
R5	1.1E-01	2.4E-02	1.3E-01
R6	1.4E-01	***1.3E+00***	***1.3E+00***
R7	8.6E-02	***9.0E-01***	***9.1E-01***
R8	***4.1E-01***	***1.7E+00***	***2.0E+00***
R9	***7.6E-01***	1.3E-01	***7.8E-01***
R10	***4.6E-01***	5.1E-02	***5.0E-01***
R11	***5.8E-01***	3.4E-02	***5.9E-01***
R12	***2.1E-01***	8.3E-02	***2.3E-01***
R13	***2.4E-01***	6.5E-02	***2.6E-01***
R14	1.5E-01	***1.8E+00***	***1.8E+00***

Accounting for DPM exposure through all five-primary media (*i.e.*, air, water, soil, food, and consumer products), when DPM exposure only exists in a single medium (air), is overly conservative. Furthermore, as stated in HHRA guidance (AHW 2011; Health Canada 2010a), an HQ greater than 1.0 is also not necessarily an indication of potential risk; additional assessment of the assumptions of the HHRA is required to determine whether potential risk of adverse health effects is indicated.

HQs were predicted to be greater than 1.0 at the RSA-MPOI, FL-MPOI, R1, R3, R6, R8 and R14 (Blairmore North and Centre) receptor locations. There were no HQs in excess of 1.0 at any of the other locations. At R1, R3, R6, R8 and R14 the HQ results are marginally elevated above 1.0 and the

majority of DPM contribution is from Baseline emissions. Time series data at each of the locations is provided in Appendix C and indicates that the TRV was exceeded less than 1% of the time over a 5-year period at receptor locations R1 (0.07%), R3 (0.02%) and R6 (0.1%), less than 2% of the time at R14 (1.18%) and less than 5% of the time at R8 (4.2%). None of the receptor locations indicated a predicted air concentration that exceeded the LOAEL used by Health Canada (2016) in derivation of the TRV (Appendix B). Receptor locations R8 and R14 are in Blairmore and are closest to the rail load out location. These areas are also near a rail line and HWY 3. As a result, Baseline contributions are the primary driver for the elevated HQ results (contributing 85% and 92% of the DPM emissions estimate, respectively). Mitigation measures have been proposed for the management of Project diesel emissions (Section 6.7.1) which will support in a further reduction of the Project contribution to increased DPM.

Acute exposure to project related DPM is not considered to pose a risk of adverse human health effect based on the following lines of evidence:

- the mine site area is restricted from the public during construction and operation activities
- outside of the mine area contribution of DPM is largely a result of Baseline emissions;
- all DPM predictions bellow the LOAEL used in derivation of the Health Canada (2016) TRV (Appendix C);
- predicted exposures exceeding the TRV are marginal and relatively infrequent based on time series data (Appendix C);
- the health endpoint identified to define the TRV is reversible and acute;
- Other COPC know to be components of diesel emissions (CACs, metals) are also assessed in the HHRA as individual and grouped COPCs; and,
- the conservative nature inherent within the air modelling methodology.

6.1.2 Multiple COPC Assessment

Table 6.1-10 presents acute HQs for toxicity groups (eye irritation, nasal irritation, respiratory irritation, neurological and reproductive/developmental) at the RSA-MPOI. The results have been reassessed in accordance using the adjusted chemical groupings (IR AER-170 [Addendum 5, CEAR #69] and HC-6 [Addendum 6, CEAR #70]) and with a more conservative screening HQ of 0.2 (IR HC-R2-11 [Addendum 8 Part B, CEAR #89]).

Table 6.1-10 Predicted Additive HQs by Toxicity Groups – Acute Inhalation			
Toxicity Endpoint	**RSA-MPOI**		
	Project	**Baseline**	**Application**
Eye Irritation	8.5E-03	3.1E-03	9.2E-03
Nasal Irritation	9.2E-03	2.6E-03	9.5E-03
Respiratory Irritation[1,2]	***4.0E+00***	***1.1E+00***	***4.1E+00***
Neurological	1.1E-04	2.9E-05	1.1E-04

1 Derived using non-CAAQS based TRVs for NO_2 and SO_2

2 Silica HQ results were calculated using maximum predicted silica concentrations in both $PM_{2.5}$ and PM_{10} (Section 5.2.1.1). The highest predicted HQ results were those modelled on PM_{10} predictions and an assumed % silica in coal of 73%, a highly conservative assumption, which were included in the respiratory irritation toxicity group.

Predicted additive HQ results were less than 0.2 for all groups except for the acute inhalation Respiratory Irritant group (HQ = 4.1 at the RSA-MPOI). As the Respiratory Irritation group includes contaminants found in only a single media (air); a comparison to an HQ target of 0.2 is overly conservative. An assessment of HQs for all receptor locations was conducted (Table 6.1-11).

Table 6.1-11 Predicted Additive Hazard Quotients for Acute Inhalation of Respiratory Irritants			
Location	**Respiratory Irritants (HQs)**		
	Project	**Baseline**	**Application**
RSA-MPOI	***4.0E+00***	***1.1E+00***	***4.1E+00***
FL-MPOI	***1.2E+00***	***4.0E-01***	***1.2E+00***
R1	***3.3E-01***	***6.8E-01***	***7.0E-01***
R2	***2.3E-01***	1.8E-01	***3.5E-01***
R3	1.6E-01	***6.0E-01***	***6.2E-01***
R4	7.8E-02	1.8E-01	***2.5E-01***
R5	1.2E-01	1.8E-01	***2.9E-01***
R6	1.9E-01	***9.3E-01***	***9.3E-01***
R7	1.6E-01	***6.5E-01***	***6.6E-01***
R8	***5.0E-01***	***1.1E+00***	***1.2E+00***

Table 6.1-11 Predicted Additive Hazard Quotients for Acute Inhalation of Respiratory Irritants

Location	Respiratory Irritants (HQs)		
	Project	Baseline	Application
R9	***5.7E-01***	***2.6E-01***	***6.0E-01***
R10	***7.6E-01***	2.0E-01	***7.9E-01***
R11	***6.2E-01***	1.9E-01	***6.5E-01***
R12	***3.5E-01***	***2.2E-01***	***4.4E-01***
R13	***4.0E-01***	***2.1E-01***	***4.8E-01***
R14	***3.0E-01***	***9.8E-01***	***9.9E-01***

Predictive additive HQ results for the acute inhalation Respiratory Irritant were greater than 1.0 only at the RSA-MPOI, FL-MPOI, and R8 (Blairmore North). HQs for R8 were only slightly greater than 1.0 for the Baseline and Application cases, only. The remaining locations were all below an HQ of1.0.

The elevated HQ result is attributed primary to nitrogen dioxide and $PM_{2.5}$ in the irritant grouping (*i.e.*, at the RSA- MPOI - nitrogen dioxide has an HQ of 1.5 and $PM_{2.5}$ has an HQ of 1.9). A discussion of the NO_2 and $PM_{2.5}$ results is provided in detailed account for why the nitrogen dioxide HQ and $PM_{2.5}$ results are considered a low potential for human health risk is provided above in Section 6.1.1.1.

In addition, it is important to note, that inclusion of $PM_{2.5}$ HQs calculate using the established TRV is overly conservative and is not supported by HHRA guidance for three reasons. Firstly, the health end point established for the TRV derivation is not respiratory irritation; instead, the impetus behind this guideline was the weight of available evidence for an association between acute exposure to ambient fine PM and increased population mortality and morbidity. Secondly, the guideline is based on a 24-hour exposure duration and is therefore sub-chronic in nature and does not reflect transient short-term (acute) 1-hr exposures (which is the exposure duration for all other chemicals considered within this group). Thirdly, $PM_{2.5}$ is not a chemical; it is the concentration of all particulates with a diameter of ≤ 2.5 µm, which would, by definition, include metals (chromium, copper and vanadium concentrations were scaled from $PM_{2.5}$) and the inclusion of $PM_{2.5}$ within this group effectively double counts the chemical concentration of those metals already being assessed

6.1.3 Summary

The results of the acute inhalation assessment demonstrate that the Project emissions do not pose a risk of adverse health effects at the receptor locations assessed outside the Mine Permit Boundary for all COPC assessed.

Within the Project Footprint, the results of the acute inhalation risk assessment indicate that predicted exposure to the maximum predicted air concentrations are less than the applied HQ targets for all COPC with the exception of NO_2, $PM_{2.5}$ and PM_{10} (HQ target of 1.0), arsenic, coal dust and DPM (HQ target of 0.2). As presented in the Air Quality Assessment (Consultant Report #1, CEAR #42), the locations of the MPOI receptors are close to key Project activities at the edge of the pit boundary within the Project footprint; which will be restricted to the general public during construction and operation.

Outside of the Mine Permit Boundary, HQs greater than the applied HQ targets were predicted for NO_2 (derived using the CCME CAAQS), PM_{10} and DPM at various receptor locations. Again, examination of the multiple lines of evidence indicated that although there are predicted exceedances the potential risk of adverse health effects is low.

Predictive additive HQ results were less than 1.0 for all groups except for the acute inhalation respiratory irritant group at the RSA-MPOI where the elevated HQ results was determined to be due to the inclusion of a single chemical parameter - NO_2. As previously discussed, comparison to a HQ target of 0.2 is overly conservative and multiple lines of evidence indicated that elevated NO_2 results are considered a low potential for human health risk.

6.2 Chronic Inhalation

6.2.1 HQ and ILCR Results

Risk parameters (HQs and ILCRs) for chronic inhalation are based on long-term exposures. Both carcinogenic and non-carcinogenic effects have been evaluated. The chronic inhalation risk results based on the assumption that humans would spend extended periods of time (one lifetime; assumed to be 80 years) at the locations with the maximum concentrations (MPOI) are presented in Table 6.2-1. Section 6.2.2 details the results for the multiple COPC assessment and Table 6.2-7 presents the RSA-MPOI chronic inhalation results for toxicity groups (eye irritation, respiratory, nasal irritation, neurological, kidney and liver, nasal tumours, and lung tumours). The complete risk results for all receptor locations and all COPCs (which are lower than the MPOI results) are provided in Appendix D (Chronic Inhalation Results).

As this is an assessment of the chronic inhalation pathway, the predicted exposures and risk quotients are not affected by the age specific characteristics of the receptor, only by location. For non-threshold

(carcinogenic) substances, the target is for the contribution from the Project itself to result in a cancer risk of not greater than 1 in 100,000 (*i.e.,* the "Project only" ILCR should be less than $1.0x10^{-5}$).

Table 6.2-1 Predicted Hazard Quotients (HQs) and Incremental Lifetime Cancer Risk (ILCR) Quotients for the Chronic Inhalation Assessment at the RSA-MPOI

Parameter	Project	Baseline	Application
Criteria Air Contaminants HQs (Target HQ = 1)			
Nitrogen Dioxide	8.6E-01	***1.3E+00***	***1.6E+00***
	1.5E+00 [1]	***2.2E+00*** [1]	***2.8E+00*** [1]
$PM_{2.5}$[2]	***1.8E+00***	5.8E-01	***1.8E+00***
PM_{10}[2]	***2.7E+00***	6.5E-01	***3.3E+00***
Threshold (Non-Carcinogenic) Substances HQs (Target HQ = 0.2)			
Aluminium	1.1E-04	2.1E-04	2.5E-04
Antimony	3.1E-05	1.5E-05	3.1E-05
Barium	1.7E-03	7.2E-04	1.7E-03
Beryllium	3.3E-04	1.3E-04	3.3E-04
Cadmium	2.0E-02	4.2E-02	5.0E-02
Cobalt	7.7E-03	3.2E-03	7.7E-03
Copper	4.2E-04	8.7E-04	1.0E-03
Lead	1.2E-03	2.5E-03	2.9E-03
Manganese	1.1E-03	2.1E-03	2.5E-03
Mercury	3.0E-05	1.2E-05	3.0E-05
Molybdenum	8.6E-07	3.6E-07	8.7E-07
Nickel	4.6E-02	1.9E-02	4.6E-02
Selenium	3.9E-07	1.6E-07	4.0E-07
Uranium	3.3E-04	1.3E-04	3.3E-04
Vanadium	5.6E-03	1.1E-02	1.4E-02
Benzene	2.1E-03	4.1E-03	5.0E-03
Toluene	1.5E-06	2.9E-06	3.6E-06
Xylenes	2.6E-05	5.1E-05	6.1E-05

Table 6.2-1 Predicted Hazard Quotients (HQs) and Incremental Lifetime Cancer Risk (ILCR) Quotients for the Chronic Inhalation Assessment at the RSA-MPOI

Parameter	Project	Baseline	Application
Acetaldehyde	7.6E-05	1.5E-04	1.8E-04
Acrolein	6.1E-04	1.2E-03	1.4E-03
Formaldehyde	2.4E-04	4.6E-04	5.6E-04
Propylene	2.5E-05	4.9E-05	5.9E-05
Acenaphthene	2.5E-06	4.9E-06	5.9E-06
Acenaphthylene	5.0E-06	9.7E-06	1.2E-05
Anthracene	6.7E-07	1.3E-06	1.6E-06
Fluorene	6.9E-06	1.3E-05	1.6E-05
Naphthalene	1.2E-03	2.3E-03	2.8E-03
Pyrene	2.0E-06	3.9E-06	4.7E-06
Coal Dust	***3.5E+00***	-	**-**
Silica[3]	***2.5E+00***	6.3E-04	***2.5E+00***
Diesel Particulate Matter (DPM)	***2.9E-01***	***5.5E-01***	***6.9E-01***
Non-Threshold (Carcinogenic) Substances ILCRs			
Arsenic	4.6E-06	-	-
Chromium	6.2E-07	-	-
Benzo(a)pyrene	7.7E-09	_	_
Fluoranthene	2.7E-08	_	_
Naphthalene	1.2E-07	_	_
Phenanthrene	2.7E-08	_	_

[1]Chronic NO_2 HQ calculated using the CCME CAAQS as per IR HC-3 (Addendum 5, CEAR #69).

[2]Based on 98th percentile value.

[3]Coal Dust HQ results were calculated based on PM_{10} (Section 5.2.1.1) exposure concentration modified for % contribution of coal. Target HQ of 1.0.

[4]Silica HQ results were calculated using maximum predicted silica concentrations in both $PM_{2.5}$ and PM_{10} (Section 5.2.1.1). The highest predicted HQ results were those modelled on PM_{10} predictions and an assumed % silica in coal of 73%, a highly conservative assumption.

As shown in Table 6.2-1, risk results for NO_2 (derived using the CCME CAAQS), $PM_{2.5}$, PM_{10}, and silica were greater than a target HQ of 1.0. DPM and coal dust HQ results were greater than a target HQ of 0.2 at the RSA-MPOI location. A detailed review of the risk results for all COPCs with HQ greater than the acceptable threshold was conducted (NO_2, $PM_{2.5}$, PM_{10}, silica, DPM and coal dust).

6.2.1.1 Criteria Air Contaminants

An additional evaluation of all predicted HQs greater than the target value of 1.0 for CACs was conducted. The HQs results for NO_2, $PM_{2.5}$, PM_{10} for all receptor locations are shown below in Tables 6.2-2, Table 6.2-4 and Table 6.2-5, respectively.

Nitrogen Dioxide

Table 6.2-2 Predicted NO_2-Annual Hazard Quotients at all Receptor Locations

Receptor	Project	Baseline	Application
Derived Using the US EPA TRV			
RSA-MPOI	8.6E-01	***1.3E+00***	***1.6E+00***
FL-MPOI	3.0E-01	5.2E-01	6.9E-01
R1	7.8E-02	6.5E-01	6.8E-01
R2	1.6E-02	4.1E-01	4.3E-01
R3	1.3E-02	6.7E-01	6.8E-01
R4	4.5E-03	4.1E-01	4.1E-01
R5	7.6E-03	4.1E-01	4.2E-01
R6	2.0E-02	9.5E-01	9.6E-01
R7	3.6E-02	7.7E-01	7.8E-01
R8	3.9E-01	***1.2E+00***	***1.3E+00***
R9	1.2E-01	4.5E-01	5.4E-01
R10	3.3E-01	4.2E-01	7.1E-01
R11	7.0E-02	4.1E-01	4.8E-01
R12	1.0E-01	4.3E-01	5.2E-01
R13	8.6E-02	4.2E-01	5.0E-01
R14	6.3E-02	9.0E-01	9.2E-01

Table 6.2-2 Predicted NO_2-Annual Hazard Quotients at all Receptor Locations			
Receptor	**Project**	**Baseline**	**Application**
Derived Using the CCME CAAQs			
RSA-MPOI	***1.5E+00***	***2.2E+00***	***2.8E+00***
FL-MPOI	5.2E-01	9.1E-01	***1.2E+00***
R1	1.4E-01	***1.1E+00***	***1.2E+00***
R2	2.7E-02	7.1E-01	7.4E-01
R3	2.3E-02	***1.2E+00***	***1.2E+00***
R4	7.8E-03	7.1E-01	7.2E-01
R5	1.3E-02	7.1E-01	7.3E-01
R6	3.5E-02	***1.7E+00***	***1.7E+00***
R7	6.3E-02	***1.3E+00***	***1.4E+00***
R8	6.7E-01	***2.0E+00***	***2.2E+00***
R9	2.0E-01	7.7E-01	9.4E-01
R10	5.7E-01	7.3E-01	***1.2E+00***
R11	1.2E-01	7.2E-01	8.3E-01
R12	1.7E-01	7.4E-01	9.1E-01
R13	1.5E-01	7.3E-01	8.8E-01
R14	1.1E-01	***1.6E+00***	***1.6E+00***

Risk results derived using the US EPA TRV (Table 6.2-2) predicted HQs greater than 1.0 at the RSA-MPOI and R8 (Blairmore North) locations only. Project contributions at both locations were substantially lower than predictive Baseline contribution to the Application Case HQ results. As with the acute assessment, the RSA-MPOI location is located on the edge of the pit boundary, within the Project footprint and is therefore considered to be inaccessible to the general public during Project construction and operation (Consultants Report #1a, Figure 5.2-4 and 5.4-4, CEAR #42). In addition, it is overly conservative to assume that chronic exposure may occur at the RSA-MPOI.

The HQ result predicted at R8 (Blairmore North) was a result of existing baseline conditions. Predicted concentrations from project emissions (1.58 $\mu g/m^3$) were less than 5% of baseline values (42.6 $\mu g/m^3$). The resultant Application HQ was only slightly higher than 1.0 and is not indicative of a potential risk of adverse human health effect.

Annual NO_2 HQs were also derived using the CCME CAAQS. Multiple receptor locations had predicted HQs greater than 1.0, including the RSA-MPOI, FL-MPOI, R1 (Lost Lemon Campground), R3, R6 (Coleman), R7 (Frank), R8 (Blairmore North), R10, and R14 (Blairmore Centre). As identified previously as a part of the acute NO_2 CAAQS review an examination of the multiple lines of evidence indicated that although there are predicted exceedances of the chronic NO_2 CAAQS the potential risk of adverse health effects is low. The conclusion was drawn from:

- the lack of Project related exceedances when compared to the US EPA TRV;
- limited Project contribution to the resultant Application HQ at the majority of receptor locations;
- conservative assumptions built into the air dispersion predicted modelling and human exposure assessment;
- marginal exceedance of the HQ target of 1.0 (considered to be within the margins of safety given the level of conservatism built in the model); and
- support from Alberta government that the use of CAAQS should not be applied for the assessment of predictive (modelled) air data
- the infrequency of the predicted exceedance(s).

Particulate Matter ($PM_{2.5}$)

For $PM_{2.5}$ the HQ was slightly greater than 1.0 at the RSA-MPOI only; all other locations were less than 1.0 (Table 6.2-3). As the predicted HQs are below 1.0 at all other receptor locations and the location of the predicted maximum is inaccessible to the general public (Consultants Report #1a, Figure 5.4-4, CEAR #42), the elevated $PM_{2.5}$ concentration is considered to present negligible risk for adverse human health effect.

Table 6.2-3 Predicted $PM_{2.5}$-Annual Hazard Quotients at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***1.8E+00***	5.8E-01	***1.8E+00***
FL-MPOI	2.1E-01	3.5E-02	2.1E-01
R1	1.3E-02	1.4E-01	1.5E-01
R2	1.1E-02	7.8E-04	1.2E-02
R3	5.6E-03	8.2E-02	8.7E-02
R4	3.0E-03	3.1E-04	3.3E-03
R5	4.8E-03	5.0E-04	5.3E-03
R6	6.5E-03	3.9E-01	3.9E-01
R7	7.4E-03	1.6E-01	1.7E-01
R8	6.5E-02	4.9E-01	5.5E-01
R9	4.3E-02	1.2E-02	5.5E-02
R10	2.7E-01	3.3E-03	2.7E-01
R11	5.4E-02	1.6E-03	5.5E-02
R12	3.0E-02	6.3E-03	3.6E-02
R13	4.3E-02	4.6E-03	4.8E-02
R14	1.0E-02	4.7E-01	4.8E-01

Particulate Matter (PM_{10})

Table 6.2-4 Predicted PM_{10}-Annual Hazard Quotients at all Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***2.7E+00***	6.5E-01	***3.3E+00***
FL-MPOI	3.2E-01	6.8E-01	9.8E-01
R1	8.9E-03	8.0E-01	8.1E-01
R2	1.3E-02	6.5E-01	6.6E-01
R3	6.4E-03	7.3E-01	7.3E-01
R4	3.4E-03	6.5E-01	6.5E-01
R5	5.7E-03	6.5E-01	6.6E-01
R6	6.5E-03	***1.1E+00***	***1.1E+00***
R7	6.1E-03	8.2E-01	8.3E-01
R8	4.4E-02	***1.2E+00***	***1.2E+00***
R9	7.4E-02	6.6E-01	7.3E-01
R10	3.7E-01	6.5E-01	***1.0E+00***
R11	7.0E-02	6.5E-01	7.2E-01
R12	5.2E-02	6.6E-01	7.1E-01
R13	5.7E-02	6.5E-01	7.1E-01
R14	7.0E-03	***1.2E+00***	***1.2E+00***

For PM_{10} the HQ was greater than 1.0 at the RSA-MPOI, R6 (Coleman), R8 (Blairmore North), R14 (Blairmore Centre) and R10 receptor locations. The RSA-MPOI is within the Project Footprint where access will be restricted and R10 is within the Mine Permit Boundary.

The predicted HQ for PM_{10} at R10 was generally consistent with the predicted HQs for the nearby towns of Blairmore and Coleman. The predicted HQs are also based on a conservative estimate of PM_{10} toxicity (as discussed in Section 6.1.1.1) with predicted HQs for $PM_{2.5}$, generally a more reliable measure of PM toxicity, being below 1.0. The predicted HQ for R10 also assumes a person living at the location, but road access will be restricted and therefore there is a low likelihood of continuous public presence during construction and operation of the mine. In addition, subsequent to the assessment of this location, the cabin located at R10 (within the Mine Permit Boundary) was purchased by Benga.

The predicted PM_{10} concentrations at the receptor locations outside of the Project footprint were determined to be due to existing baseline conditions - predicted concentrations from project emissions are less than 5% of baseline values at Coleman (<1% at R6) and Blairmore (3.6% at R8 and <1% at R14).

Based on multiple lines of evidence the potential risk of adverse health effects caused by chronic exposure to PM_{10} is low.

6.2.1.2 Coal Dust

Table 6.2-5 Predicted Coal Dust -Annual HQ Results at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***3.5E+00***	-	**-**
FL-MPOI	***4.3E-01***	-	**-**
R1	1.2E-02	-	-
R2	1.7E-02	-	-
R3	8.5E-03	-	-
R4	4.5E-03	-	-
R5	7.5E-03	-	-
R6	8.6E-03	**-**	**-**
R7	8.0E-03	**-**	**-**
R8	5.8E-02	**-**	**-**
R9	9.7E-02	-	-
R10	***4.8E-01***	-	**-**
R11	9.2E-02	-	-
R12	6.8E-02	-	-
R13	7.5E-02	-	-
R14	9.1E-03	**-**	**-**

Coal dust HQ results were greater than 0.2 at the RSA-MPOI, FL-MPOI and R10 (Residential #4) receptor locations. The RSA-MPOI, FL-MPOI and R10 locations are within and at the Mine Permit Boundary where access will be restricted.

It is notable that these predictions mirror the results presented in Section 6.2.1.1 for PM_{10}. The predicted HQs are based on a very conservative estimate of PM_{10} toxicity as the TRV for chronic coal dust exposure is based on a PM_4 concentration. Based on multiple lines of evidence including restricted access to those receptor locations where predicted HQ values were greater than 0.2, the conservatism in using PM_{10} data in comparison to a TRV based on PM_4, and the fact that apart from the RSA-MPOI that all predicted HQ results are less than 1.0, chronic inhalation exposure to project related emissions of coal dust present negligible risk for adverse human health effect.

6.2.1.3 Silica

Silica concentrations predicted to occur in coal dust were modelled based on $PM_{2.5}$ and PM_{10} data using values obtained from literature (Section 5.2.1.1). The percent silica in coal contribution is provided as a range and therefore HQ results are presented based on low (1.7%), mean (37%), and high (73%) SiO_2 content in $PM_{2.5}$ and PM_{10}, Tables 6.2-6 and 6.2-7, respectively.

Table 6.2-6 Predicted Silica ($PM_{2.5}$) - Annual HQ Results at all Assessed Receptor Locations

Receptor	Project			Baseline			Application		
	Low	High	Mean	Low	High	Mean	Low	High	Mean
RSA-MPOI	1.9E-01	5.2E-01	3.6E-01	6.5E-02	6.5E-02	6.5E-02	2.6E-01	5.9E-01	4.2E-01
FL-MPOI	2.3E-02	6.1E-02	4.2E-02	3.8E-03	3.8E-03	3.8E-03	2.7E-02	6.5E-02	4.6E-02
R1	1.4E-03	3.7E-03	2.6E-03	1.6E-02	1.6E-02	1.6E-02	1.7E-02	1.9E-02	1.8E-02
R2	1.2E-03	3.2E-03	2.2E-03	8.7E-05	8.7E-05	8.7E-05	1.3E-03	3.3E-03	2.3E-03
R3	6.1E-04	1.6E-03	1.1E-03	9.1E-03	9.1E-03	9.1E-03	9.7E-03	1.1E-02	1.0E-02
R4	3.3E-04	8.8E-04	6.0E-04	3.5E-05	3.5E-05	3.5E-05	3.6E-04	9.2E-04	6.4E-04
R5	5.2E-04	1.4E-03	9.6E-04	5.5E-05	5.5E-05	5.5E-05	5.8E-04	1.5E-03	1.0E-03
R6	7.1E-04	1.9E-03	1.3E-03	4.3E-02	4.3E-02	4.3E-02	4.3E-02	4.5E-02	4.4E-02
R7	8.0E-04	2.2E-03	1.5E-03	1.8E-02	1.8E-02	1.8E-02	1.9E-02	2.0E-02	2.0E-02
R8	7.0E-03	1.9E-02	1.3E-02	5.4E-02	5.4E-02	5.4E-02	6.1E-02	7.3E-02	6.7E-02
R9	4.7E-03	1.3E-02	8.6E-03	1.3E-03	1.3E-03	1.3E-03	6.0E-03	1.4E-02	1.0E-02
R10	2.9E-02	7.9E-02	5.4E-02	3.6E-04	3.6E-04	3.6E-04	3.0E-02	7.9E-02	5.4E-02
R11	5.8E-03	1.6E-02	1.1E-02	1.7E-04	1.7E-04	1.7E-04	6.0E-03	1.6E-02	1.1E-02
R12	3.3E-03	8.8E-03	6.0E-03	7.0E-04	7.0E-04	7.0E-04	4.0E-03	9.5E-03	6.7E-03
R13	4.7E-03	1.3E-02	8.7E-03	5.1E-04	5.1E-04	5.1E-04	5.2E-03	1.3E-02	9.2E-03
R14	1.1E-03	3.0E-03	2.0E-03	5.2E-02	5.2E-02	5.2E-02	5.3E-02	5.5E-02	5.4E-02

Silica as a component of $PM_{2.5}$ HQ results were less than an HQ of 1.0 at all receptor locations (irrespective of the $\%SiO_2$ content) (Table 6.2-7). Silica is not considered a human health risk in $PM_{2.5}$.

Table 6.2-7 Predicted Silica (PM_{10}) - Annual HQ Results at all Assessed Receptor Locations

Receptor	Project			Baseline			Application		
	Low	High	Mean	Low	High	Mean	Low	High	Mean
RSA-MPOI	***1.3E+00***	***2.5E+00***	***1.9E+00***	6.3E-04	6.3E-04	6.3E-04	***1.3E+00***	***2.5E+00***	***1.9E+00***
FL-MPOI	1.6E-01	3.0E-01	2.3E-01	1.7E-02	1.7E-02	1.7E-02	1.8E-01	3.2E-01	2.5E-01
R1	4.5E-03	8.2E-03	6.3E-03	7.7E-02	7.7E-02	7.7E-02	8.1E-02	8.5E-02	8.3E-02
R2	6.5E-03	1.2E-02	9.2E-03	3.0E-04	3.0E-04	3.0E-04	6.8E-03	1.2E-02	9.5E-03
R3	3.2E-03	5.9E-03	4.6E-03	4.0E-02	4.0E-02	4.0E-02	4.3E-02	4.6E-02	4.4E-02
R4	1.7E-03	3.1E-03	2.4E-03	1.1E-04	1.1E-04	1.1E-04	1.8E-03	3.2E-03	2.5E-03
R5	2.9E-03	5.2E-03	4.0E-03	1.8E-04	1.8E-04	1.8E-04	3.0E-03	5.4E-03	4.2E-03
R6	3.3E-03	6.0E-03	4.7E-03	2.3E-01	2.3E-01	2.3E-01	2.3E-01	2.4E-01	2.4E-01
R7	3.0E-03	5.6E-03	4.3E-03	9.0E-02	9.0E-02	9.0E-02	9.4E-02	9.6E-02	9.5E-02
R8	2.2E-02	4.1E-02	3.1E-02	2.7E-01	2.7E-01	2.7E-01	2.9E-01	3.1E-01	3.0E-01
R9	3.7E-02	6.8E-02	5.3E-02	5.8E-03	5.8E-03	5.8E-03	4.3E-02	7.4E-02	5.8E-02
R10	1.8E-01	3.4E-01	2.6E-01	1.4E-03	1.4E-03	1.4E-03	1.9E-01	3.4E-01	2.6E-01
R11	3.5E-02	6.5E-02	5.0E-02	6.3E-04	6.3E-04	6.3E-04	3.6E-02	6.5E-02	5.1E-02
R12	2.6E-02	4.8E-02	3.7E-02	2.8E-03	2.8E-03	2.8E-03	2.9E-02	5.1E-02	4.0E-02
R13	2.9E-02	5.2E-02	4.0E-02	2.0E-03	2.0E-03	2.0E-03	3.0E-02	5.4E-02	4.2E-02
R14	3.5E-03	6.4E-03	4.9E-03	2.7E-01	2.7E-01	2.7E-01	2.8E-01	2.8E-01	2.8E-01

Silica as a component of PM_{10} HQ results were greater than an HQ of 1.0 at the RSA-MPOI only; HQ results were less than 1.0 at all other receptor locations (Table 6.2-7). As predicted HQ results are below 1.0 at all other receptor locations, the location of the predicted maximum is inaccessible to the general public (Consultants Report #1a, Figure 5.4-4, CEAR #42) and the marginal exceedances predicted (maximum reported HQ = 2.5) at the maximum assumed SiO_2 content for coal, the elevated silica concentration is considered to present negligible risk for adverse human health effect.

6.2.1.4 Diesel Particulate Matter

Table 6.2-8 Predicted DPM -Annual HQ Results at all Assessed Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	***2.9E-01***	***5.5E-01***	***6.9E-01***
FL-MPOI	4.9E-02	3.9E-02	***5.3E-02***
R1	1.9E-02	1.5E-01	1.7E-01
R2	4.4E-03	1.1E-03	5.4E-03
R3	3.6E-03	1.1E-01	1.2E-01
R4	1.4E-03	4.5E-04	1.9E-03
R5	2.0E-03	7.0E-04	2.7E-03
R6	5.2E-03	***3.6E-01***	***3.6E-01***
R7	8.2E-03	1.8E-01	1.9E-01
R8	1.1E-01	***5.0E-01***	***6.1E-01***
R9	2.4E-02	1.4E-02	3.7E-02
R10	4.1E-02	3.9E-03	4.4E-02
R11	1.4E-02	2.0E-03	1.6E-02
R12	1.5E-02	7.3E-03	2.2E-02
R13	1.3E-02	5.3E-03	1.8E-02
R14	1.4E-02	***4.4E-01***	***4.6E-01***

For chronic inhalation exposure to DPM (Table 6.2-8), HQs were predicted to be greater than 0.2 at RSA-MPOI, R6 (Coleman), R8 (Blairmore North), and R14 (Blairmore Centre). Baseline emissions were predicted to be the primary contributor to the elevated HQ results at all receptor locations.

As discussed previously, comparison with an HQ target of 0.2 for DPM is overly conservative as DPM exposure only exists in a single medium (air). HQs were not predicted to be greater than 1.0 at any of the receptor locations.

Provided that the mine site area is restricted from the public during construction and operation activities, that outside of the mine area contribution of DPM is primarily a result of Baseline emissions and the conservative nature inherent in both the TRV and the air modelling methodology, chronic exposure to project related DPM is not considered to pose a risk of adverse effect to human health.

6.2.2 Multiple COPC Assessment

Table 6.2-9 presents chronic HQs for toxicity groups (kidney and liver in addition to neurological) as well as ILCR (lung tumours) at the RSA-MPOI.

Table 6.2-9 Predicted Additive HQs and ILCR Results by Toxicity Groups – Chronic Inhalation

Toxicity Endpoint	RSA-MPOI		
	Project	Baseline	Application
Eye Irritant (HQ)	2.6E-04	5.1E-04	6.2E-04
Respiratory Irritant (HQ)	2.6E-02	4.0E-02	5.2E-02
Nasal Irritant (HQ)	2.1E-03	4.1E-03	5.0E-03
Neurological (HQ)	2.4E-03	4.8E-03	5.8E-03
Kidney and Liver (HQ)	4.1E-05	7.9E-05	9.6E-05
Nasal Tumours (ILCR)	1.3E-07	-	-
Lung Tumours (ILCR)	1.4E-06	-	-

Predicted additive HQ results were less than 0.2 and predicted additive ILCR results was less than 1 in 100,000 ($1.0x10^5$) for all groups at the RSA-MPOI. Therefore, these results do not indicate a predicted risk for adverse health effect via the chronic inhalation pathway by additive COPC exposure.

6.2.3 Summary

For the majority of the COPCs assessed, the results of the chronic inhalation risk assessment indicate that predicted exposure to the maximum predicted air concentrations for most locations are well below their respective TRVs - do not pose a risk of adverse human health effects.

Within the Mine Permit Boundary, the results of the chronic inhalation risk assessment indicate that predicted exposure to the maximum predicted air concentrations are less than the applied HQ targets for all COPC with the exception of NO_2, $PM_{2.5}$ and PM_{10} (HQ target of 1.0), coal dust, silica and DPM (HQ target of 0.2). As presented in the Air Quality Assessment (Consultant Report #1, CEAR #42), the locations of the RSA-MPOI receptors are close to key Project activities at the edge of the pit boundary within the Project footprint; which will be restricted to the general public during construction and operation.

The only exceedances predicted for outside of the Mine Permit Boundary were for NO_2, PM_{10} and coal-dust (which was modelled from PM_{10} concentrations). NO_2 predictions which exceeded the respective TRV outside of the Mine Permit Boundary occurred when using the CCME CAAQS which predicted exceedance at R1 (Lost Lemon Campground), R3, R6 (Coleman), R7 (Frank), R8 (Blairmore North), R10, and R14 (Blairmore Centre). However, based on multiple lines of evidence including the lack of support from Alberta government on the CAAQS being applied to modelled data, limited contribution of Project emissions, and the marginal exceedance of the CAAQS (highest HQ was 2.8 at the RSA-MPOI located within the Mine Permit Boundary) the potential risk for causing an adverse human health effect is low.

For PM_{10} the HQ was greater than 1.0 outside of the Mine Permit boundary at R8 (Blairmore North), and R14 (Blairmore Centre). The predicted PM_{10} concentrations at the receptor locations outside of the Project footprint were determined to be due to existing baseline conditions. Additional assessment of the PM_{10} results indicated that the potential risk of adverse health effects is low.

Exceedances were predicted for DPM at R6 (Coleman), R8 (Blairmore North), and R14 (Blairmore Centre), in comparison to a conservative HQ target of 0.2. No HQs were predicted to be greater than 1.0 for any receptor location. Provided that contribution of DPM is primarily a result of Baseline emissions chronic exposure to project related DPM is considered a low potential risk of adverse human health effects.

6.3 Chronic Multimedia Exposure

6.3.1 HQ and ILCR Results

Long-term (chronic) risks from the multimedia exposure assessment were evaluated for COPCs emitted to air which could potentially accumulate in the environment, as described above (Section 5.1.1). This assessment focuses on secondary exposure to these COPCs through oral and dermal exposure pathways.

HQ and cumulative ILCR results were calculated assuming Indigenous receptor characteristics as they represent the most sensitive receptor group based on their assumed lifetime exposure within the LSA and RSA, and a higher assumed ingestion rate of country foods (wildlife and local vegetation) than other receptor groups. HQs and cumulative ILCR values for all other receptors at the same locations would inherently be lower. It was conservatively assumed that the Indigenous receptor lived at, and harvested food from all the HHRA receptor locations including the RSA MPOI locations (Figure A.4).

As for the chronic inhalation assessment above, risks for non-threshold substances were assessed based on the incremental contribution of the project. Thus, the potential cumulative ILCR were assessed based on exposure to Project emissions only.

As described in IR HC-R2-11 (Addendum 8 Part B, CEAR #89), following review, a refinement of the multimedia model input assumptions and parameters for background exposure was conducted. An HQ of 0.2 was used as a screening level benchmark and the model was re-run.

Predicted HQs (threshold compounds) for the most sensitive receptor age group (toddler) and ILCRs (carcinogens) for a composite lifetime receptor are summarized in Table 6.3-1 for the location with the highest predicted exposures (RSA-MPOI). Risk quotients for toxicity groups and similar critical effect pathways are summarized in Table 6.3-5. Risk quotients for all age groups, COPCs and all the other receptor locations are provided in Appendix F (Detailed Multimedia Model Results).

Table 6.3-1 Predicted Hazard Quotients and ILCR Results for the Multimedia Assessment

Parameter	RSA-MPOI		
	Project	Baseline	Application
HQ – Toddler Receptor			
Acenaphthene	8.4E-08	1.3E-02	1.3E-02
Acenaphthylene	8.6E-07	8.9E-03	8.9E-03
Anthracene	2.1E-07	2.8E-03	2.8E-03
Fluorene	9.7E-06	4.9E-02	4.9E-02
Pyrene	2.4E-06	6.4E-02	6.4E-02
Fluoranthene	1.2E-05	4.9E-02	4.9E-02
Formaldehyde	1.4E-07	2.5E-07	3.1E-07
Aluminium	1.8E-07	***3.6E+00***	***3.6E+00***
Antimony	1.1E-05	***2.1E-01***	***2.1E-01***
Barium	3.6E-05	***2.2E+00***	***2.2E+00***
Beryllium	1.5E-06	5.7E-03	5.7E-03
Cadmium	2.1E-04	***4.4E+00***	***4.4E+00***
Cobalt	4.2E-06	***3.8E-01***	***3.8E-01***
Copper	1.8E-06	***2.4E-01***	***2.4E-01***

Table 6.3-1 Predicted Hazard Quotients and ILCR Results for the Multimedia Assessment

Parameter	RSA-MPOI		
	Project	Baseline	Application
Lead	3.0E-05	***1.7E+00***	***1.7E+00***
Manganese	3.9E-07	***2.6E+01***	***2.6E+01***
Mercury	1.4E-06	3.5E-07	1.4E-06
Methylmercury	***5.1E+00***	***1.2E+00***	***5.1E+00***
Molybdenum	2.2E-07	***3.0E-01***	***3.0E-01***
Nickel	8.6E-06	6.1E-02	6.1E-02
Selenium	1.5E-06	8.1E-02	8.1E-02
Thallium	2.3E-04	***2.3E+01***	***2.3E+01***
Uranium	3.5E-06	8.8E-07	3.5E-06
Vanadium	6.3E-05	***5.5E-01***	***5.5E-01***
Zinc	1.2E-04	***7.7E-01***	***7.7E-01***
ILCR – Composite Receptor			
Benz(a)anthracene	2.2E-09	-	-
Benzo(a)pyrene	8.0E-07	-	-
Benzo(b)fluoranthene	4.1E-07	-	-
Benzo(g,h,i)perylene	7.4E-09	-	-
Benzo(k)fluoranthene	8.0E-08	-	-
Chrysene	2.8E-08	-	-
Dibenzo(a,h)anthracene	1.0E-06	-	-
Fluoranthene	2.1E-08	-	-
Indeno(1,2,3-cd)pyrene	2.5E-08	-	-
Phenanthrene	8.9E-09	-	-
Arsenic	6.5E-09	-	-
Chromium	8.5E-09	-	-

Results presented in Table 6.3-1 are summarized as follows:

- With the exception of methylmercury none of the assessed COPCs under the Project Case exceed a target HQ of 0.2;
- Some COPCs were elevated as compared to a target HQ of 0.2 for both the Baseline and Application case:
  - Antimony;
  - Cobalt;
  - Copper;
  - Molybdenum;
  - Selenium;
  - Vanadium; and
  - Zinc.
- Some COPCs were elevated as compared to a target HQ of 1.0 for both the Baseline and Application case:
  - Aluminum;
  - Barium;
  - Cadmium;
  - Lead;
  - Manganese;
  - Methylmercury; and
  - Thallium.

It should be noted that the Baseline and Application cases included predicted exposures estimated for three exposure pathways (inhalation of air, inhalation/ingestion of soil, and ingestion of locally grown vegetation); therefore, comparison with an HQ of 0.2 is overly conservative. In addition, as stated in HHRA guidance (AHW 2011; Health Canada 2010a), an HQ greater than 1.0 is not necessarily an indication of potential risk; additional assessment of the assumptions of the HHRA is required to determine whether potential risk of adverse health effects is indicated.

A detailed review of the risk results was conducted for the aforementioned metals (aluminum, antimony, barium, cadmium, cobalt, copper, lead, manganese, methylmercury, molybdenum, selenium, thallium, vanadium and zinc).

6.3.1.1 Antimony, Cobalt, Copper, Molybdenum Selenium, Vanadium and Zinc

In all seven cases, the multimedia model prediction indicated that the Application-case exposure resulted in HQ values above 0.2 and below 1.0 (Appendix F). However, Project-case contributions are exceptionally low, and have no material effect on Application-case results.

As project contributions are orders of magnitude lower than the predicted baseline exposures, the project is anticipated to have negligible increase in human health risk. As background concentrations are reported as being less than an HQ of 1.0 for all seven metals, justification for elevated background concentrations is not required and are an artifact of the conservatism built into the human health exposure model.

6.3.1.2 Aluminum

Aluminum is a common element that makes up about 8% of the earth's crust, is typically found in soil at concentrations of 1-30% and has relatively low toxicity to humans (Krewski *et al*. 2007). The TRV developed for aluminum is not based on a human health effect study; rather, it is based on several different animal dietary studies with an uncertainty factor applied (WHO 2007). It was further noted that a lower bioavailability of aluminum compounds in food items likely exists as compared to the reviewed dietary studies. There are no AEP (2019) guidelines for aluminum concentration in soil.

Due to low inherent toxicity and the fact that measured concentrations are consistent with what would be expected to naturally occur in background; aluminum is not considered to be a human health concern for the Site.

6.3.1.3 Barium

In Alberta, a soil quality guideline of 10,000 mg/kg for human direct soil contact has been derived (AEP 2019). This soil quality guideline was based on an RfD of 0.2 mg/kg-bw/day for barium as described in US EPA (2005) and adopted by Health Canada (2010a) (AENV 2009). The maximum measured barium concentration in background soil was 417 mg/kg. Hence, the measured concentration meets the Alberta government Tier 1 soil criteria guideline for the protection of human health. The predicted HQ (HQ>1) at Baseline is therefore an artifact of a number of conservative assumptions inherent in the model, these include:

- assumed 100% of vegetables for consumption are obtained from the Site;
- assumed 100% bioavailability of barium through inadvertent ingestion of soil and food consumption; and
- the inherent conservatism built into the bioaccumulation model.

Based on the low measured concentration of barium in soil, the fact that background concentrations meet current guideline standards, and the conservatism built into the model, barium is not considered to be a human health risk.

6.3.1.4 Cadmium

In Alberta, a soil quality guideline of 1.4 mg/kg exists for the protection of human direct soil contact, and was adopted, without modification, from the CCME (AEP 2019; CCME 1999). The maximum measured concentration of cadmium in background soils for the Site was 2.04 mg/kg; which is elevated as compared to the Tier 1 guideline. However, it remains lower than previously reported background concentrations for cadmium (3.22 mg/kg) in the Province of Alberta (PTAC 2016) and is much lower than background concentrations reported elsewhere in the country (8.1 mg/kg) (Frank *et al*. 1986, CCME 1999).

Provided that predicted risk exists only for Baseline contribution and the fact that measured concentrations in background are lower than reported background concentrations in Alberta and across Canada; cadmium is not considered to be a human health risk.

6.3.1.5 Lead

In Alberta, a soil quality guideline of 140 mg/kg exists for the protection of human direct soil contact, and was adopted, without modification, the CCME (AEP 2019; CCME 1999). The maximum measured concentration of lead in background soils for the Site was 16.1 mg/kg; which is below the provincial and federal guideline.

Provided that predicted risk exists only for Baseline contribution and the fact that measured concentrations in background are below guideline, the elevated HQs are considered a result of the conservative assumptions built into the multimedia model and lead is not considered to be a human health risk.

6.3.1.6 Manganese

Manganese is commonly present in the environment and is an essential element for human health (IOM 2001). In the current assessment, the primary exposure pathways which contributed to the predicted HQ values were the consumption of Baseline plants and wild game. Specifically, 75% of the EDI was attributed to Baseline fruit and berry ingestion (75.05% for toddler and 76.28% for an adult) and approximately 10% of the EDI was attributed to the ingestion of moose and grouse meat (10.14% for toddler and 12.02% for an adult). The EDI for the toddler and adult was 20 mg/d and 54 mg/d, respectively. There is currently no AEP (2019) guideline for manganese concentration in soil.

Focusing on the elevated exposure resulting from fruit and berry ingestion, a review of the model indicated that it was the measured concentration of manganese in Saskatoon berries (collected as part of the baseline vegetation program [CR#10 - HHRA - Appendix G, CEAR #42]) and the conservative assumptions built into the risk model with respect to the ingestion rate of berries, that was driving the modelled exposure.

For the HHRA, it was assumed that 100% of a receptor's berry ingestion was attributable to the measured concentration of manganese in Saskatoon berries. The concentrations measured in background plant tissue ranged dramatically from 54 mg/kg to 1,330 mg/kg and it was the upper 95%ile of the measured concentrations that was selected for the purposes of the HHRA (1,222 mg/kg); a conservative assumption.

To evaluate if the traditional food consumption rate for berries applied in the HHRA was reflective of actual Indigenous communities, the exposure characteristics applied in the multimedia exposure model were compared with the mean and 95th percentile consumption rates reported in the First Nations Food, Nutrition & Environment Study (FNFNES). The FNFNES values were based only on the highest recorded rates among adults (age 19-50 or 50+) which regularly consumed traditional foods. Individuals from these communities which did not regularly consume traditional foods were not included in calculating the FNFNES values. In all cases, the Health Canada recommended values applied in the HHRA were considerably higher than the FNFNES data and were considered to over-estimate the potential for manganese exposure due to berry ingestion.

Based on a review of the conservatism of the model, a refinement to both the berry concentration and berry ingestion rates was conducted. Specifically, an average berry concentration of 435 mg/kg and the FNFNES (2016) mean berries and plants ingestion rate of 18.5 g/d (adjusted for the toddler life stage based on body weight [6.8 g/d]) were used as updated input parameters in the model. The model, which still assumed 100% of the estimated daily intake of fruits and berries as being sourced from the Site, was re-run and resulted in a calculated EDI for the toddler and adult of 8 mg/d and 21 mg/d, respectively. HQ values are presented in Appendix F.

The HQ values are based on the US EPA (1996) oral RfD of 0.140 mg/kg bw/d; which itself was based on a NOAEL of 10 mg/d (0.14 mg/kg bw/d for a 70 kg adult). The NOAEL was derived using several studies based on central nervous system effects in humans. A LOAEL does not currently exist for this parameter in literature but Finley *et al*. (2003) did not observe signs of manganese deficiency or toxicity in adult females with dietary intakes of up to 20 mg/day for 8 weeks.

The calculated toddler EDI of 8 mg/d is lower than the NOAEL reported by Finley *et al*. (2003) however, it is recognized that the NOAEL is based on an adult exposure study. Health Canada (2010c) provides an age adjusted NOAEL used in derivation of a toddler TRV of 2 mg/day. The EDI

based on background is greater than the no observable effect level (NOAEL) used by Health Canada (2010c). However, exceedance of a NOAEL value is not a direct indication of potential risk – it simply means that it is higher than the concentration that was shown not to cause an effect. The Project contribution remains insignificant with modelled EDI's for the toddler and adult of 3.0×10^{-7} mg/d and 8.9×10^{-7} mg/d, respectively.

Provided exposure is a result of measured Baseline concentrations, the conservative nature of the multimedia model, the insignificance of Project contribution, and the fact the modelled EDIs were lower than, or equal to, NOAELs reported in literature, manganese is not considered to be a human health risk.

6.3.1.7 Methylmercury

Methylmercury (MeHg) is not a contaminant of potential concern (COPC) identified in the Project air emissions; however, elemental mercury was identified as a COPC due to its occurrence in soils and rock and therefore road and blasting dust was identified as a potential source of elemental mercury.

An estimate of potential risk of adverse human health effects associated with exposure to MeHg *via* dietary exposure was conducted. The predicted air concentrations of elemental mercury at the maximum point of impingement from both the RSA-MPOI and FL-MPOI were conservatively used to estimate the surface water concentration of MeHg in a hypothetical lake located at each MPOI. There are no lakes within the LSA or the Mine Permit Boundary (which contains the MPOI), only small watercourses. Potential exposure estimates based on deposition to a lake is an additional conservative assumption which purposefully results in an overestimate of potential risk of adverse health effects. The results of this conservative assessment indicated that potential exposure to MeHg *via* secondary consumption of fish does not pose a risk of adverse health effects. Details of the methods and assumption applied in the MeHg assessment are provided below.

Methylmercury concentrations are higher in large-bodied, longer-living animals; those at the top of the food chain like predatory fish. Methylmercury is produced primarily under anaerobic conditions, methylated mostly by anaerobic bacteria, particularly sulfate reducers and methanogens in aquatic sediments (Environment and Climate Change Canada 2017). Therefore, the anaerobic conditions of lake sediments, rather than rivers, streams or creeks, have a higher potential for MeHg formation. To conservatively estimate the potential upper boundary of MeHg that may bioaccumulate in fish, a review of available lake conversion or translation factors for total to MeHg, along with bioaccumulation factors (BAF) for predatory fish relevant to human consumption from regulatory agencies were completed.

Due to the complexities in food chain modelling for mercury, methylmercury in fish has been reported to be more accurately estimated from dissolved methyl-mercury concentrations *via* a

bioaccumulation factor (US EPA 2001 and 2009; RIVM 2015). The US EPA has published a translation factor which can be used to estimate the proportion of dissolved MeHg from total mercury in surface water (US EPA, 2001, 2009). Published translation factors are available for rivers, estuaries and lakes. The translation factor of 0.032 (dissolved MeHg/total Hg) for lakes was applied herein.

A summary of the available reported BAF values, considering dissolved MeHg and wet weight, are presented in Table 6.3-2.

Table 6.3-2 Review of Bioaccumulation Factor (BAF) in Fish from Dissolved MeHg

BAF	Reference	Notes
2,670,000	US EPA, 2001	National BAF Value for trophic level four (wet weight), geometric mean of available values. No specific fish species is presented. Designed to estimate the central tendency of the concentrations of mercury in fish of a given trophic level from an average concentration.
680,000	US EPA, 2001	National BAF Value for trophic level three (wet weight), geometric mean of available values.
117,000	US EPA, 2001	National BAF for trophic level two (wet weight), geometric mean of available values.
3,162,278	RIVM, 2015	Median BAF for trophic level 3.5 – 4.5 (log 6.5), wet weight.
501,187	RIVM, 2015	Median BAF for trophic level 2.5 – 3.5 (log 5.7), wet weight.
85,700	ATSDR, 1999	Highest reported, rainbow trout. Wet or dry weight not indicated.

Health Canada has published a tolerable daily intake (TDI) for MeHg of 0.47 µg/mg-bw/d for the general adult population and 0.2 µg/mg-bw/d for women of child-bearing age and children <12 years old (Health Canada 2010c; Health Canada 2007). The TDI of 0.2 µg/mg-bw/d was applied herein for all age groups.

As shown in Table 6.3-1, the HQs for the RSA-MPOI (toddler receptor) were greater than 1.0 (and thus 0.2) for the Project, Baseline, and Application cases. These HQs were calculated using the overly conservative fish ingestion rate of 220 g/day (Table 5.1-4), which is based on the Canadian Indigenous fish ingestion rate identified by Richardson (1997). Subsequent to the original HHRA, a fish ingestion rate specific to Albertan Indigenous adults of 54 g/day was identified by Chan *et al*. (2016). To evaluate traditional fish consumption rate in the updated HHRA that is reflective of actual Albertan Indigenous communities, the rate of 54 g/day was applied.

The adult fish ingestion rate of 54 g/d was scaled to derive a fish ingestion rate for all other age groups (Table 6.3-3). Scaling was completed by calculating the relative ingestion factor for each age group as compared to an adult based on Canadian Native fish ingestion rates reported by Richardson (1997), and then multiplied by the updated adult fish ingestion rate provided in FNFNES (2016). This process has an advantage over the use of relative body weight scaling as age groups have disproportionate ingestion rates relative to body size (*e.g.*, toddlers are relatively small but have high metabolism and an elevated caloric intake per kg body weight when compared to other age groups).

Table 6.3-3 Fish Ingestion Rate Derivation (g/day)

Receptor	Canadian Indigenous Fish Ingestion Rate (Richardson 1997)	Relative Ingestion Factor	Alberta Indigenous Fish Ingestion Rate (FNFNES 2016)	Applied Fish Ingestion Rate (g/day)
Infant[1]	0	-	-	0
Toddler	95	0.43	-	23
Child	170	0.77	-	42
Teen	200	0.91	-	49
Adult	220	1	54	54
Worker[2]	-	-	-	-

[1]Receptor assumed to obtain 100% of sustenance from breast milk or formulae.

[2]Receptor would not acquire sustenance from country food diet. Receptor accounted for under the "Adult" scenario.

The application of this regionally derived ingestion rate represents the mean portion size and frequency of fish consumption as reported by consumers throughout the province of Alberta and is thought to be based on the most current and local information available. As methylmercury is primarily formed in aquatic sediments and subsequently bioaccumulated up the aquatic food chain, terrestrial sources of methylmercury are not a significant source of exposure and only dietary exposure from fish has been considered. The resulting HQs, using the Albertan Indigenous adult fish ingestion rate of 54 g/day are provided in Table 6.3-4.

Table 6.3-4 Methylmercury Hazard Quotients from Fish Ingestion - Toddler

Receptor	Project	Baseline	Application
RSA-MPOI	***1.2E+00***	***2.8E-01***	***1.2E+00***
FL-MPOI	1.6E-01	1.3E-03	1.6E-01
R1	7.8E-04	2.2E-02	2.3E-02
R2	1.2E-03	3.2E-05	1.2E-03
R3	7.8E-04	8.1E-03	8.9E-03
R4	4.4E-04	1.6E-05	4.5E-04
R5	9.9E-04	2.4E-05	1.0E-03
R6	8.6E-04	***2.1E-01***	***2.1E-01***
R7	6.3E-04	4.7E-02	4.8E-02
R8	5.6E-03	1.7E-01	1.7E-01
R9	1.1E-02	3.1E-04	1.2E-02
R10	1.6E-01	9.1E-05	1.6E-01
R11	1.3E-02	5.4E-05	1.3E-02
R12	9.2E-03	2.1E-04	9.4E-03
R13	1.5E-02	1.3E-04	1.5E-02
R14	6.1E-04	1.8E-01	1.8E-01

With the exception of the RSA-MPOI and R6 receptor location, all remaining HQs were below 0.2. The RSA-MPOI location is within the Mine Permit Boundary which will not be accessible for the general public during construction and operation activities. Review of the results at R6 demonstrated that the exceedances are primarily due to Baseline conditions and are thus attributed to other emission sources in the area and not contributions from the Project.

Multiple levels of conservatism applied in this this assessment include:

- The application of the translation factor for lakes, which is higher relative to aerobic systems like rivers and creeks, assumes that fish are exposed only to lake water. No lake habitat is present in the regional study area, most of the aquatic habitat is characterized as low order creeks and streams.

- The use of the maximum available BAF of 2,670,000 assumes that all fish consumed are from trophic level four (food chain apex), while in reality fish from both trophic level three and four a reported as traditional food items (Chan *et al*. 2016).
- The use of predicted air concentrations from the RSA-MPOI and FL-MPOI.
- The use of deposition rate from within the project boundary to lakes outside the boundary is thought to be highly conservative.

Given the conservatism built into the evaluation of methylmercury exposure from fish ingestion, no adverse health effects are predicted.

6.3.1.8 Thallium

In Alberta, a soil quality guideline of 1.0 mg/kg exists for the protection of human direct soil contact, and was adopted, without modification, the CCME (AEP 2019; CCME 1999). The maximum measured concentration of thallium in background soils for the Site was 0.22 mg/kg; which is below the provincial and federal guideline.

In addition, there is a paucity of information available regarding the toxicity of thallium. In 2009, the US EPA IRIS were the only agency to provide a TRV for oral exposure to thallium (0.00008 mg/kg bw/day). US EPA IRIS has since revoked this TRV citing poor quality of the toxicological database (US EPA 2009). Currently, the only TRV available for this COPC is a less reliable, much lower TRV (the US EPA Provisional Peer Review Toxicity Value (PPRTV) of 0.00001 mg/kg bw/day). Confidence in the PPRTV for reliable application in a HHRA is low.

Provided that predicted exceedances are attributable to predicted Baseline exposures and the fact that measured concentrations in background are below guideline, the elevated HQs are considered a result of the conservative assumptions built into the multimedia model and thallium is not considered to be a human health risk.

6.3.2 Multiple COPC Assessment

Table 6.3-5 presents chronic HQ results for toxicity groups (gastrointestinal, liver, kidney and reproductive) as well as ILCR results (gastrointestinal tumours) for oral and dermal exposure considered at the RSA-MPOI.

Table 6.3-5 Predicted Additive Hazard Quotients and ILCR Results by Toxicity Groups – Oral and Dermal Exposure

Toxicity Endpoint	RSA-MPOI		
	Project	Baseline	Application
Gastrointestinal (HQs)	3.5E-06	***2.5E-01***	***2.5E-01***
Liver (HQs)	3.7E-05	***4.6E+00***	***4.6E+00***
Kidney (HQs)	2.8E-04	***6.8E+00***	***6.8E+00***
Reproductive (HQs)	1.0E-04	***5.8E+00***	***5.8E+00***
Gastrointestinal Tumours (ILCR)	2.3E-06	-	-

Predicted additive HQ results for all toxicity groups were much less than a target HQ of 0.2 as it relates to Project (Table 6.3-5). Application-case exceedances were entirely a result of the Baseline exposure. As previously discussed in Section 6.3.1, the Baseline results are indicative of naturally occurring background levels. Provided that the exposure is a result of measured Baseline concentrations, the conservative nature of the multimedia model and the insignificance of Project contribution, results of the multiple chemical exposure assessment for oral and dermal exposure is not considered to be a human health risk.

6.3.3 Summary

Results of the multimedia risk assessment indicate that for the majority of COPCs assessed, predicted exposure is well below their respective TRVs – these contaminants do not pose a risk of adverse human health effects.

Exceedances of the target HQ were predicted for several metals (aluminum, antimony, barium, cadmium, cobalt, copper, lead, manganese, molybdenum, selenium, thallium, vanadium and zinc) which were entirely a result of naturally occurring concentrations in background media. These metals are not considered to be a human health risk.

An estimate of potential risk of adverse human health effects associated with exposure to methylmercury was completed. Multiple levels of conservatism were applied in this this assessment including the use of conservative fish ingestion rates, a maximum BAF, predicted air concentrations from the RSA-MPOI and the use of deposition rates within the project boundary to model lakes outside of the boundary (Section 6.3.1.7). Methylmercury is not considered to be a human health risk.

6.4 Combined Multimedia and Chronic Inhalation Exposure

6.4.1 HQ and ILCR Results

Table 6.4-1 presents the combined HQ and ILCR results for multimedia (oral and dermal) and chronic inhalation exposure routes which have a similar critical effects pathway (liver, kidney, neurological and lung) at the RSA-MPOI. Thee predicted additive risk is calculated by summing the HQ and ILCR results presented in Section 6.2 and 6.3 to provide an indication of potential risk caused by oral, dermal and inhalation exposure to chemicals which have the same toxicity endpoint.

Table 6.4-1 Predicted Additive Hazard Quotients and ILCR Results for Multimedia and Chronic Inhalation Exposure via Similar Critical Effect Pathways

Toxicity Endpoint	RSA-MPOI		
	Project	Baseline	Application
Liver (HQ_{oral})	7.8E-05	***4.6E+00***	***4.6E+00***
Kidney (HQ_{oral})	3.2E-04	***6.8E+00***	***6.8E+00***
Neurological (HQ)	2.4E-03	***2.6E+01***	***2.6E+01***
Lung Tumours (ILCR)	1.5E-06	-	-

Predicted additive HQ results for Project related emissions were much less than a target HQ of 0.2 (Table 6.4-1). Application-case exceedances were entirely a result of the Baseline case and driven by background concentrations through oral (multimedia) exposure, as previously discussed in Section 6.3. The predicted additive ILCR result was less than 1 in 100,000 (1.0×10^{-5}) and is considered essentially negligible.

6.4.2 Summary

Results of the combined multimedia and chronic inhalation exposure assessment indicate that the primary source of human exposure is as a result of naturally occurring metal concentrations in background. These metals are not considered to be a human health risk for the reasons identified in Section 6.3.

6.5 End Pit Lake

Water quality samples were collected from three historical end-pit lake stations as part of the baseline field program during July and October 2014 and February 2016 (CR#5 – Surface Water Quality Assessment Report, CEAR #42). Water quality measured at end-pit lakes created by historical coal mines was considered a suitable surrogate for the anticipated water quality of the Project end-pit lake

which will be constructed under similar conditions and for similar purpose. These water quality results were combined with modelled dissolved metal concentrations from SRK and compared to Health Canada drinking water quality guidelines (Health Canada 2017). The results are provided in Table 6.5-1.

Table 6.5-1 Surface Water Quality Results (Human Health Risk)

Parameter	Health Canada DWQG (mg/L)		Max Concentration (mg/L)	
	Aesthetic Objective (AO)	Maximum Acceptable Concentration (MAC)	Surrogate Lakes (Total Metals)	Modelled Concentration[1] (Dissolved Metals)
Antimony	-	0.006	0.0038	0.00013
Arsenic	-	0.010	0.00063	0.00404
Barium	-	1.0	0.115	0.314
Boron	-	5	0.032	0.067
Cadmium	-	0.005	0.000116	0.0003
Chromium	-	0.05	0.00165	0.00011
Copper	1.0	-	0.00306	0.0007
Iron	0.3	-	**1.11**	0.0052
Lead	-	0.010	0.000959	0.00004
Manganese	0.05	0.1*	0.0396	**0.146**
Mercury	-	0.001	0.0000201	0.000056
Selenium	-	0.05	0.00904	0.0155
Silver	None required		0.000075	0.000009
Uranium	-	0.02	0.000659	0.000415
Zinc	5.0	-	0.0093	0.1234

[1]Concentrations of organic compounds were below analytical detection limits.

DWQG – Drinking Water Quality Guideline.

BOLD indicates measured concentration is elevated as compared to the applied guideline.

*Proposed MAC value (Health Canada 2016b).

Based on the comparison of measured and modelled data to Health Canada (2017) DWQG value; iron and manganese were the only two parameters reported at concentrations greater than applied guidelines.

The water quality guidelines for iron and manganese were created for aesthetic objectives and are not health based (Health Canada 2017). Instead, the guidelines are based on taste and the potential to stain laundry and plumbing fixtures; these are not applicable guidelines for the assessment of human health. Additionally, Health Canada does not recommend a health-based guideline for iron as there is no evidence of a dietary toxicity in the general population. Iron is not a human health concern for the end-pit lake.

Manganese was also elevated as compared to the draft MAC value of 0.1 mg/L proposed by Health Canada (Draft 2016). Health Canada based their recommended drinking water quality guideline on the lowest observed adverse effect level (LOAEL) of 25 mg/kg bw/day taken from the work of Kern *et al.* (2010, 2011) and Beaudin *et al.* (2013) who assessed the effect of manganese exposure on neurodevelopmental endpoints on neonatal rats, and whose findings were consistent with those reported in other epidemiological studies (Bouchard *et al.*, 2011; Khan *et al*., 2011; Roels *et al*., 2012; Oulhote *et al*., 2014). The LOAEL was adjusted by an uncertainty factor of 1000 for interspecies variation (10), intraspecies variation (10), and the use of a LOAEL rather than a NOAEL (10), which resulted in a tolerable daily intake (TDI) of 0.025 mg/kg bw per day.

The input parameters used in derivation of the proposed MAC by Health Canada (2016) do not reflect human receptor characteristics as published by Health Canada in 2012. In it, the average weight of an infant is 8.2 kg, and the water ingestion rate is lower at 0.3 L/day. The proposed MAC was updated using the exposure parameters used in this HHRA, and the resulting MAC was recalculated to be 0.34 mg/L. The maximum concentration of manganese modelled for the end-pit lake was 0.146 mg/L, which is lower than the revised MAC. In addition, receptor characteristics for child, teen and adult exposures were also modelled based on Health Canada (2016) input parameters, and it was verified that the infant and toddler receptors (which result in the same revised MAC value) are the most sensitive age groups for development of the MAC.

Overall, manganese is not considered human health concern for the end-pit lake. However, it should be reiterated that surrogate lakes and modelled surface water concentrations are for mitigation and planning purposes only. These values and the conclusions presented should not be considered a substitute for actual surface water collected data and the potential for human health risk should be revisited upon decommissioning and mine-site closure.

6.6 Significant Impact Ranking

When the predicted health risk results for a COPC was below the targeted risk quotient of 1.0 (a magnitude rating of "nil") or an ILCR of 1.0×10^{-5} the potential impact of the Project on the VC was automatically defined as "not significant" and further assessment of the remaining attributes was not

required. Health risks with a magnitude ranking of "low", "moderate", or "high" were assessed for all the attributes described in Table 6.6-1.

The results of the HHRA indicated that emission predicted to occur due to Project activities were "not significant" with respect to potential risk of adverse human health effects.

Table 6.6-1 Summary of Impact Significance on Human Health

Measurable Parameter	Nature of Potential Impact or Effect	Type of Effect	Extent[a]	Duration [b]	Frequency[c]	Reversibility[d]	Magnitude [e]	Project Contribution/ Direction [f]	Confidence Rating[g]	Probability of Occurrence [h]	Significance [j]
1. NO_2 HQ – Using CAAQS[1]											
MPOI	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R1 (Lost Lemon)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R3 (Res. 1)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R6 (Coleman)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R7 (Frank)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R8 (Blairmore N.)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant

Table 6.6-1 Summary of Impact Significance on Human Health

Measurable Parameter	Nature of Potential Impact or Effect	Type of Effect	Extent[a]	Duration [b]	Frequency[c]	Reversibility[d]	Magnitude [e]	Project Contribution/ Direction [f]	Confidence Rating[g]	Probability of Occurrence [h]	Significance [j]
At R9 (Indigenous)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
At R10 (cabin)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R11 (Trappers Cabin)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
At R14 (Blairmore Centre)	Potential human health effects (unpublished)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
2. $PM_{2.5}$ HQ											
MPOI only	Potential human health effects (premature mortality)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
3. PM_{10} HQ											
MPOI only	Potential human health effects (population	Acute	Local	Short	Periodic	Reversible in short term	Moderate	Negative	High	Low	Not significant
		Chronic	Local	Short	Continuous	Irreversible	Low	Negative	High	Moderate	Not significant

Table 6.6-1 Summary of Impact Significance on Human Health

Measurable Parameter	Nature of Potential Impact or Effect	Type of Effect	Extent[a]	Duration [b]	Frequency[c]	Reversibility[d]	Magnitude [e]	Project Contribution/ Direction [f]	Confidence Rating[g]	Probability of Occurrence [h]	Significance [j]
	mortality and morbidity)										
At Coleman (R6)	Potential human health effects (population mortality and morbidity)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At Blairmore (R8 and R14)	Potential human health effects (population mortality and morbidity)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
At R10 (cabin)	Potential human health effects (population mortality and morbidity)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
		Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
4. Coal Dust											
MPOI only	Potential human health effects (undefined)	Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Low	Not significant
5. DPM											
MPOI	Potential human health effects (respiratory)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
At R1 (Lost Lemon)	Potential human health effects (respiratory)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant

Table 6.6-1 Summary of Impact Significance on Human Health

Measurable Parameter	Nature of Potential Impact or Effect	Type of Effect	Extent[a]	Duration [b]	Frequency[c]	Reversibility[d]	Magnitude [e]	Project Contribution/ Direction [f]	Confidence Rating[g]	Probability of Occurrence [h]	Significance [j]
At R3 (Res. 1)	Potential human health effects (respiratory)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
At R6 (Coleman)	Potential human health effects (respiratory)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
At R8 (Blairmore N.)	Potential human health effects (respiratory)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
At R14 (Blairmore Centre)	Potential human health effects (respiratory)	Acute	Local	Short	Periodic	Reversible in short term	Low	Negative	High	Low	Not significant
6. Silica (based on PM_{10})											
MPOI	Potential human health effects (respiratory)	Chronic	Local	Long	Continuous	Irreversible	Low	Negative	High	Moderate	Not significant

[1] Results of NO_2 assessment using the US EPA TRV resulted HQs above 1.0 at the MPOI only. NO_2 was assessed using the CCME CAAQS in response to a Health Canada IR.

(a) Local, Regional, Provincial, National, Global

(b) Short, Long, Extended, Residual

(c) Continuous, Isolated, Periodic, Occasional

(d) Reversible in short term, Reversible in long term, Irreversible

(e) Nil, Low, Moderate, High

(f) Neutral, Positive, Negative

(g) Low, Moderate, High

(h) Low, Medium, High

(I) Not significant, significant

6.7 Mitigation and Monitoring

The results of the HHRA suggest that short-term predicted risks to human health will be limited to the RSA-MPOI within the project footprint, or locations with elevated baseline concentrations with minimal contribution from project emissions.

Assuming public access within the Mine Permit Boundary is restricted and the mitigation measures assumed by the other disciplines are implemented (EIA, CEAR #42, Sections A.11.1.1, A.11.2.1, A.11.3.1, A.11.4.1, A.11.5.1, A.11.6.1, A.11.7.1, A.11.8.1, A.11.9.1, A.11.10.1, and A.11.11.1), there is no need for further mitigation of emissions based on the results of the HHRA. Due to the potential for limited acute exposure risk within the Project footprint, a monitoring program (as described in Consultant Report #1a, Section 6.5, CEAR #42) is recommended in order to validate the air model predictions.

6.7.1 Mitigation of Diesel Particulate Matter

To meet Tier 4 PM emission standards, engine manufacturers will choose to rely on one of the following controls:

1. exhaust filters coated with diesel oxidation catalysts, similar to a catalytic converter;
2. high efficiency diesel particulate filters, which physically remove or filters out particulates from the exhaust stream; or
3. combination of above controls.

Whether an engine requires only catalytic conversion or both catalytic conversion and diesel particulate filters will depend on the engine design and other emission controls implemented into the engine. For example, engines that rely on heavy exhaust gas recirculation (EGR) to control NOX emissions may need both diesel oxidation catalysts and diesel particulate filtration to control particulates down to Tier 4 levels since EGR tends to increase the formation of particulates within the combustion cylinders. Benga will make their final selection of vendor and diesel fleet equipment at the completion of the engineering process. The final equipment selection will comply with Tier 4 emission benchmarks and Benga would not normally add controls beyond that.

As part of its ongoing mine planning, Benga will look for ways to improve efficiency of vehicle operation (minimize haul road distances, reduce haul road slopes, minimize idling, *etc.*) that will reduce overall emissions from Project equipment. Benga will also implement manufacturer recommended vehicle maintenance programs to manage emissions.

6.8 Assessment of Uncertainty

Risk assessments are subject to a number of uncertainties. Typically, these uncertainties are addressed by the use of conservative assumptions to ensure that predictions are protective of human health. Specific sources of uncertainty for the present assessment include:

- Concentrations of chemicals in ambient air can be highly variable. To address this, worst-case concentrations were used to assess human health risks. Risk quotients were calculated based on the MPOI, while exposure is more likely to occur at specific receptor locations, resulting in a likely over-prediction of risks.
- The existing sources within the study area (EIA, Section E.1.2, CEAR #42) likely contributes to baseline exposures of COPCs but there is uncertainty in the magnitude of this contribution; therefore, rather than assessing the incremental contribution of the Project to risks for non-threshold substances, the combined baseline and Project exposures were assessed against incremental exposure limits.
- Indigenous populations may harvest country foods (local vegetation and wildlife) from locations other than where they live. Most Indigenous groups live on reserve and in urban centers outside of the Crowsnest Pass, however, for the HHRA this receptor type was assumed to live at all the HHRA receptor locations, resulting in a highly conservative estimate of chronic exposure.
- Toxic interactions between chemicals are generally poorly known. This was addressed by assuming additive interactions between chemicals producing similar effects on the same organs.
- Organic chemicals may be metabolized by plants and animals; however, the extent of metabolization is often uncertain. As a result, metabolization was not generally accounted for, resulting in likely over-prediction of COPC concentrations in plants and animals.
- Additional conservative assumptions were made in order to avoid under predicting potential exposure and risk to human receptors, including:
  - assuming COPC concentrations would persist for 80 years;
  - chronic exposure was assumed to occur 7 days per week, 365 days per year at all receptor locations;
  - no transformation processes for metals or organic COPCs in soil were assumed;
  - COPCs were all assumed to be fully bioavailable in food;
  - all food eaten by receptors was assumed to be derived from the study area, with wild game spending their entire lifespan within the study area; and
  - dermal exposure was assumed to occur year-round.

Overall, the risk assessment is believed to provide a conservative estimate of potential human health risks, and likely over-predicts risks for many scenarios.

7.0 SUMMARY AND CONCLUSIONS

The results of the HHRA demonstrate that emissions from the Project are not predicted to pose a risk of adverse health effects at the receptor locations accessible to the general public. While risk quotients greater than 1.0 were predicted, they were identified to occur within the Mine Project Footprint, an area assumed to be inaccessible by the public during construction and operation of the mine, were within the Mine Permit Boundary, an area with restricted road access and low likelihood of continuous public presence during construction and operation of the mine, or were due to existing baseline emissions with minimal contribution from the Project. Due to the conservative assumptions applied in the air dispersion modelling and HHRA, the risk results outside the RSA-MPOI were not considered to be indicative of a risk of potential adverse health effects.

Air quality monitoring (as described in Consultant Report #1a, Section 6.6, CEAR #42) should be undertaken to validate the predicted air concentrations and confirm the conclusion that Project emissions do not pose any risk of adverse health effect.

7.1 Acute Inhalation

Acute inhalation risks were evaluated by comparing maximum predicted annual average concentrations in air to toxicity limits. The majority of the HQ results for the acute inhalation assessment were below target HQ values at all the receptor locations assessed. The results of the acute inhalation assessment demonstrate that the Project emissions do not pose a risk of adverse health effects at the receptor locations assessed outside the Mine Project Boundary for all COPC assessed.

Within the Mine Footprint, the results of the acute inhalation risk assessment indicate that predicted exposure to the maximum predicted air concentrations are below the TRV for all COPC with the exception of NO_2, $PM_{2.5}$, PM_{10}, arsenic, coal dust and DPM at the RSA-MPOI. As presented in the Air Quality Assessment (Consultant Report #1, CEAR #42), the locations of the MPOI receptors are close to key Project activities at the edge of the pit boundary within the Project footprint within the area which will be restricted to the general public during construction and operation.

Outside of the Mine Permit Boundary, HQs greater than 1.0 were predicted for DPM and PM_{10} at one or more of the following receptor locations: Lost Lemon Campground (R1), R3, Coleman (R6), Blairmore North (R8) and Blairmore Center (R14). Review of the results indicated that at these locations the exceedances were primarily due to baseline conditions and are thus attributed to other

emission sources in the area (*e.g.*, residential, automobile traffic and rail activities) and not contributions from the Project.

Potential risk of cumulative acute effects (multiple COPC assessment) on humans from the Project are predicted only at the RSA-MPOI locations which are within the Mine Footprint and thus not expected to be accessible to the general population.

7.2 Chronic Inhalation

Chronic inhalation risks were evaluated by comparing maximum predicted annual average concentrations in air to toxicity limits. For the majority of the COPCs assessed, the results of the chronic inhalation risk assessment indicate that predicted exposure to the maximum predicted air concentrations at multiple locations were all below their respective TRVs and therefore do not pose a risk of adverse human health effects. Although some small exceedance were predicted for a few CACs at the RSA-MPOI, due to their location close to proposed mining activities it is overly conservative to assume that a person will be living at that location for long periods of time.

At the RSA-MPOI, the HQs for NO_2, $PM_{2.5}$, PM_{10} coal dust and silica HQs were greater than their respective TRVs at the RSA-MPOI. As presented in the Air Quality Assessment (Consultant Report #1a, Figures 5.1-1 through 5.6-2, CEAR #42), the locations of the MPOIs are close to key Project activities on the edge of the pit boundary within the Project footprint. It was assumed that access to areas within the Mine Footprint will be restricted to the general public during Project construction and operation and therefore, Project emissions were not predicted to pose a risk of adverse health effects.

Overall, exceedances predicted at those receptor locations located outside of the Mine Permit Boundary were small and typically attributed to background sources in the area (*e.g.*, residential, automobile traffic and rail activities) and not contributions from the Project.

7.3 Chronic Multimedia Exposure

Chronic risks from secondary exposure through oral and dermal pathways were evaluated using maximum predicted annual average concentrations in air and a multimedia exposure model. The multimedia HQs and ILCR values were less than 0.2 for all COPCs except for several metals (aluminum, antimony, barium, cadmium, cobalt, copper, lead, manganese, methylmercury, molybdenum, selenium, thallium, vanadium and zinc) which were entirely a result of naturally elevated concentrations in background. These metals are not considered to be a human health risk.

8.0 WILDLIFE RISK ASSESSMENT

A screening level wildlife risk assessment (WRA) was also conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk of adverse effects associated with Project emissions on the health of wildlife in the study areas. The maximum predicted air concentrations associated with Project emissions do not exceed either the acute or chronic toxicity reference values protective of wildlife, with the exception of $PM_{2.5}$ in the mammalian acute assessment which was only slightly greater than 1.0. Similarly, maximum predicted long-term soil and surface water concentrations did not exceed the soil quality and surface water quality guidelines respectively. Because of the highly conservative assumptions that were used during the wildlife risk assessment, the prediction confidence was considered high. Details of the wildlife risk assessment methods and results are provided in Appendix H (Screening Wildlife Risk Assessment).

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APPENDIX A: FIGURES

669000 676000 683000 690000 697000 704000

5532000 5525000 5518000 5511000 5504000 5497000 5490000

INSET

Dutch Creek
Station Creek
Fly Creek
Camp Creek
Bob Creek
Beaverdam Creek
Coyote Creek
North Racehorse Creek
Salt Creek
Wintering Creek
Racehorse Creek
Pocket Creek
Frost Creek
Tetley Creek
Grave Brook
Todd Creek
South Racehorse Creek
Daisy Creek
Tp 10
Tp 9
Vicary Creek
Forestry Trunk Road
South Todd Creek
Wildcat Creek
Tp 9
Tp 8
Allison Creek
McGillivray Creek
Nez Perce Creek
Blairmore Creek
Cold Creek
Caudron Creek
Morin Creek
Ross Creek
Cow Creek
Rellstier Creek
40
Coleman
Crowsnest River
Green Creek
Connelly Creek
Tp 8
Tp 7
3
Crowsnest Creek
York Creek
Burk Creek
Blairmore
Frank
Star Creek
Ptolemy Creek
North York Creek
York Creek
Bellevue
Lyons Creek
Drum Creek
Drum Creek
Andy Good Creek
Byron Creek
Lynx Creek
Scrubby Creek
Corbin Creek
Goat Creek
Jackson Creek
Screwdriver Creek
Carbondale River
R4 R3 W5M

LEGEND

- Proposed Mine Permit Boundary
- Project Footprint
- Undisturbed Area
- Air Quality Local Study Area
- Air Quality Regional Study Area
- Model Domain
- End-Pit Lake

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

AIR QUALITY & HUMAN HEALTH RISK ASSESSMENT - LOCAL STUDY AREA AND REGIONAL STUDY AREA

NOTES

AltaLIS, 2016; NRCAN, 2015; Riversdale, 2016
Datum/Projection: UTM NAD 83 Zone 11

PROJECT: 14-00201-01
DRAWN BY: JL
CHECKED BY: BS
DATE: MAY 27, 2019

0 2.5 5 10
Kilometres

FIGURE

A.1

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674000 680000 686000 692000 698000

5522000 5516000 5510000 5504000 5498000 5492000

Rg 4 Rg 3 W5M

Forestry Trunk Road

Tp 10

Tp 9

Tp 9

Tp 8

Tp 8

Tp 7

Blairmore Creek

Gold Creek

40

Coleman

3

Blairmore

Frank

Bellevue

3

674000 680000 686000 692000 698000

LEGEND

- First Nations Receptors
- Potential Receptors
- Primary Highway
- Secondary Highway
- Proposed Mine Permit Boundary
- Air Quality Local Study Area
- Air Quality Regional Study Area
- End-Pit Lake

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

POTENTIAL HUMAN HEALTH RECEPTOR LOCATIONS

NOTES

AltaLIS, 2016; NRCAN, 2015; Riversdale, 2016
Datum/Projection: UTM NAD 83 Zone 11

PROJECT:	14-00201-01
DRAWN BY:	JL
CHECKED BY:	BS
DATE:	MAY 27, 2019

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Kilometres

FIGURE

A.2

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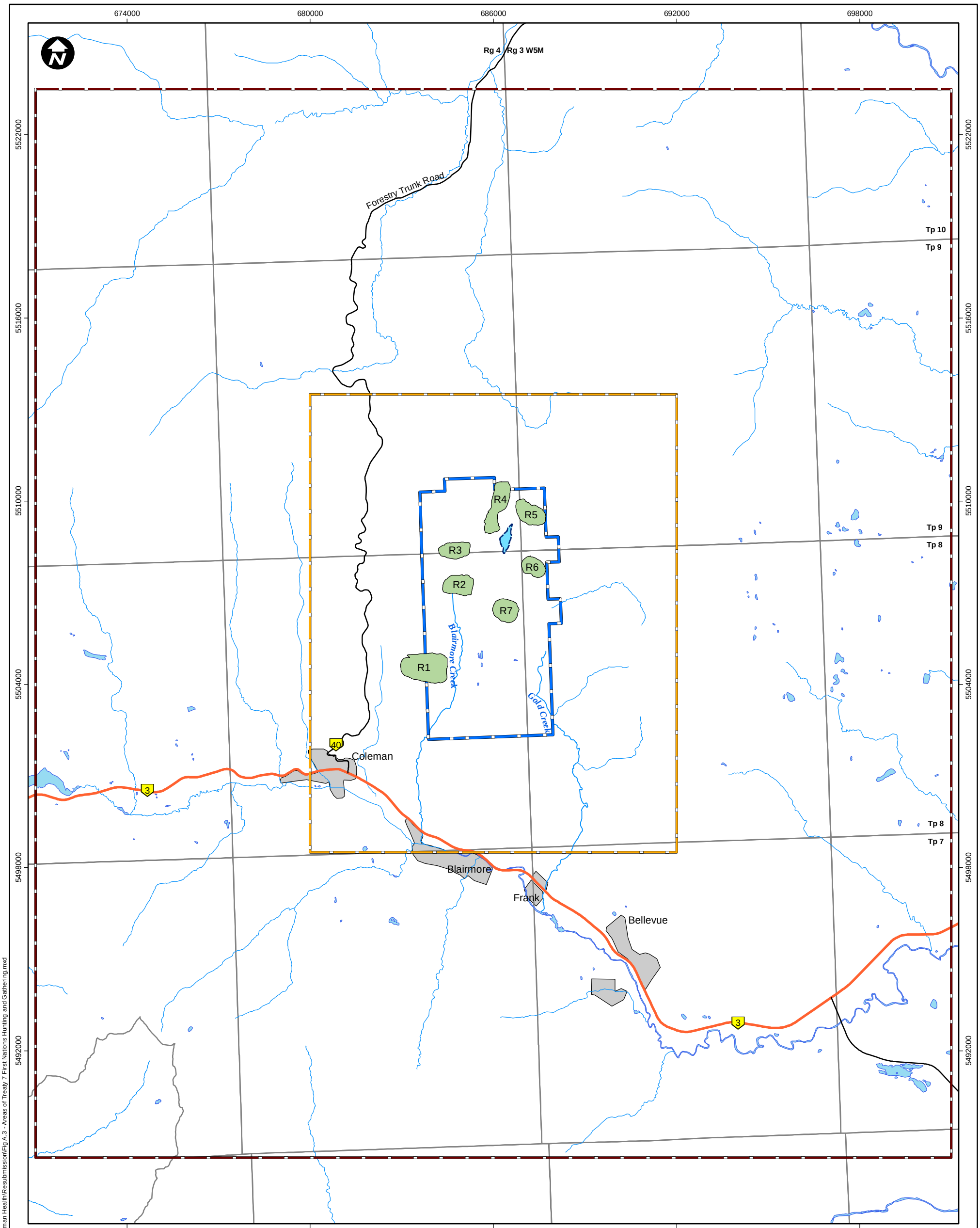

LEGEND

- Primary Highway
- Secondary Highway
- First Nations Receptor
- Proposed Mine Permit Boundary
- Air Quality Local Study Area
- Air Quality Regional Study Area
- End-Pit Lake

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

AREAS OF TREATY 7 FIRST NATIONS HUNTING AND GATHERING IN THE LOCAL STUDY AREA

NOTES

AltaLIS, 2016; NRCAN, 2015; Riversdale, 2016
Datum/Projection: UTM NAD 83 Zone 11

PROJECT:	14-00201-01
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Kilometres

FIGURE

A.3

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Label	Special Receptor Name
R1	Lost Lemon Campground
R2	Trapper's Cabin #1
R3	Residential #1
R4	Residential #2
R5	Residential #3
R6	Coleman
R7	Frank
R8	Blairmore
R9	Aboriginal (traditional land use)
R10	Residential #4
R11	Trapper's Cabin #2
R12	Residential #5
R13	Residential #6
R14	Blairmore Center

LEGEND

- Special Receptor
- Proposed Mine Permit Boundary
- Project Footprint
- Undisturbed Area
- Air Quality Local Study Area
- Air Quality Regional Study Area
- Model Domain
- End-Pit Lake

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

ASSESSED HEALTH RECEPTOR LOCATIONS

NOTES

AltaLIS, 2016; NRCAN, 2015; Riversdale, 2016
Datum/Projection: UTM NAD 83 Zone 11

PROJECT: 14-00201-01
DRAWN BY: JL
CHECKED BY: BS
DATE: MAY 27, 2019

FIGURE

A.4

0 2.5 5 10
Kilometres

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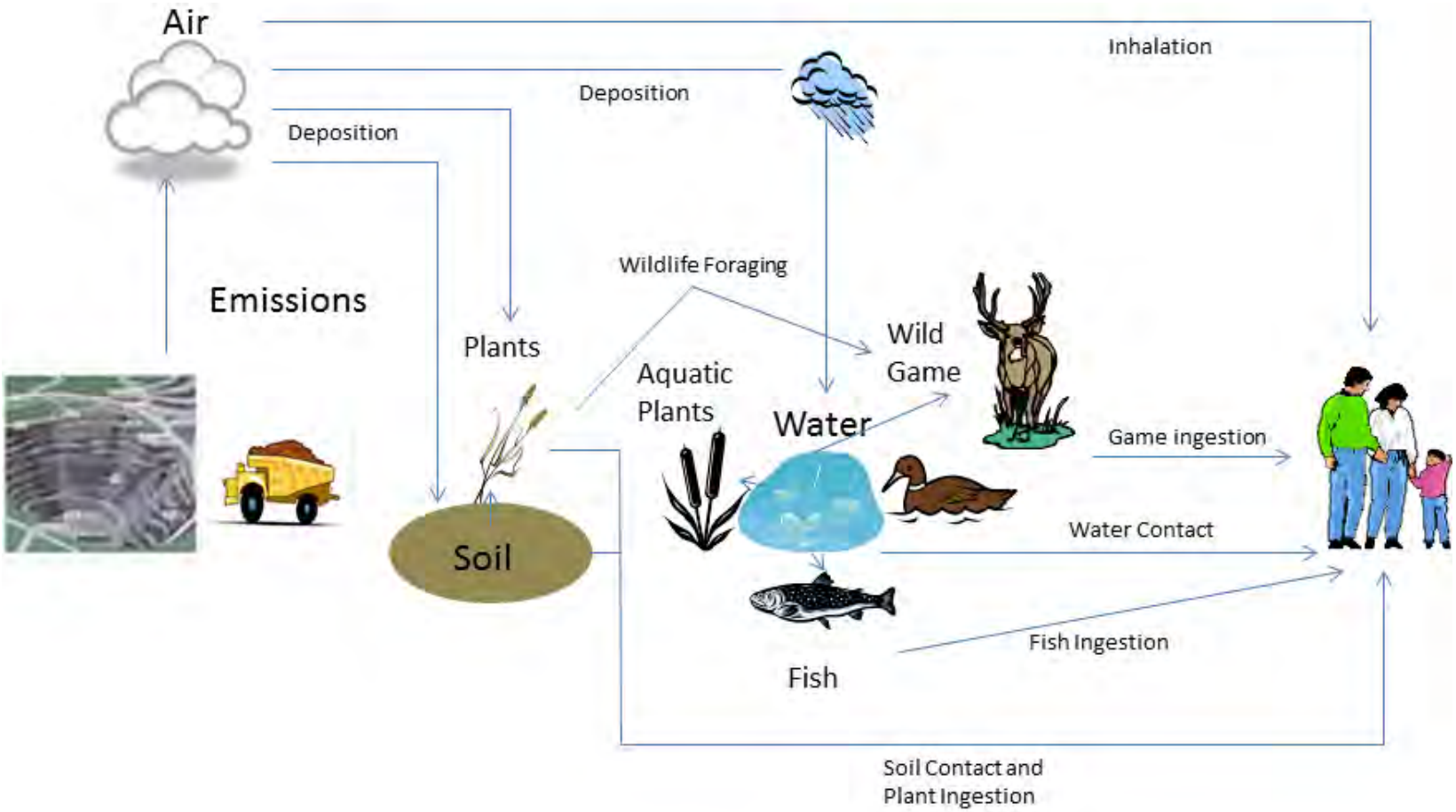

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

MULTI-MEDIA CONCEPTUAL SITE MODEL

PROJECT: 14-00201-01	
DRAWN BY: JDC	
CHECKED BY: DS	
DATE: AUGUST 27, 2015	

NOTES

MEMS, 2015

NOT TO SCALE

FIGURE

A.5

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APPENDIX B: TOXICOLOGICAL PROFILES

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1.0 ACENAPHTHENE

1.1 Inhalation Exposure Limits

1.1.1 Acute Inhalation Exposure Limits

Table B.1-1 Acute Inhalation Exposure Limits for Acenaphthene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value (µg/m^3)	-	-	-	1	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

An interim acute ESL of 1 µg/m^3 was recommended for acenaphthene as a fraction of exhaust PM_{10} by TCEQ (2013); however, no supporting documentation was provided for this exposure limit. No short-term occupational exposure limits have been developed for acenaphthene (OSHA 2013).

Acenaphthene is a C12 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to acenaphthene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

1.1.2 Chronic Inhalation

Table B.1-2 Chronic Inhalation Exposure Limits for Acenaphthene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value (µg/m^3)	-	-	-	-	-	0.1	-	-

Table B.1-2 Chronic Inhalation Exposure Limits for Acenaphthene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013	Health Canada 2010	OEHHA 2013	RIVM 2009	TCEQ 2013	US EPA 1994	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

An interim chronic ESL of 0.1 µg/m^3 was recommended for acenaphthene as a fraction of exhaust PM_{10} by TCEQ (2013); however, no supporting documentation was provided for this exposure limit. The US EPA (1994) and ATSDR (1995) determined there were insufficient data for the purpose of deriving a chronic inhalation exposure concentration for acenaphthene.

In the absence of a chronic inhalation exposure limit specific to acenaphthene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this C12 aromatic hydrocarbon. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

1.2 Oral Exposure Limits

1.2.1 Chronic Oral Exposure Limit

Table B.1-3 Chronic Oral Exposure Limits for Acenaphthene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Exposure Limit Type	MRL (adjusted)	-	-	CR	**RfD**
Exposure Limit Value (mg/kg bw/day)	0.06	-	-	0.5	**0.06**
Critical Organ or Effect	Liver	-	-	Cancer potency relative to B[a]P	**Liver**
Species	Mice	-	-	Rat	**Mice**

Table B.1-3 Chronic Oral Exposure Limits for Acenaphthene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Study	US EPA 1989	-	-	Kroese *et al* 1999	**US EPA 1989**
Source	ATSDR 1995	Health Canada 2010	OEHHA 2013	RIVM 2001	**US EPA 1994**

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1999a) identified an intermediate oral MRL of 0.6 mg/kg body weight/day for acenaphthene based on a NOAEL of 175 mg/kg body weight/day for liver toxicity in mice following 90 days gavage exposure to acenaphthene (US EPA 1989; ATSDR 1995). Adjusting the ATSDR intermediate MRL by an additional uncertainty factor of 10 for subchronic to chronic extrapolation would result in a chronic exposure limit of 0.06 mg/kg body weight/day. The US EPA (1994) identified the same NOAEL for acenaphthene and established a chronic oral RfD of 0.06 mg/kg body weight/day after applying a 3,000-fold uncertainty factor (US EPA 1994).

The RIVM (2001) recommend a CR of 0.5 mg/kg body weight/day for acenaphthene based on a relative carcinogenic potency to benzo[a]pyrene of 0.01 and an excess lifetime cancer risk of 1 in 10,000. Health Canada (2010) does not list a potency equivalency factor (PEF) to benzo[a]pyrene (B[a]P) for acenaphthene; therefore, the RIVM exposure limit based on cancer potency relative to B[a]P was not considered.

The RfD of 0.06 mg/kg body weight/day (US EPA 1994) was selected to evaluate risks associated with chronic oral exposure to acenaphthene. Acenaphthene was included in the chemical group for liver effects following oral exposures.

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2.0 ACENAPHTHYLENE

2.1 Inhalation Exposure Limits

2.1.1 Acute Inhalation Exposure Limits

Table B.2-1 Acute Inhalation Exposure Limits for Acenaphthylene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	1	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An interim acute ESL of 1 $\mu g/m^3$ was recommended by TCEQ (2013) for acenaphthylene, based on acenaphthene which is evaluated by TCEQ as PM_{10} (TCEQ 2013). No supporting documentation was provided for this exposure limit. No short-term occupational exposure limits have been developed for acenaphthylene (OSHA 2013).

Acenaphthylene is a C12 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to acenaphthylene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

2.1.2 Chronic Inhalation

Table B.2-2 Chronic Inhalation Exposure Limits for Acenaphthylene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-

Table B.2-2 Chronic Inhalation Exposure Limits for Acenaphthylene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.1	-	-
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013	Health Canada 2010	OEHHA 2013	RIVM 2001	TCEQ 2013	US EPA 1991	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An interim chronic ESL of 0.1 µg/m³ was recommended for acenaphthylene (TCEQ 2013), based on acenaphthene which is evaluated by TCEQ as PM_{10} (TCEQ 2013). No supporting documentation was provided for this exposure limit. The US EPA (1991) and ATSDR (1995) determined there were insufficient data for the purpose of deriving a chronic inhalation exposure concentration for acenaphthylene.

In the absence of a chronic inhalation exposure limit specific to acenaphthylene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this C12 aromatic hydrocarbon. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

2.2 Oral Exposure Limits

2.2.1 Chronic Oral Exposure Limit

Table B.2-3 Chronic Oral Exposure Limits for Acenaphthylene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Exposure Limit Type	-	-	-	CR	-
Exposure Limit Value (mg/kg bw/day)	-	-	-	0.05	-

Table B.2-3 Chronic Oral Exposure Limits for Acenaphthylene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Critical Organ or Effect	-	-	-	Cancer potency relative to B[a]P	-
Species	-	-	-	Rat	-
Study	-	-	-	Kroese *et al* 1999	-
Source	ATSDR 1995	Health Canada 2010	OEHHA 2013	RIVM 2001	US EPA 1991

- not available

Bold – Exposure Limit selected for HHRA

The ATSDR (1995) and US EPA (1991) determined there were insufficient data for the purpose of deriving an oral exposure limit for acenaphthylene.

The RIVM (2001) recommend an excess carcinogenic risk (CR) of 0.05 mg/kg body weight/day for acenaphthylene based on a relative carcinogenic potency to benzo[a]pyrene of 0.01 and an excess lifetime cancer risk of 1 in 10,000. Health Canada (2010) does not list a potency equivalency factor (PEF) to benzo[a]pyrene (B[a]P) for acenaphthylene and, therefore, the RIVM exposure limit based on potency relative to B[a]P was not considered.

Acenaphthylene is structurally very similar to acenaphthene. For the purpose of this assessment, the oral RfD identified for acenaphthene was selected to evaluate risks associated with chronic oral exposure to acenaphthylene (US EPA 1994). Details on this oral exposure limit are provided in the toxicity profile for acenaphthene. Acenaphthylene was included in the chemical group for liver effects following oral exposures.

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3.0 ACETALDEHYDE

3.1 Inhalation Exposure Limits

3.1.1 Acute Inhalation

Table B.3-1 Acute Inhalation Exposure Limits for Acetaldehyde

AGENCY	AEP	ATSDR	OEHHA	TCEQ
Exposure Limit Type	1-hour AAQO	-	1-hour REL 8-hour REL	1-hour ESL
Exposure Limit Value (µg/m³)	90	-	**470** 300	15
Critical Organ or Effect	Odour	-	Eye and respiratory irritation Nasal irritation	Odour
Species	Human	-	Human Rat	-
Study	Adopted TCEQ ESL	-	Prieto *et al.* 2000 Appelman *et al.* 1982; 1986	-
Source	ESRD 2013	ATSDR 2013	OEHHA 2013; 2008	TCEQ 2013

- not available

Bold – Exposure Limit selected for HHRA.

An AAQO of 90 µg/m³ is recommended by Alberta (ESRD 2013) for 1-hour exposures to acetaldehyde. This limit was adopted from an odour ESL recommended by the TCEQ and was last reviewed in 1999.

The TCEQ (2013) currently recommends an acute (1-hour) ESL of 15 µg/m³ for acetaldehyde based on an odour endpoint; no supporting documentation was provided (TCEQ 2013).

The OEHHA (2013) recommend a 1-hour REL of 470 µg/m³ for acetaldehyde. This REL was derived from responses observed in a study of controlled, short-term (2-5 minutes) exposures of asthmatic individuals to acetaldehyde (Prieto *et al.* 2000). A LOAEL of 142 mg/m³ for bronchoconstriction was identified from this study. The OEHHA (2008) applied a 300-fold uncertainty factor to this LOAEL account for use of a LOAEL (10), variability in human response (3) and potential asthma exacerbation in children (10). This REL was determined by the OEHHA (2008) to also be protective of potential eye

irritation associated with acute exposure to acetaldehyde, following review of another controlled exposure study in humans (Silverman *et al.* 1946).

An 8-hour REL of 300 µg/m³ is also recommended for acetaldehyde by the OEHHA (2013). This REL was derived from inhalation studies in rats intermittently exposed (6 hours/day, 5 days/week) to acetaldehyde over a 4 week period (Appelman *et al.* 1982; 1986). A NOAEL of 270 mg/m³ for degeneration of olfactory epithelium was identified from the Appelman *et al.* (1982; 1986) studies. The OEHHA (2008) determined a BMC_{05} of 178 mg/m³ using benchmark modelling. The BMC_{05} was converted to a human equivalent concentration of 242 mg/m³ using pharmacokinetic modelling and adjusted for continuous exposure, resulting in a BMC_{05}(HEC) of 86.5 mg/m³. A cumulative uncertainty factor of 300 was applied to the BMC_{05}(HEC) to account for subchronic exposure (3), extrapolation from an animal study (3), variability in human response (3) and potential asthma exacerbation in children (10).

The OEHHA REL of 470 µg/m³ was considered the most appropriate health-based guideline for the assessment of acute exposure to acetaldehyde as it was based on human responses and considered sensitive individuals. Acetaldehyde was included in the chemical groups for eye irritation, nasal irritation and respiratory irritation following acute inhalation exposures.

3.1.2 Chronic Inhalation

Table B.3-2 Chronic Inhalation Exposure Limits for Acetaldehyde

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	TC TC_{05}	REL RsC	-	ESL	RfC RsC	-
Exposure Limit Value (µg/m³)	-	-	390 17	140 **3.7**	-	45	**9** 5	-
Critical Organ or Effect	-	-	Nasal lesions Nasal tumours	Nasal lesions Nasal tumours	-	-	Nasal lesions Nasal tumours	-
Species	-	-	Rat	Rat	-	-	Rat	-
Study	-	-	Appelman *et al.* 1982; 1986 Woutersen *et al.* 1986	Appelman *et al.* 1982; 1986 Woutersen *et al.* 1986	-	-	Appelman *et al.* 1982; 1986 Woutersen and Appleman 1984	-

Table B.3-2 Chronic Inhalation Exposure Limits for Acetaldehyde

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Source	ESRD 2013	ATSDR 2013	Health Canada 2000	OEHHA 2013; 2011; 2008	RIVM 2001	TCEQ 2013	US EPA 1991	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

IARC (2013) has classified acetaldehyde as possibly carcinogenic to humans (Group 2B). Health Canada (2000), the OEHHA (2011) and US EPA (1991) have established chronic inhalation guidelines based on evidence in rats of an association between chronic inhalation exposure to acetaldehyde and nasal tumours (Woutersen *et al*. 1986; Woutersen and Appleman, 1984). These agencies also established guidelines based on nasal lesions in rats (Appelman *et al.* 1982; 1986) following acetaldehyde inhalation. The TCEQ (2013) recommends a chronic ESL of 45 for acetaldehyde; however, no supporting documentation was provided for this exposure limit.

The OEHHA (2011) recommend a unit risk factor of 0.0000027 per μg/m^3 for acetaldehyde. This risk factor was calculated from the incidence of nasal tumors in rats following exposure to acetaldehyde for 6 hours/day, 5 days/week and up to 28 months (Woutersen *et al.* 1986). The unit risk factor translates to an RsC of 3.7 μg/m^3, assuming an acceptable incremental cancer risk of 1 in 100,000.

Health Canada (2000) determined a TC_{05} of 86 mg/m^3 based on the incidence of tumours in the nasal cavity of rats chronically exposed to acetaldehyde (Woutersen *et al.*, 1986). The TC_{05} was derived using a multistage model with adjustment for intermittent to continuous exposure (Health Canada, 2000). The TC_{05} is associated with a 5% (1 in 20) increase in tumour incidence over background. Dividing the TC_{05} by a factor of 5,000 results in an RsC of 17 μg/m^3 for a 1 in 100,000 incremental cancer risk level.

The US EPA (1991) recommends a unit risk factor of 0.0000022 per μg/m^3 for acetaldehyde. This risk factor was calculated from the incidence of nasal tumors in rats following exposure to acetaldehyde for 6 hours/day, 5 days/week for 27 months (Woutersen and Appleman 1984). The unit risk factor translates to an RsC of 5 μg/m^3 assuming a 1 in 100,000 incremental cancer risk.

The OEHHA (2013) recommends an REL of 140 μg/m^3 for noncarcinogenic effects of acetaldehyde following chronic exposure. This REL was derived from the same rat inhalation studies (Appelman *et al.* 1982; 1986) previously described for the 8-hour OEHHA REL. The BMC_{05} (HEC) of 242 mg/m^3 was adjusted for chronic exposure, resulting in a POD of 43.2 mg/m^3. A cumulative uncertainty factor of 300 was again applied to account for subchronic exposure (3), extrapolation from an animal study

(3), variability in human response (3) and potential asthma exacerbation in children (10) (OEHHA 2008).

Health Canada (2000) developed a TC of 390 μg/m^3 for the noncarcinogenic effects of acetaldehyde following chronic exposure. This guideline was also based on the Appelman *et al.* (1982; 1986) inhalation studies reporting nasal lesions in rats intermittently exposed (6 hours/day, 5 days/week) to acetaldehyde over a 4 week period.

A BMC_{05} of 218 mg/m^3 was calculated for non-neoplastic lesions in the rat nasal olfactory epithelium (Health Canada 2000). The BMC_{05} was adjusted for continuous exposure (24 hours/day, 7 days/week) and an uncertainty factor of 100 applied to account for extrapolation from an animal study (10) and variability in human response (10).

The US EPA (1991) recommends an RfC of 9 μg/m^3 for acetaldehyde based on noncarcinogenic effects following chronic exposure. A NOAEL of 273 mg/m^3 for degeneration of olfactory epithelium was identified from the Appelman *et al.* (1982; 1986) studies. The US EPA calculated a NOAEL(HEC) of 8.7 mg/m^3 after adjusting the NOAEL for continuous exposure. The US EPA (1991) applied a 1,000-fold uncertainty factor to the NOAEL (HEC) to account for use of a subchronic study (10), extrapolation from an animal study and incompleteness of the database (10) and variability in human response (10).

The noncarcinogenic REL defined by OEHHA was applied in the current risk assessment. It was selected over the lower US EPA (1991) value as it is a more current assessment of the same studies. The lowest air concentration recommended by the OEHHA (3.7 μg/m^3) was selected for the assessment of carcinogenic effects following chronic inhalation exposure to acetaldehyde. Acetaldehyde was included in the chemical group for nasal tumours following chronic inhalation exposures.

Acetaldehyde was included in the chemical group for nasal irritation following chronic inhalation exposures.

3.2 Oral Exposure Limits

No chronic oral exposure limit was required for acetaldehyde as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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4.0 ACROLEIN

4.1 Inhalation Exposure Limits

4.1.1 Acute Inhalation

Table B.4-1 Acute Inhalation Exposure Limits for Acrolein

AGENCY	AEP	ATSDR	OEHHA	TCEQ
Exposure Limit Type	1-hour AAQO	1-hour MRL	**1-hour REL**	1-hour ReV
Exposure Limit Value (µg/m³)	4.5	7	**2.5**	11
Critical Organ or Effect	Eye, nasal, respiratory irritation	Eye, nasal, respiratory irritation	**Eye, nasal, respiratory irritation**	Eye, nasal, respiratory irritation
Species	Human	Human	**Human**	Human
Study	Adopted from Ontario (2009) based on Darley *et al.* 1960	Weber-Tschopp *et al.* 1977	**Darley *et al.* 1960**	Weber-Tschopp *et al.* 1977
Source	ESRD 2013	ATSDR 2013; 2007	**OEHHA 2013; 2008**	TCEQ 2014

- not available

Bold – Exposure Limit selected for HHRA.

The ESRD (2013), ATSDR (2013), OEHHA (2013) and TCEQ (2013) all recommend 1-hour exposure limits for acrolein based on eye, nasal and respiratory irritation reported in controlled human exposure studies (Weber-Tschopp *et al.* 1977; Darley *et al.* 1960).

The ESRD (2013) 1-hour guideline of 4.5 µg/m³ was adopted from the Ontario MOE (2009) which identified a LOAEL of 137 µg/m³ for eye, mucous membrane and respiratory irritation in human volunteers following short-term (5-minutes) exposure to up to 3,000 µg/m³ acrolein (Darley *et al.* 1960). An uncertainty factor of 30 was applied to the LOAEL to account for use of a LOAEL (3) and variation in human response (10) (Ontario MOE 2009).

The ATSDR (2013) recommend a 1-hour MRL of 7 µg/m³ for acrolein. The MRL was based on a LOAEL of 0.3 ppm (700 mg/m³) for decreased respiratory rate as well as nose and throat irritation in human volunteers exposed to 0.3 ppm acrolein for 60 minutes (Weber-Tschopp *et al.* 1977). An

uncertainty factor of 100 was applied to the LOAEL to account for use of a LOAEL (10) and variation in human response (10) (ATSDR 2007).

The OEHHA (2013) recommend a 1-hour REL of 2.5 µg/m^3 for acrolein. Similar to the MOE (2009), the OEHHA (2008) identified a LOAEL of 140 µg/m^3 for eye irritation in volunteers following short-term (5-minutes) exposure to acrolein (Darley *et al*. 1960). An uncertainty factor of 60 was applied to account for use of a LOAEL (6) and variation in human response (10).

An acute ReV of 11 µg/m^3 is recommended for acrolein by the TCEQ (2014). Similar to the ATSDR (2007), the TCEQ (2014) identified a LOAEL of 0.3 ppm (700 mg/m^3) for eye, nose, throat irritation and decreased respiratory rate in human volunteers exposed for 60 minutes to acrolein (Weber-Tschopp *et al.* 1977). An uncertainty factor of 63 was applied to the LOAEL to account for use of a LOAEL (6.3) and variation in human response (10) (TCEQ 2010).

The lowest 1-hour exposure limit of 2.5 µg/m^3 (OEHHA, 2008) was selected for the assessment of acute exposure to acrolein. Acrolein was included in the chemical groups for eye irritation, nasal irritation and respiratory irritation following acute inhalation exposures.

4.1.2 Chronic Inhalation

Table B.4-2 Chronic Inhalation Exposure Limits for Acrolein

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	TC	**REL**	-	ReV	RfC	-
Exposure Limit Value (µg/m^3)	-	-	0.4	**0.35**	-	2.7	0.02	-
Critical Organ or Effect	-	-	Nasal lesions	**Nasal lesions**	-	Nasal lesions	Nasal lesions	-
Species	-	-	Rat	**Rat**	-	Rat	Rat	-
Study	-	-	Cassee *et al.* 1996	**Dorman *et al.* 2008**	-	Dorman *et al.* 2008	Feron *et al.* 1978	-
Source	ESRD 2013	ATSDR 2013	Health Canada 2000	**OEHHA 2013; 2008**	RIVM 2001	TCEQ 2014	US EPA 2003	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

Health Canada (2000) recommends a TC of 0.4 µg/m^3 for acrolein. A BMC_{05} of 0.14 mg/m^3 was calculated for a 5% increase in the incidence of nasal lesions in rats following inhalation (nose-only) exposure to acrolein for 6 hours/day over a 3 day period (Cassee *et al*. 1996). The BMC_{05} was adjusted for continuous exposure and an uncertainty factor of 100 applied to account for use of an animal study (10) and variability in human response (10). No uncertainty factor was applied for less than chronic exposure. Health Canada (2000) noted the degenerative changes observed by Cassee *et al.* (1996) following short-term exposures were consistent with observations in longer-term bioassays in rats (Feron *et al.* 1978) and hamsters (Feron and Kruysse, 1977).

The OEHHA (2013) recommend a chronic REL of 0.35 µg/m^3 for acrolein. The REL was based on a NOAEL of 0.2 ppm for lesions in the respiratory epithelium of rats exposed to acrolein 6 hours/day, 5 days/week for 13 weeks (Dorman *et al.* 2008). The OEHHA (2008) calculated a NOAEL(HEC) of 0.03 ppm (70 mg/m^3) after adjusting the NOAEL for continuous exposure. An uncertainty factor of 200 was applied to account for extrapolation from an animal study (3), use of a subchronic study (3), variability in human response (10) and use of a dosimetric adjustment factor for formaldehyde, an analogue chemical, to determine the human exposure concentration for acrolein (2).

The TCEQ (2014) recommend a ReV of 2.7 µg/m^3 for chronic exposure to acrolein. This guideline was based on a NOAEL of 0.2 ppm for hyperplasia of the respiratory epithelium of rats exposed to acrolein 6 hours/day, 5 days/week for 13 weeks (Dorman *et al.* 2008). The study investigated duration and concentration effects for several exposure groups and evaluated the histopathology and recovery of the respiratory tract post-exposure. The TCEQ (2014) calculated a $NOAEL_{HEC}$ of 0.03571 ppm (80 µg/m^3). The NOAEL was not adjusted for continuous exposure based on close agreement of both NOAELs and LOAELs from acute and subchronic animal and human studies, studies indicating concentration was generally more important in producing adverse effects than duration of exposure and chronic studies with structurally similar acrylate esters that induce similar responses show little progression in lesions (TECQ 2014). An uncertainty factor of 30 was applied to the $NOAEL_{HEC}$ to account for interspecies (3) and intraspecies (10) variability.

The US EPA (1991) recommends a RfC of 0.02 µg/m^3 for acrolein based on a LOAEL of 0.9 mg/m^3 for nasal lesions in rats exposed to acrolein for 5 days/week over 13 days (Feron *et al.* 1978). The US EPA calculated a LOAEL (HEC) of 0.02 mg/m^3 after adjusting for continuous exposure and applied a 1,000 fold uncertainty factor to account for use of a minimal LOAEL (3), use of a subchronic study (10), extrapolation from an animal study (3) and variability in human response (10). The US EPA selected the Feron *et al.* (1978) study over the more recent study by Cassee *et al.* (1996) based on the reporting of results for a higher number of test animals (including both sexes of rats, hamsters and rabbits), a longer exposure duration, and better characterization of multiple endpoints and the dose-response by Feron *et al.* (1978).

The OEHHA and TCEQ both identified guidelines for acrolein based on the most recent study for nasal irritation in rats (Dorman *et al.* 2008). The lowest of these guidelines (0.35 µg/m^3) was selected for the current assessment of chronic inhalation exposure to acrolein. Acrolein was included in the chemical group for nasal irritation following chronic inhalation exposures.

4.2 Oral Exposure Limits

No chronic oral exposure limit was required for acrolein as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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5.0 ALUMINUM

5.1 Inhalation Exposure Limits

5.1.1 Acute Inhalation

Table B.5-1 Acute Inhalation Exposure Limits for Aluminum

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	**20 (aluminum chloride, aluminum alkyls & soluble salts)** 50 (other forms of aluminum)	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	-	-	-	TECQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

Few agencies have assessed the inhalation toxicity of aluminum, and neither ESRD nor WHO have published air quality guidelines.

TECQ (2014) published interim short-term ESLs of 20 µg/m³ for both aluminum chloride and aluminum alkyls and soluble salts, as well as interim short-term ESLs of 50 µg/m³ for several other forms of aluminum including aluminum oxide (abrasive), aluminum phosphate, aluminum silicate, aluminum sulfate, and aluminum metal. All of these ESLs apply to aluminum in PM_{10}. The basis was indicated as being human health, but detailed justification is not available.

OMOE (2012) has specified ½ hour guidelines of 100 µg/m³ for aluminum distearate, aluminum oxide, aluminum stearate and aluminum tristearate, as well as 24-hour guidelines of 120 µg/m³ for aluminum oxide and 2,180 µg/m³ for the other aluminum species. The basis for these guidelines is not provided.

Due to the lack of defensible acute inhalation exposure limits, aluminum was not assessed on an acute basis.

5.1.2 Chronic Inhalation

Table B.5-2 Chronic Inhalation Exposure Limits for Aluminum

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	**p-RfC**	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	2 (aluminum chloride, aluminum alkyls & soluble salts) 5 (other forms of aluminum)	**5**	-
Critical Organ or Effect	-	-	-	-	-	-	**Neurotoxicity**	-
Species	-	-	-	-	-	-	**Human**	-
Study	-	-	-	-	-	-	**Hosovski *et al.* 1990**	-
Source	-	-	-	-	-	TECQ 2014	**US EPA 2006**	-

- not available

Bold – Exposure Limit selected for HHRA.

IARC (2014) has not assessed the carcinogenicity of aluminum; while occupational exposures during aluminum production have been deemed carcinogenic to humans, this was not linked to aluminum itself.

TECQ (2014) published interim long-term ESLs of 2 µg/m³ for both aluminum chloride and aluminum alkyls and soluble salts, as well as interim long-term ESLs of 5 µg/m³ for several other forms of aluminum including aluminum oxide (abrasive), aluminum phosphate, aluminum silicate, aluminum sulfate, and aluminum metal. All of these ESLs apply to aluminum in PM_{10}. The basis was indicated as being human health, but detailed justification is not available.

US EPA (2006) established a provisional RfC of 0.005 mg/m³ (5 µg/m³) based on an occupational study (Hosovski *et al.* 1990) where workers were exposed to estimated time-weighted average

concentrations of 4.6 – 11.5 mg/m^3 aluminum for an average of 12 years and found to have signs of impaired coordination. The lowest concentration was corrected for continuous exposure, and an uncertainty factor of 300 (10 for intrahuman variability, 10 for use of a LOAEL, 3 for database deficiencies) was applied.

The US EPA (2006) p-RfC is considered the most defensible value.

5.2 Oral Exposure Limits

5.2.1 Chronic Oral

Table B.5-3 Chronic Oral Exposure Limits for Aluminum

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL	-	-	-	p-RfD	-
Exposure Limit Value (mg/kg bw/day)	1	-	-	-	1	**0.143**
Critical Organ or Effect	Decreased grip strength and thermal sensitivity	-	-	-	Neurotoxicity (developmental)	-
Species	Mouse	-	-	-	Mouse	-
Study	Golub *et al*. 2000	-	-	-	Golub *et al*. 1995; Donald *et al*. 1989	-
Source	ATSDR 2008	-	-	-	US EPA 2006	-

- not available

Bold – Exposure Limit selected for HHRA.

ATSDR (2008) developed a chronic MRL for aluminum of 1 mg/kg bw/d. This MRL was based on a mouse dietary study (Golub *et al.* 2000) where 7 or 1,000 µg Al (as aluminum lactate) per g diet was fed from conception through 24 months of age. The critical effect was determined to be decreased forelimb and hindlimb grip strength and temperature sensitivity in both male and female mice in the high dose group. The LOAEL was determined to be 100 mg Al/kg-bw/d. Uncertainty factors of 3 for use of a minimal LOAEL, 10 for extrapolation from animals to humans, and 10 for human variability; a modifying factor of 0.3 was also applied to account for possible differences in bioavailability between aluminum lactate in diet and aluminum in drinking water or a typical US diet.

US EPA (2006) derived a provisional RfD of 1 mg/kg-bw/d (1,000 µg/kg bw/d) based on mouse feeding studies where neurotoxicity was observed in offspring of exposed mice (Donald *et al.* 1989; Golub *et al.* 1995). A LOAEL of 100 mg/kg-bw/d was adjusted by an uncertainty factor of 100 (3 for use of a minimal LOAEL, 10 for interspecies extrapolation, and 3 for intrahuman variability where the critical effect occurs in a sensitive sub-group). The confidence in the principal studies and the provisional RfD was considered to be low.

The Joint FAO/WHO Expert Committee on Food Additives (JECFA) (WHO 2007) recommended a provisional tolerable weekly intake of 1 mg/kg body weight for aluminum and its salts. They determined that the available studies were not adequate for defining dose-response relationships. A range of LOELs of 50 to 75 mg/kg-bw/d was identified in several different animal dietary studies; an uncertainty factor of 100 (for inter- and intra-species differences) was applied to the lower end of this range along with an uncertainty factor of 3 to reflect deficiencies in the database offset by a probably lower bioavailability of aluminum compounds in food compared to the reviewed dietary studies. JECFA noted that this PTWI is likely exceeded to a large extent by some population groups. An equivalent daily dose would be 0.143 mg/kg bw/d.

The WHO (2007) PTWI is based on a thorough review, includes appropriate justification and is more conservative than the US EPA and ATSDR values, and is applied herein.

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6.0 ANTHRACENE

6.1 Inhalation Exposure Limits

6.1.1 Acute Inhalation Exposure Limits

Table B.6-1 Acute Inhalation Exposure Limits for Anthracene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	0.5	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An interim acute ESL of 0.5 µg/m³ was recommended for anthracene as a fraction of exhaust PM_{10} by TCEQ (2013), however no supporting documentation was provided for this exposure limit. No short-term occupational exposure limits have been developed for anthracene (OSHA 2013).

Anthracene is a C14 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to anthracene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

6.1.2 Chronic Inhalation

Table B.6-2 Chronic Inhalation Exposure Limits for Anthracene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.05	-	-

Table B.6-2 Chronic Inhalation Exposure Limits for Anthracene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013	Health Canada 2010	OEHHA 2013	RIVM 2009	TCEQ 2013	US EPA 1994	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An interim chronic ESL of 0.05 µg/m^3 was recommended for anthracene as a fraction of exhaust PM_{10} by TCEQ (2013); however, no supporting documentation was provided for this exposure limit. The US EPA (1994) and ATSDR (1995) determined there were insufficient data for the purpose of deriving a chronic inhalation exposure concentration for anthracene.

In the absence of a chronic inhalation exposure limit specific to anthracene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this C14 aromatic hydrocarbon. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

6.2 Oral Exposure Limits

6.2.1 Chronic Oral Exposure Limit

Table B.6-3 Chronic Oral Exposure Limits for Anthracene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Exposure Limit Type	MRL (adjusted)	-	-	TDI	**RfD**
Exposure Limit Value (mg/kg bw/day)	1	-	-	0.04	**0.3**
Critical Organ or Effect	NOAEL	-	-	Body weight	**NOAEL**
Species	Mice	-	-	Rat	**Mice**

Table B.6-3 Chronic Oral Exposure Limits for Anthracene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Study	US EPA 1989	-	-	Various; TPHCWG 1997	**US EPA 1989**
Source	ATSDR 1995	Health Canada 2010	OEHHA 2013	RIVM 2001	**US EPA 1994**

- not available

Bold – Exposure Limit selected for HHRA

The ATSDR (2013) identified an intermediate oral MRL of 10 mg/kg body weight/day based on no treatment related effects in mice following subchronic exposure to anthracene at doses up to 1,000 mg/kg body weight/day (US EPA 1989; ATSDR 1995). Adjusting the ATSDR intermediate MRL by an additional uncertainty factor of 10 for subchronic to chronic extrapolation would result in a chronic exposure limit of 1 mg/kg body weight/day (1,000 µg/kg body weight/day). The US EPA (1994) identified the same NOAEL for anthracene (*i.e.*, 1,000 mg/kg body weight/day) and established a chronic oral RfD of 0.3 mg/kg body weight/day after applying a 3,000-fold uncertainty factor. The additional 3-fold uncertainty was applied to account for a lack of reproductive/developmental data and lack of data in another species (US EPA 1994).

The RIVM (2001) have developed a tolerable daily intake of 0.04 mg/kg body weight/day for non-carcinogenic aromatic compounds with equivalent carbon number >9 to 16, including anthracene. This TDI was adopted from TPHCWG (1997) which identified a range of reported oral RfD values for decreased bodyweight (from 30 to 300 µg/kg body weight/day) in rats following exposure to 8 aromatic compounds within this range; 4 of the 8 RfD values being 40 µg/kg body weight/day.

The US EPA (1989) NOAEL was specific to anthracene and identified for guideline development by both the US EPA and ATSDR. Therefore, an RfD of 0.3 mg/kg body weight/day, the lowest guideline from this study, was selected to evaluate risks associated with chronic oral exposure to anthracene.

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7.0 ANTIMONY

7.1 Inhalation Exposure Limits

7.1.1 Acute Inhalation

Table B.7-1 Acute Inhalation Exposure Limits for Antimony

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	5	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	-	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

Very few acute exposure limits are available for antimony. TCEQ (2014) specified an interim short-term ESL of 5 µg/m³ (in PM_{10}) for antimony. While it is identified as being health-based, the basis is not provided.

OMOE (2012) has specified a ½ hour standard for antimony of 75 µg/m³ and a 24-hour standard of 25 µg/m³; these values are identified as being health-based but the detailed basis is not provided.

Due to the lack of defensible acute inhalation exposure limits, antimony was not assessed on an acute basis.

7.1.2 Chronic Inhalation

Table B.7-2 Chronic Inhalation Exposure Limits for Antimony

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	**RfC (SBO3)**	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.5	**0.2**	-
Critical Organ or Effect	-	-	-	-	-	-	**Respiratory**	-
Species	-	-	-	-	-	-	**Rat**	-
Study	-	-	-	-	-	-	**Newton *et al.* 1994**	-
Source	-	-	-	-	-	TCEQ (2014)	**US EPA 1995**	-

- not available

Bold – Exposure Limit selected for HHRA.

TCEQ (2014) specified an interim short-term ESL of 0.5 µg/m³ (in PM10) for antimony. While it is identified as being health-based, the basis is not provided.

US EPA (1991) did not publish inhalation toxicity limits for antimony, but references historical studies suggesting an inhalation NOEL for myocardial damage of approximately 0.5 mg/m³ in historical occupational studies. US EPA (1995) did establish an RfC for antimony trioxide of 0.0002 mg/m³ based on respiratory effects in rats observed by Newton *et al.* (1994) in a 1-year inhalation study. A benchmark concentration (BMC10) of 0.87 mg/m³, or 0.074 mg/m³ as a human-equivalent concentration, was calculated. An uncertainty factor of 10 for sensitive humans was applied, along with a factor of 3 for interspecies extrapolation, 3 for less-than lifetime exposure and 3 for database inadequacies (lack of reproductive and developmental studies).

ATSDR (1992) evaluated the toxicity of antimony but concluded that data were inadequate to derive MRLs.

IARC (2014) classified antimony trioxide as possibly carcinogenic to humans (Group 2B) based on inadequate evidence in humans but evidence of carcinogenicity in animal inhalation studies. They

determined that antimony trisulfide was not classifiable as to its carcinogenicity to humans. Elemental antimony was not assessed.

The US EPA RfC is specific to antimony trioxide; in the absence of information on the specific form of antimony it is applied for screening purposes.

7.2 Oral Exposure Limits

7.2.1 Chronic Oral

Table B.7-3 Chronic Oral Exposure Limits for Antimony

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	**TDI**	-	TDI	Oral Rfd	TDI
Exposure Limit Value (mg/kg bw/day)	-	**0.0002**	-	0.006	0.0004	0.006
Critical Organ or Effect	-	**Serum glucose and haematuria**	-	Decreased body weight and reduced food/water intake	Survival, glucose levels and cholesterol levels	Decreased body weight and reduced food/water intake
Species	-	**Rat**	-	Rat	Rat	Rat
Study	-	**Poon *et al.* 1998**	-	Poon *et al.* 1998; Lynch *et al.* 1999	Schroeder *et al* 1970	Poon *et al.* 1998; Lynch *et al.* 1999
Source	-	**Health Canada 1997**	-	RIVM 2009	US EPA 1991	WHO 2003

- not available

Bold – Exposure Limit selected for HHRA.

Health Canada (1997) established a TDI of 0.0002 mg/kg-bw/d (0.2 µg/kg-bw/d) based on a 13-week rat water ingestion study (Poon *et al.* 1998), where a NOAEL of 0.5 mg/L in drinking water, equivalent to 0.06 mg/kg-bw/d was established. An uncertainty factor of 300 (10 for intraspecies variation, 10 for interspecies variation and 3 for use of a short-term study) was applied.

WHO (2003) used the same Poon *et al.* (1998) study as Health Canada; however, they incorporated a review by Lynch *et al.* (1999) that concluded the critical effects suggested by Poon *et al.* (1998) were

expected to be reversible/adaptive and not consistent with other studies, and that therefore a NOAEL of 6.0 mg/kg-bw/d should be applied based on decreased body weight gain, food intake and water intake. An uncertainty factor of 1,000 (10 for intraspecies variation, 10 for interspecies variation and 10 for a subchronic study) was then applied to calculate a TDI of 0.006 mg/kg-bw/d. RIVM (2006) used the same study and rationale to derive an identical TDI.

US EPA (1991) published an oral RfD of 0.0004 mg/kg-bw/d (0.4 µg/kg-bw/d) based on a rat study (Schroeder *et al* 1970) where rates were exposed to 5 ppm potassium antimony tartrate in water. The experimental group had on average shorter lifespans, decreased blood glucose levels (males only) and altered cholesterol levels compared to controls. The estimated exposure dose (0.35 mg/kg-bw/d) was adjusted by an uncertainty factor of 1,000 (10 for interspecies conversion, 10 for sensitive individuals, and 10 for use of a LOAEL). A notation on the website indicates that a 2002 literature review identified one or more significant new studies.

The Health Canada, WHO and RIVM values are all based on the same critical study and differ based on the interpretation of the critical effect. The Health Canada evaluation relies on the interpretation of the study authors, and is also the most conservative value, and is therefore applied.

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8.0 ARSENIC

8.1 Inhalation Exposure Limits

8.1.1 Acute Inhalation

Table B.8-1 Acute Inhalation Exposure Limits for Arsenic

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	1 hr AAQO	-	REL	ReV ESL	-
Exposure Limit Value (µg/m³)	0.1	-	**0.2 (acute)** 0.015 (8-hour)	9.9 3	-
Critical Organ or Effect	Respiratory effects	-	Developmental	Rales; decreased body weight (maternal)	-
Species	-	-	Mouse (acute); human (8-hour)	Rat	-
Study	-	-	-	Holson *et al* 1999	-
Source	ESRD 2013	-	OEHHA 2014	TCEQ 2012	-

- not available

Bold – Exposure Limit selected for HHRA.

ESRD (2013) has published a 1-hour ambient air quality objective of 0.1 µg/m³ for arsenic. The supporting documentation indicates that it is based on respiratory effects, which are noted as occurring in animal studies at concentrations as low as 123 µg/m³; the specific derivation is not detailed.

OEHHA (2014) published an acute REL of 0.2 µg/m³ based on decreased foetal weight in mice, and an 8-hour REL of 0.015 µg/m³ based on decreased intellectual function in 10 year old children. While the supporting documentation includes a toxicological review, the specifics of the REL derivation are not provided.

TCEQ (2012) developed an acute ReV of 9.9 µg/m³ and acute ESL of 3 µg/m³ based on maternal toxicity in rats. Rales (crackling sounds) and decreased body weight were observed in female rats exposed through mating and gestation (Holson *et al* 1999). A NOAEL of 3 mg/m³ arsenic trioxide was determined; after adjusting for the exposure regime and human equivalence the point of departure was 3,891 µg/m³. Uncertainty factors of 3 for interspecies extrapolation, 10 for intraspecies variability

and 10 for database uncertainties were applied resulting in an arsenic trioxide ReV of 13 μg/m^3, or 9.9 μg/m^3 expressed as arsenic. An additional factor of 3 is applied for the ESL to account for cumulative and aggregate risk.

8.1.2 Chronic Inhalation

Table B.8-2 Chronic Inhalation Exposure Limits for Arsenic

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	AAQO (annual)	-	**RSC**	-	-	ESL	-	-
Exposure Limit Value (μg/m^3)	0.01	-	**0.0016**	-	-	0.067	-	0.0066
Critical Organ or Effect	Cancer	-	**Cancer**	-	-	Respiratory and lung cancer	-	Cancer
Species	Humans	-	**Humans**	-	-	Humans	-	Human
Study	-	-	**Higgins *et al* 1986**	-	-	-	-	-
Source	ESRD 2013	-	**Health Canada 2010**	-	-	TCEQ 2012	-	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

IARC (2014) has classified arsenic as Group 1 (carcinogenic to humans) based on sufficient evidence in humans.

ESRD (2013) has published an annual ambient air quality objective of 0.01 μg/m^3 for arsenic. The supporting documentation indicates that it is based on carcinogenicity, which is noted as occurring in animal studies at concentrations as low as 70 μg/m^3; the specific derivation is not detailed.

Health Canada (2010) established an inhalation slope factor of 27 (mg/kg-bw/d)$^{-1}$ and inhalation unit risk of 6.4 (mg/m^3)$^{-1}$. These values were calculated from a TC_{05} of 7.83 μg/m^3 based on lung cancer observed in an occupational epidemiology study (Higgins *et al.* 1986). An equivalent RSC for a 1 in 100,000 cancer risk would be 0.0016 μg/m^3.

TCEQ (2012) published an ESL of 0.067 µg/m^3 based on combined data from multiple epidemiological occupational studies. The combined URF for lung cancer was determined to be 1.5x10^{-4} per µg/m^3, resulting in an air concentration for a 1 in 100,000 cancer risk for 0.067 µg/m^3.

WHO (2000) determined that an air concentration of approximately 0.0066 µg/m^3 corresponds to an excess lifetime cancer risk of 1 in 100,000, based on human epidemiological studies in Sweden and the United States and assuming a linear dose-response relationship.

8.2 Oral Exposure Limits

8.2.1 Chronic Oral

Table B.8-3 Chronic Oral Exposure Limits for Arsenic

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL	**Oral RsD**	-	-	-	-
Exposure Limit Value (mg/kg bw/day)	0.0003	**0.0000056**	-	-	-	-
Critical Organ or Effect	Dermal lesions	**Cancer (bladder, lung, liver)**	-	-	-	-
Species	Human	**Human**	-	-	-	-
Study	Tseng *et al.* 1968; Tseng 1977	**Morales *et al* 2000, Chen *et al* 1985, Wu *et al* 1989**	-	-	-	-
Source	ATSDR 2007	**Health Canada 2010**	-	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

ATSDR (2007) published an oral MRL of 0.0003 mg/kg-bw/d (0.3 µg/kg-bw/d) based on an epidemiological study in Taiwan (Tseng *et al.* 1968; Tseng 1977). A clear dose-response relationship was observed between arsenic exposure from well water and Blackfoot disease, hyperkeratosis and hyperpigmentation. A NOAEL of 0.0008 mg/kg-bw/d and less-serious LOAEL of 0.014 mg/kg-bw/d

were established. An uncertainty factor of 3 for human variability was applied; a factor of 10 was not considered warranted due to the size of the population studied.

Health Canada (2010) published a slope factor of 1.80 $(mg/kg\text{-}bw/d)^{-1}$, which is equivalent to a risk-specific dose (for a 1 in 100,000 risk) of 0.0000056 mg/kg-bw/d. The slope factor was based on an ecological study in southwestern Taiwan reported by Wu *et al.* (1989) and Chen *et al.* (1992) among others, and an analysis of the data by Morales *et al.* (2000), with bladder, liver and lung cancer observed in populations exposed to arsenic in drinking water. The upper 95% values from the study were used to derive the slope factor.

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9.0 BARIUM

9.1 Inhalation Exposure Limits

9.1.1 Acute Inhalation

Table B.9-1 Acute Inhalation Exposure Limits for Barium

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	-	-	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Due to the lack of defensible acute inhalation exposure limits, barium was not assessed on an acute basis.

9.1.2 Chronic Inhalation

Table B.9-2 Chronic Inhalation Exposure Limits for Barium

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	**TCA**	-	-	-
Exposure Limit Value (µg/m³)	-	-	-		**1.0**	-	-	-
Critical Organ or Effect	-	-	-	-	**Cardiovascular**	-	-	-
Species	-	-	-	-	**male rats**	-	-	-

Table B.9-2 Chronic Inhalation Exposure Limits for Barium								
AGENCY	**AEP**	**ATSDR**	**HEALTH CANADA**	**OEHHA**	**RIVM**	**TCEQ**	**US EPA**	**WHO**
Study	-	-	-	-	**European Commission, ESIS, IUCLID dataset**	-	-	-
Source	-	-	-	-	**RIVM**	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The RIVM (2001) derived a tolerable concentration in air of 1 µg/m³ based on cardiovascular effects on male rats exposed to insoluble barium carbonate dust for 4 hours/day, 6 days/week for a total of 4 months (IPCS, 1990). The NOAEL of 1.15 mg/m³ for insoluble barium carbonate was extrapolated to 0.16 mg/m³ for continuous exposure (4 hours/day 6 days/week, for 4 months), equivalent to a NOAEL of 0.11 mg/m³ for soluble barium. An uncertainty factor of 100 was applied to the NOAEL for soluble barium to account for interspecies (10) and intraspecies (10) variability, resulting in a TCA of 1 µg barium/m³.

9.2 Oral Exposure Limits

9.2.1 Chronic Oral

Table B.9-3 Chronic Oral Exposure Limits for Barium						
AGENCY	**ATSDR**	**HEALTH CANADA**	**OEHHA**	**RIVM**	**US EPA**	**WHO**
Exposure Limit Type	MRL	TDI RfD	-	TDI	**RfD**	RfD
Exposure Limit Value (mg/kg bw/day)	0.2	0.016 0.2	-	0.02	**0.2**	0.016
Critical Organ or Effect	Kidneys	Kidneys	-	Cardiovascular	**Kidneys**	Kidneys
Species	Mice	Mice	-	Humans	**Mice**	Mice

Table B.9-3 Chronic Oral Exposure Limits for Barium

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Study	NTP, 1994	Brenniman and Levy, 1985; NTP 1994	-	Vermeire *et al.*, 1991	**NTP, 1994**	Brenniman and Levy, 1985
Source	ATSDR 2007	Health Canada 2010	-	RIVM 2001	**US EPA 2005**	WHO 2004

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR chronic MRL of 0.2 mg/kg-bw/d was derived based on nephropathy in male mice. The $BMDL_{05}$ of 61.13 mg/kg-bw/d for male mice (NTP, 1994) was selected for deriving the chronic-duration oral MRL. Data from the male mice were used because they identified a lower BMDL than the female data. Uncertainty factors of 10 for interspecies variation, 10 for intraspecies variation and 3 for lack of an adequate developmental toxicity study were applied (ATSDR 2007).

Health Canada (2010) has adapted the US EPA RfD of 0.2 mg/kg bw/day based on study conducted by NTP in which nephropathy was observed in mice (NTP, 1994). Within their *Canadian Drinking Water Quality Guidelines*, Health Canada (2014) describes a maximum acceptable concentration (MAC) of 1 mg/L. The MAC was calculated based on the NOAEL of 7.3 mg/L from an epidemiological study where adverse effects on blood pressure and increases in the prevalence of cardiovascular disease were not observed in a population ingesting water containing a mean concentration of 7.3 mg/L barium (Brenniman and Levy, 1985). An uncertainty factor of 10 was applied to the NOAEL to account for intraspecies variability, resulting in a MAC of 0.73 mg/L (Health Canada, 1990). The TDI of 16 µg/kg bw/d was derived by assuming an adult water ingestion rate of 1.5 L/d and an adult body weight of 70.7 kg. The WHO (2004) value of 16 µg/kg bw/d for barium was derived from the same study as Health Canada's value, using the same approach.

The RIVM uses a TDI of 0.02 mg/kg bw/d for soluble barium based on a NOAEL of 0.2 mg/kg bw/d in drinking water and an uncertainty factor of 10 (RIVM 2001). An oral TDI was derived on the basis of a NOAEL in a study with human volunteers who were exposed to barium in a drinking water study with 0.2 mg/kg bw/day as the lowest dose. Although no clear no effect level was found in this study, a TDI of 0.02 mg/kg bw/day was derived using the lowest does of barium in the study and an uncertainty factor of 10.

The US EPA revised the RfD value for barium in 2005 due to selection of a new principal study (NTP 1994), selection of a new critical effect, the use of benchmark dose modeling to determine the

point of departure and a new evaluation of both the literature and application of uncertainty factors. Renal effects were concluded to likely be the most sensitive endpoints of barium toxicity. Mild to severe cases of nephropathy were observed in 19/60 male and 37/60 female mice in the high dose group (NTP, 1994). An RfD of 0.2 mg/kg-day was derived using the benchmark dose for renal lesions in male mice as the critical effect. A 10% Benchmark Response (BMR) is traditionally used as the point of comparison across studies with quantal data; however, for this assessment it was determined that a lower BMR could be used because the critical effect was considered to be substantially adverse and distinctly chemical-related and because the data range included a response lower than 10%. The BMD for a 5% extra risk of chemical-related nephropathy (BMD_{05}) was 84 mg/kg-day for male mice, and the lower 95% confidence limit (*i.e.*, $BMDL_{05}$) was 63 mg/kg-day. An uncertainty factor of 300 was applied to the $BMDL_{05}$ to account for interspecies variability (10), intraspecies variability (10) and deficiencies in the database (3). The US EPA selected the study by NTP (1994) over the epidemiological study by Brenniman and Levy (1985) due to insufficient dose-response data to establish an association between repeated human exposure to barium in drinking water and hypertension. The US EPA selected nephropathy in male mice as the critical effect because it provided the best available evidence of a dose-response relationship (US EPA, 2005).

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10.0 BENZENE

10.1 Inhalation Exposure Limits

10.1.1 Acute Inhalation

Table B.10-1 Acute Inhalation Exposure Limits for Benzene

AGENCY	AEP	ATSDR	OEHHA	TCEQ
Exposure Limit Type	**1-hour AAQO**	24-hour MRL	6-hour REL	1-hour ReV
Exposure Limit Value (µg/m³)	**30**	30	1,300	580
Critical Organ or Effect	**Haematological**	Haematological/ Immunological	Reproductive/developmental toxicity	Haematological/ Immunological
Species	**-**	Mice	Rats	Mice
Study	**-**	Rozen *et al* 1984	Coate *et al* 1984	Rozen *et al* 1984
Source	**AEP 2019**	ATSDR 2013; 2007	OEHHA 1999a; 2013a	TCEQ 2007

- not available

Bold – Exposure Limit selected for HHRA.

The Alberta Ambient Air Quality Objective (AAQO) for benzene (30 µg/m³) was obtained from the United States Environmental Protection Agency (US EPA) toxicological review of benzene for non-cancer effects (US EPA 2002). Within this document, the US EPA derived a chronic reference concentration (RfC) of 30 µg/m³ (US EPA 2002).

The US EPA's inhalation RfC of 30 µg/m³ is considered to be the level at which no appreciable risk with lifetime chronic human exposure is expected to occur. The value was obtained by applying an uncertainty factor (UF) of 300 to the $BMCL_{ADJ}$ (lower 95% confidence limit of the benchmark concentration adjusted for continuous exposure) using data from Rothman *et al.* (1996) occupational exposure study. The 300-fold UF was included to account for effect level extrapolation (3), intraspecies variability (10), subchronic to chronic extrapolation (3) and database deficiency (3). Although more stringent, the resultant RfC is not toxicological reference value (TRV) representative of an acute exposure. Health Canada guidance states that a chronic TRV can be used for acute exposure assessment if a suitable acute value is not available (HC 2010). The TRV developed by the Texas Commission on Environmental Quality (TCEQ) was identified as suitable.

The TCEQ developed a 1-hour reference value (ReV) of 580 µg/m^3 for benzene using the lowest observable adverse effect level (LOAEL) identified by Rozen *et al.* (1984), which was supported by two additional studies reporting hematotoxic effects in mice (Dempster and Snyder 1991; Corti and Snyder, 1996). The TCEQ (2007) converted the LOAEL of 10.2 ppm (33 mg/m^3) to a 1-hour human equivalent concentration (HEC) of 18.5 ppm (59 mg/m^3) which was then divided by a 100-fold uncertainty factor to account for use of a LOAEL (3), extrapolation from animals to humans (3) and human variability (10).

The TCEQ 1-hour ReV of 580 µg/m^3 is still considered the most appropriate TRV for evaluation of acute human health risk as the AAQO TRV of 30 µg/m^3 is based on a chronic RfC. However, in answer to the IR request HC-4 (Addendum 6, CEAA #70, April 30 2018) the acute hazard quotients (HQs) were re-calculated for all receptor locations based on an acute benzene exposure limit of 30 µg/m^3.

10.1.2 Chronic Inhalation

Table B.10-2 Chronic Inhalation Exposure Limits for Benzene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	Annual AAQO	MRL	TC_{05}	REL RsC	CR (adjusted)	ReV $ESL_{linear(c)}$	**RfC** **RsC**	RsC
Exposure Limit Value (µg/m^3)	3	9.8	3	60 0.3	2	280 4.5	**30** **1.3 to 4.5**	1.7
Critical Organ or Effect	Leukemia	Haematological Immunological	Leukemia	Haematological Leukemia	Leukemia	Haematological Leukemia	**Haematological Leukemia**	Leukemia
Species	Human	Human	Human	Human	Human	Human	**Human**	Human
Study	Adopted from Health Canada	Lan *et al* 2004	Rinsky *et al* 1987	Tsai *et al* 1983 Rinsky *et al* 1981	Adopted from WHO 2000	Rothman *et al* 1996 Rinsky *et al* 1981; 1987	**Rothman *et al*. 1996** **Rinsky *et al* 1981; 1987**	Multiple
Source	AEP 2010	ATSDR 2013; 2007	Health Canada 2010	OEHHA 1999b; 2011; 2013a	RIVM 2001	TCEQ 2007	**US EPA 2003; 2000**	WHO 2000

- not available
Bold – Exposure Limit selected for HHRA.

IARC (2013) has classified benzene as carcinogenic to humans (Group 1). With the exception of ATSDR, all the regulatory agencies reviewed have established chronic inhalation guidelines based on epidemiological evidence of an association between chronic occupational exposure to benzene and leukemia mortality rates. The ATSDR, OEHHA, TCEQ and US EPA have also established chronic inhalation guidelines based on haematological/immunological effects (*i.e.*, lymphocyte response).

The ATSDR (2013) recommend a chronic MRL of 9.8 µg/m^3 for benzene. The MRL was derived from a study of workers in Chinese shoe manufacturing industries (Lan *et al*. 2004) which reported an exposure-response relationship between benzene exposure levels (measured by individual vapour monitors) and decreased lymphocyte count in workers exposed an average of 6.1 years (ATSDR 2007).

Health Canada (2010) derived a TC05 of 15 mg/m^3 for benzene based on the incidence of mortality from leukemia in a cohort of rubber hydrochloride (pliofilm workers) (Rinsky *et al.* 1987). The exposure concentration associated with a 5% increase in mortality from acute myelogenous leukemia (TC05) was derived using cancer potencies based on exposure estimates of Crump and Allen (1984) as described in Health Canada (1993). The TC05 translates to an exposure limit of 3 µg/m^3 for a 1 in 100,000 incremental increase in mortality from acute myelogenous leukemia. The AEP adopted the benzene guideline from Health Canada for their annual AAQO (AEP 2019).

A REL of 60 µg/m^3 was derived by OEHHA (2013a) for chronic exposure to benzene. This REL was based on haematological effects following occupational exposure of a cohort of 454 male petroleum refinery workers exposed to benzene (personal monitors) over an average for 7.4 years (Tsai *et al.* 1983). It is noted the reference exposure levels for benzene are currently under review and a chronic REL of 7 µg/m^3, based on haematological effects in Chinese shoe worker (Lan *et al*. 2004), is being proposed (OEHHA 2013b).

The OEHHA (2011) also recommend a unit risk factor of 0.000029 per µg/m^3 for benzene based on mortality from leukemia in pliofilm workers as reported by Rinsky *et al.* (1981) using a weighted cumulative exposure/relative risk procedure by CDHS (1984). This unit risk factor translates to a RsC of 0.3 µg/m^3 for a 1 in 100,000 incremental increase in mortality from leukemia.

The WHO (2001) recommend an air quality of guideline of 1.7 µg/m^3 for an excess lifetime cancer (leukemia) risk of 1 in 100,000 following chronic exposure to benzene. This guideline was derived from a range of studies reporting risk estimates for mortality from leukemia in the pliofilm cohort of workers (Crump and Allen, 1984; Rinsky *et al.* 1987; Paustenbach *et al.* 1992).

The RIVM (2001) has established a CR of 20 µg/m^3 for benzene assuming an excess cancer risk of 1 in 10,000. This was divided by 10-fold to determine an air concentration of 2 µg/m^3 for an excess cancer

(leukemia) risk of 1 in 100,000 for comparison with other agencies. The RIVM (2001) adopted the lower limit of the EU (1999) cancer risk estimates for chronic exposure to benzene, which is equivalent to the unit risk recommended by the WHO (2000).

A ReV of 280 µg/m^3 is recommended for benzene by the TECQ (2007). This guideline is based on hematotoxic effects (reduced lymphocyte count) in Chinese workers occupationally exposed to benzene for an average of 6.3 years (Rothman *et al*. 1996). The critical effect of decreased lymphocyte count is supported by the results of Lan *et al*. (2004) for workers in Chinese shoe manufacturing industries exposed to benzene for an average of 6.1 years (TCEQ 2007). The TCEQ (2007) derived a benchmark concentration (BMC) of 8.4 mg/m^3 (adjusted for continuous exposure) from the Rothman *et al* (1996) study to which an uncertainty factor of 30 was applied to account for human variability (10) and a lack of data for reproductive/developmental effects (3).

The TCEQ (2007) also recommend an exposure limit of 4.5 µg/m^3 for an excess lifetime cancer risk of 1 in 100,000 following chronic exposure to benzene. This air concentration was derived using the cancer potency estimates of Crump and Allen (1994) for acute myelogenous leukemia in the pliofilm cohort described by Rinsky *et al.* (1981; 1987).

The US EPA (2003) recommends an RfC of 30 µg/m^3 for benzene. This RfC was based on the effect of reduced absolute lymphocyte count in Chinese workers reported in the Rothman *et al*. (1996) study. A BMC of 8.2 mg/m^3 was calculated and adjusted by an uncertainty factor of 300 to account for human variability (10), extrapolating from a LOAEL to a NOAEL (3), extrapolating from subchronic to chronic exposure (3) and database uncertainties (3) (US EPA 2002).

The US EPA (2000) also recommends unit risk factors for benzene based on the incidence of acute myelogenous leukemia reported in workers exposed to benzene. Air concentrations recommended for benzene at a 1 in 100,000 cancer risk level range from 1.3 to 4.5 µg/m^3 and were determined from the pliofilm cohort described by Rinsky *et al.* (1981; 1987) using risk calculations recommended by Paustenbach *et al.* (1993); Crump and Allen (1984); Crump (1994) and U.S. EPA (1998).

The lowest air concentration recommended by the ATSDR (2007) for haematological/immunological effects (9.8 µg/m^3) was selected for the assessment of non-carcinogenic effects following chronic inhalation exposure to benzene.

The range of air concentrations identified by the US EPA (2003) for a 1 in 100,000 cancer risk level is supported by similar exposure limits derived by Health Canada, RIVM, TCEQ and WHO for the same response (*i.e.,* leukemia). The lowest air concentration recommended by the US EPA (1.3 µg/m^3) was selected for the assessment of carcinogenic effects following chronic inhalation exposure to

benzene. Benzene was included in the chemical group for leukemia following chronic inhalation exposures.

10.2 Oral Exposure Limits

No chronic oral exposure limit was required for benzene as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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11.0 BENZO[A]PYRENE AND BENZO[A]PYRENE EQUIVALENTS

IARC (2013) has classified benzo[a]pyrene (B[a]P) as carcinogenic to humans (Group 1). Studies on the carcinogenic potential of B[a]P and mixtures of polycyclic aromatic hydrocarbons (PAHs) following chronic inhalation or oral exposures are outlined in ATSDR (1995); Health Canada (2010); RIVM (2001); and US EPA (1994).

Relative potency factors may be used for a group of chemicals where a common mode of action has been identified for the same toxic endpoint, as in the case of carcinogenic PAHs (US EPA 2005; Health Canada 2012). The dose-response data for the carcinogenic effects of B[a]P are well studied and B[a]P has been selected as an index chemical for several other carcinogenic PAHs with a common mode of action. The potency equivalency factors (PEFs) recommended by Health Canada (2012) were selected for the current assessment of carcinogenic PAHs sharing a common mode of action with B[a]P. Table 1 provides a summary of the carcinogenic PAHs assessed and their relative potency to B[a]P. The emissions of these PAHs were adjusted by the PEF to allow for the assessment of the carcinogenicity of this group of chemicals as B[a]P.

Table B.11-1 Potency Equivalence Factors[1] (PEFs) for Carcinogenic PAHs

Polycyclic Aromatic Hydrocarbon	Potency Equivalence Factors[1]
7,12-Dimethylbenz(a)anthracene ($C_{20}H_{16}$)	10
Benz(a)anthracene ($C_{18}H_{12}$)	0.1
Benzo(a)pyrene ($C_{20}H_{12}$)	1
Benzo(b)fluoranthene ($C_{24}H_{14}$)	0.1
Benzo(g,h,i)perylene ($C_{22}H_{12}$)	0.01
Benzo(k)fluoranthene ($C_{24}H_{14}$)	0.1
Chrysene ($C_{18}H_{12}$)	0.01
Dibenz(a,h)anthracene ($C_{22}H_{14}$)	1
Fluoranthene ($C_{16}H_{10}$)	0.001
Indeno(1,2,3-cd)pyrene ($C_{22}H_{12}$)	0.1
Phenanthrene ($C_{14}H_{10}$)	0.001

[1]Relative to B[a]P (Health Canada 2012)

11.1 Inhalation Exposure Limits

11.1.1 Acute Inhalation Exposure Limits

Table B.11-2 Acute Inhalation Exposure Limits for Benzo[a]pyrene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	0.03	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013; 1995	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An acute ESL of 0.03 $\mu g/m^3$ is recommended for B[a]P as a fraction of exhaust PM_{10} by the TCEQ (2013), however, no supporting documentation was provided for this exposure limit. No short-term occupational exposure limits have been developed for B[a]P (OSHA 2013).

As a C20 aromatic hydrocarbon B[a]P has extremely low volatility and inhalation of the chemical in isolation from particulate matter is unlikely. Controlled inhalation and intratracheal instillation studies in animals have demonstrated the carcinogenicity of B[a]P over long-term (chronic) exposure periods as described below. However, the effects of acute inhalation exposure to B[a]P have not been characterized and no acute exposure limits with supporting documentation were identified.

11.1.2 Chronic Inhalation

Table B.11-3 Chronic Inhalation Exposure Limits for Benzo[a]pyrene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	AAQO	-	**TC**	RsC	-	-	-	RsC
Exposure Limit Value (µg/m³)	0.0003	-	**0.32**	0.009	-	-	-	0.00012
Critical Organ or Effect	-	-	**Respiratory tract tumours**	Respiratory tract tumours	-	-	-	Respiratory cancer
Species	-	-	**Hamster**	Hamster	-	-	-	Human
Study	-	-	**Thyssen *et al.*, 1981**	Thyssen *et al.*, 1981	-	-	-	Redmond, 1976; US EPA 1984
Source	ESRD 2013	ATSDR 2013	**Health Canada 2010**	OEHHA 2011	RIVM 2001	TCEQ 2013	US EPA 1994	WHO 1987; 2000

- not available

Bold – Exposure Limit selected for HHRA

The AERSD (2013) recommend a chronic inhalation AAQO of 0.0003 µg/m³ for B[a]P; however, no supporting documentation for the basis of this objective was provided. Health Canada (2010) and the OEHHA (2011) have developed exposure limits based on a study reporting respiratory tract tumours in hamsters chronically exposed by inhalation (nose-only) to B[a]P (Thyssen *et al.* 1981).

Health Canada (2010) developed a unit risk factor of 0.031 per µg/m³ for B[a]P using multi-stage modeling of the tumor incidence in the respiratory tract of hamsters reported in Thyssen *et al.* (1981). This translates to a TC of 0.32 µg/m³ based on a 1 in 100,000 excess lifetime cancer risk.

A unit risk factor of 0.0011 per µg/m³ was derived for B[a]P by the OEHHA (2011) using multi-stage modeling and the Thyssen *et al.* (1981) study on hamsters. The OEHHA (2011) converted the study inhalation unit risk factor to an oral risk factor (0.43 per mg/kg body weight/day) and applied an interspecies surface area correction factor to determine a human equivalent potency factor for the inhalation pathway. An RsC of 0.009 µg/m³ is calculated for $1x10^{-5}$ excess lifetime cancer risk.

The US EPA (1994) does not currently recommend an inhalation unit risk estimate for B[a]P; however, the potential inhalation toxicity of B[a]P is currently under review by the US EPA with a draft human

health assessment released August 2013 for independent peer review and public comment (US EPA 2013).

The WHO (1987; 2000) developed a unit risk factor of 0.0087 per µg/m^3 for B[a]P using a linearized multistage model and epidemiological data for mortality due to lung cancer in workers exposed to mixtures of PAH in coke-oven emissions (Redmond 1976; US EPA 1984). Using this unit risk factor for B[a]P, an air concentration of 0.00012 µg/m^3 would be associated with a 1 in 100,000 increased risk of mortality as a result of lung cancer. The WHO (1987; 2000) guideline assumed B[a]P represented an index of PAH mixtures from coke oven emissions and similar combustion processes. This guideline was not selected to represent B[a]P for the current assessment as it was developed for a mixture of chemicals and would not be appropriate for use with the PEF approach. In addition, the WHO unit risk factor was based on mortality from, rather than incidence of, lung cancer.

Both Health Canada (2010) and the OEHHA (2011) selected the Thyssen *et al.* (1981) study for the development a unit risk factors for B[a]P. The lower guideline of 0.009 µg/m^3 (OEHHA 2011) was selected for the current assessment of chronic inhalation exposure to B[a]P and B[a]P equivalents.

11.2 Oral Exposure Limits

11.2.1 Chronic Oral

Table B.11-4 Chronic Oral Exposure Limits for Benzo[a]pyrene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Exposure Limit Type	-	RsD	RsD	CR	**RsD**
Exposure Limit Value (mg/kg bw/day)	-	0.0000043	0.00000083	0.00005	**0.0000014**
Critical Organ or Effect	-	Gastric tumors	Gastric tumors	Multiple	**Forestomach; multiple**
Species	-	Mouse	Mouse	Rat	**Mouse, rat**
Study	-	Neal and Rigdon, 1967	Neal and Rigdon, 1967	Kroese *et al.*, 1999	**Neal and Rigdon, 1967; Brune *et al.*, 1981**
Source	ATSDR 2013	Health Canada 2010	OEHHA 2011	RIVM, 2001	**US EPA 1994**

- not available

Bold – Exposure Limit selected for HHRA

Health Canada (2010) derived an oral slope factor of 2.3 per mg/kg body weight/day from the Neal and Rigdon (1967) study reporting the incidence of gastric tumors in mice following up to 110 days exposure to B[a]P in the diet. This slope factor translates to an RsD of 0.0000043 mg/kg bodyweight/day, assuming an acceptable lifetime cancer risk of 1 in 100,000.

The OEHHA (2011) identified an oral slope factor of 12 per mg/kg body weight/day using the same study by Neal and Ringdon (1967), resulting in an RsD of 0.00083 for a 1 in 100,000 lifetime cancer risk.

The RIVM (2001) recommend a CR value of 0.5 assuming a lifetime cancer risk of 1 in 10,000, or 0.05 for a lifetime cancer risk of 1 in 100,000. This CR was based the results of a study conducted by RIVM (Kroese *et al.*, 1999) that reported the incidence of tumours in a variety of organs and tissues (predominately liver and forestomach) in rats following gavage exposure to B[a]P for 2 years.

The US EPA (1994) calculated slope factors from two different studies on the effects of oral exposure to B[a]P in mice (Neal and Rigdon, 1967) and rats (Brune *et al.*, 1981) which shared similarities in approach as well as results. The geometric mean of four of these slope factors was used to determine a single unit risk factor of 7.3 per mg/kg bodyweight/day. This translates to an RsD of 0.0000014 mg/kg bodyweight/day for an acceptable lifetime cancer risk of 1 in 100,000. It is noted that the oral toxicity of B[a]P is currently under review by the US EPA with a draft human health assessment released August 2013 for independent peer review and public comment (US EPA 2013).

The US EPA (1994) RsD of 0.0000014 mg/kg bodyweight/day considered the results from more than one study and rodent species and was therefore selected for the current assessment of carcinogenic effects following chronic oral exposure to B[a]P and B[a]P equivalents.

The potential non-carcinogenic effects associated with chronic oral exposure to B[a]P and B[a]P equivalents were also considered in the current assessment. Chronic oral exposure limits based on non-carcinogenic effects were identified for fluoranthene and phenanthrene. Details regarding these exposure limits are provided in the toxicity profiles for fluoranthene and phenanthrene.

The remaining B[a]P equivalents (7,12-dimethylbenz(a)anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene) range in size from C_{18}-C_{24}. In the absence of individual exposure limits for these PAH, the oral exposure limit developed for the non-carcinogenic effects of aromatic C17-C34 hydrocarbons was assigned to these chemicals. Details regarding the chronic oral exposure limit for the aromatic C17-C34 hydrocarbon group are provided in the Petroleum Hydrocarbons toxicity profile.

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12.0 BERYLLIUM

12.1 Inhalation Exposure Limits

12.1.1 Acute Inhalation

Table B.12-1 Acute Inhalation Exposure Limits for Beryllium

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	-	-	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Due to the lack of defensible acute inhalation exposure limits, beryllium was not assessed on an acute basis.

12.1.2 Chronic Inhalation

Table B.12-2 Chronic Inhalation Exposure Limits for Beryllium

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	RfD RsC		-	**RfC** **RsC**	-
Exposure Limit Value (µg/m³)	-	-	-	0.002 0.004		-	**0.02** **0.004**	-

Table B.12-2 Chronic Inhalation Exposure Limits for Beryllium

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	-	-	-	Beryllium sensitization and chronic beryllium disease		-	**Beryllium sensitization and chronic beryllium disease**	-
Species	-	-	-	Human		-	**Human**	-
Study	-	-	-	Kreiss *et al.* 1996; Wagoner *et al.* 1980		-	**Kreiss *et al.* 1996; Wagoner *et al.* 1980**	-
Source	-	-	-	OEHHA		-	**US EPA**	-

- not available

Bold – Exposure Limit selected for HHRA.

The US EPA (2012) has derived an inhalation RsC of 0.004 µg/m³ based on lung cancer in male workers following occupational exposure (Wagoner *et al.* 1980). The cohort study evaluated adult males who worked at a beryllium extraction, processing and fabrication facility between 1942 and 1967 for incidence of lung cancer. A statistically significant increase in the incidences of deaths attributable to malignant tumors of the trachea, bronchus, and lung were observed in the study population. Estimated lower and upper bounds of exposure (100 and 1,000 µg/m³) to beryllium oxide from an epidemiology study were used to estimate the lifetime cancer risk. The exposure concentrations were adjusted for duration of daily (8/24 hours) and annual (240/365 days) exposure and by a ratio of years of exposure to years at risk. The inhalation unit risk of 2.4×10^{-3} per µg/m³ equates to an RsC of 0.004 µg/m³ associated with a risk level of 1 in 100,000.

The US EPA derived a chronic inhalation RfC of 0.02 µg/m³ for beryllium (US EPA 1998). The RfC is based on two human studies of chronic beryllium disease in workers at a facility manufacturing beryllia ceramics (Kreiss *et al.* 1996) and in residents living near a beryllium manufacturing facility (Eisenbud *et al.* 1949). The Kreiss *et al.* (1996) study identified a LOAEL of 0.55 µg/m³ for beryllium sensitization and subclinical chronic beryllium disease, and the Eisenbud *et al.* (1949) study identified a NOAEL of 0.01–0.1 µg/m³ for chronic beryllium disease. The LOAEL identified in the Kreiss *et al.* (1996) study was used for the derivation of the RfC since the Eisenbud study used relatively insensitive screening methods. The LOAEL was time adjusted to 0.2 µg/m³ and divided by a total uncertainty factor of 10 to account for use of a LOAEL (3) and database limitations (3).

The OEHHA derived a chronic inhalation reference concentration that is 10 times lower than the US EPA value. OEHHA used the same study as the US EPA (Kreiss *et al.* 1996); however, they applied an additional uncertainty factor of 10 to account for the lack of a credible study on which to base a cancer potency (OEHHA 2009).

The OEHHA (2009) also reports a chronic inhalation unit risk estimate of $2.4x10^{-3}$ per $\mu g/m^3$ (equivalent to an RsC of 0.004 $\mu g/m^3$) based on the same Wagoner *et al.* (1980) study as the US EPA RsC. The OEHHA determined that the range of median exposures in the study were 100 to 1,000 $\mu g/m^3$, and these exposures were adjusted for continuous exposure (8/24 hours, 240/365 days) and for the fraction of the workers life stages spent in the plant. Adjustments were made to the data set for smoking deaths. Eight different approaches were used to fit the incidence data, and the median unit risk value was determined to be $2.4x10^{-3}$ per $\mu g/m^3$.

12.2 Oral Exposure Limits

12.2.1 Chronic Oral

Table B.12-3 Chronic Oral Exposure Limits for Beryllium

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL	-	RfD	-	**RfD**	-
Exposure Limit Value (mg/kg bw/day)	0.002	-	0.002	-	**0.002**	-
Critical Organ or Effect	Small intestine lesions	-	Small intestine lesions	-	**Small intestine lesions**	-
Species	Dogs	-	Dogs	-	**Dogs**	-
Study	Morgareidge *et al.*, 1976	-	Morgareidge *et al.*, 1976	-	**Morgareidge *et al.*, 1976**	-
Source	ATSDR, 2002	-	OEHHA, 2001	-	**US EPA 1998**	-

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR derived a chronic-duration oral MRL of 0.002 mg beryllium/kg/day (ATSDR 2002). This MRL is based on a benchmark dose (defined as the 95% lower confidence limit of the dose

corresponding to a 10% increase in the incidence of small intestine lesions in dogs compared to controls) of 0.56 mg beryllium/kg/day. The benchmark dose was divided by an uncertainty factor of 300 (10 for extrapolation from animals to humans and 10 for intrahuman variability) and a modifying factor of 3 (to account for the lack of a study that supports the gastrointestinal effects found in the Morgareidge *et al.* (1976) dog study and the uncertainty as to whether the benchmark dose level is the NOAEL).

A chronic oral reference dose (RfD) of 0.002 mg beryllium/kg/day has been derived by the US EPA (IRIS 1998). The RfD is based on a benchmark dose of 0.46 mg beryllium/kg/day for small intestine lesions in dogs exposed to beryllium sulfate in the diet for 33 to 172 weeks (Morgareidge *et al.* 1976). This benchmark concentration was divided by an uncertainty factor of 300 to account for extrapolation from animals to humans (10), human variability (10), and database gaps (3), particularly adequate reproductive and developmental toxicity studies and studies examining immunological end points. The chronic-duration oral MRL and the RfD were both derived using a benchmark analysis and the same incidence data set. The difference in the benchmark doses is due to the differences in the mathematical model fit to the incidence data (ATSDR used a probit model with a chi-square goodness-offit statistic p-value of 0.9999 and EPA used a weibull model with a chi-square goodness of fit statistic p-value of 0.96) and the higher number of significant figures that EPA used to express beryllium doses.

OEHHA has adapted the US EPA RfD of 0.002 mg beryllium/kg/day. The RfD is limited to soluble beryllium salts (OEHHA 2001).

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13.0 CADMIUM

13.1 Inhalation Exposure Limits

13.1.1 Acute Inhalation

Table B.13-1 Acute Inhalation Exposure Limits for Cadmium

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 hour standard	**24 hour MRL**	-	1 hour ESL	-
Exposure Limit Value (µg/m³)	-	0.025	**0.03**	-	0.1	-
Critical Organ or Effect	-	Kidney	**Nasal and Respiratory**	-	-	-
Species	-	Human	**Rats**	-	-	-
Study	-	Thun *et al.* 1991	**NTP 1995**	-	-	-
Source	-	OMOE 2012	**ATSDR 2012**	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (2012) has derived an acute inhalation MRL of 0.03 µg/m³. In the key study (NTP 1995), groups of five male and female F344 rats were exposed to cadmium oxide for 6.2 hours/day, 5 days/week for 2 weeks. The LOAEL of 0.088 mg/m³ was selected for the derivation of the MRL. This value was converted to account for discontinuous exposure (multiplied by 6.2 hours/24 hours and 5 days /7 days) to obtain a duration adjusted LOAEL of 0.016 mg/m³. The LOAEL was converted to a human equivalent concentration of 0.01 mg/m³. A total uncertainty factor of 300 was applied to account for intraspecies variability (10), the use of a LOAEL instead of a NOAEL (10), and for interspecies differences (3) (ATSDR 2012). The acute inhalation MRL of 0.03 µg/m³ based on nasal and respiratory effects was selected for use in the acute assessment as a 24-hour limit.

The OMOE (2012, 2007) has derived a 24-hour standard of 0.025 µg/m³ for cadmium based on kidney effects and carcinogenicity. This standard was derived from the annual guideline of 0.005 µg/m³ developed by the European Commission which considered the non-carcinogenic effects on the kidney to be the critical indicator of inhalation exposure (OMOE 2007). The standard was calculated based on the Thun *et al.* (1991) study which provides pooled data from seven epidemiological studies

examining cumulative or multi-year cadmium exposure (OMOE 2007). This exposure limit was not selected as the use of chronic data to derive an acute exposure limit is considered overly conservative.

The TCEQ (2014) reports an interim, short term (1 hour) ESL for cadmium and compounds of 0.1 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

13.1.2 Chronic Inhalation

Table B.13-2 Chronic Inhalation Exposure Limits for Cadmium

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	MRL	**RsC**	REL RsC	-	ESL	RsC	AQG
Exposure Limit Value (µg/m³)	-	0.01	**0.001**	0.02 0.002	-	0.01	0.006	0.005
Critical Organ or Effect	-	Kidney	**Lung**	Kidney and Respiratory	-	-	Respiratory	Cd body burden
Species	-	Human	**Rats**	Human	-	-	Human	Human
Study	-	Jarup and Elinder 1994	**Multiple**	Lauwerys *et al.* 1974; Thun *et al.* 1985	-	-	Thun *et al.* 1985	Buchet *et al.* 1990
Source	-	ATSDR 2012	**Health Canada 2010**	OEHHA 2000, 2009	-	TCEQ 2014	US EPA 2012	WHO 2011

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (2012) has derived a chronic inhalation MRL of 0.01 µg/m³ based on a meta-analysis of available environmental exposure studies. An internal dose (urinary cadmium expressed as µg/g creatinine) corresponding to a 10% excess risk of low molecular weight proteinuria (urinary cadmium dose, UCD10) was estimated based on the studies. The metaanalysis also included dose-response data from three occupational exposure studies (Chen *et al.* 2006a, 2006b; Jarup and Elinder 1994; Roels *et al.* 1993). Because the dose-response analysis using the European environmental exposure studies (Jarup and Elinder 1994) provided the lowest UCD_{10}, it was selected for derivation of the chronic

duration inhalation MRL. The 95% lower confidence limit of the UCD10 ($UCDL_{10}$) of 0.5 µg/g creatinine was used as the point of departure for the MRL. Based on the assumption that inhalation and oral exposures would result in the same urinary cadmium concentrations, it was determined that an inhalation exposure of 0.1 µg/m³ and a dietary intake of 0.3 µg/kg bw/day would together result in a urinary creatinine level of 0.5 µg/g. A cumulative uncertainty factor of 9 was applied to account for human variability (3) and the lack of adequate human data (3). The ATSDR did not the assess potential carcinogenic effects associated with chronic cadmium inhalation.

Health Canada (2010) has selected an RsC of 0.001 µg/m³. A TC_{05} (the concentration or dose that induces a 5% increase in the incidence of or mortality due to relevant tumours) of 2.9 µg/m³ was calculated by fitting the multistage model to the lung tumour incidences observed in rats (Government of Canada 1994). This value was amortized to be constant over the lifetime of the rat, adjusted for the longer than standard lifetime duration of the experiment and converted to an equivalent concentration in humans, resulting in a TC_{05} of 5.1 µg/m³ (Government of Canada 1994). The RsC of 0.001 µg/m³ represents the daily dose *via* inhalation that assumes an acceptable cancer risk of 1 in 100,000.

The OEHHA (2000) have developed a chronic REL of 0.02 µg/m³ based on an occupational exposure study (Lauwerys *et al*. 1974). No kidney or respiratory effects were observed for an average occupational exposure of 1.4 µg/m³ over an average of 4.1 years. This NOAEL was adjusted to a $NOAEL_{ADJ}$ of 0.5 µg/m³ for intermittent exposure (0.5 x 10/20 m³/day x 5/7 days). A cumulative uncertainty factor of 30 was applied for intraspecies variation (10) and subchronic exposure (3).

The TCEQ (2014) reports an interim, long term ESL for cadmium and compounds of 0.01 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

The OEHHA (2009) has derived an inhalation unit risk of $4.2x10^{-3}$ per µg/m³ (equivalent to an RsC of 0.002 µg/m³ assuming an acceptable cancer risk of 1 in 100,00) based on the same key study as the US EPA (Thun *et al.* 1985). The epidemiological cohort study was based on occupational exposure to cadmium. Median exposure estimates on a 24-hour basis were adjusted for intermittent exposure (8/24 hours × 1/365 days/year × 240/365). A Poisson regression model was applied to the lung cancer mortality data from Thun *et al.* (1985). The background cancer risk in 5-year age intervals and the potential for death attributable to lung cancer per µg/m³ of cadmium were then calculated for the general population. An excess cancer risk for the exposed population of $2x10^{-3}$ to $1.2x10^{-2}$ per µg/m³ was found. A 95% upper confidence limit on the maximum likelihood estimate was calculated, and adjustments were made for 'healthy worker effect' to derive the unit risk estimate. The value is based on the same study used by the US EPA (2012); however, a different modelling approach was used and the value is more conservative than that derived by the US EPA.

The US EPA (2012) has developed an RsC of 0.006 µg/m³ from an inhalation unit risk of 0.0018 per µg/m³. The inhalation unit risk is based on lung, trachea and bronchus cancer deaths in occupationally exposed workers (Thun *et al.* 1985). In addition, the US EPA also calculated an inhalation unit risk for cadmium based on a study by Takenaka *et al.* (1983) conducted on rats, which was one of the key studies reviewed in the Health Canada assessment. The US EPA (1992) calculated a more conservative RsC of 0.092 per µg/m³ from the Takenaka study; however, they concluded that use of available human data (Thun *et al.* 1985) was more reliable due to species variations in response and the type of exposure (cadmium salt *versus* cadmium fume and cadmium oxide).

It is noteworthy that other regulatory agencies concluded a reliable unit risk could not be derived from the 1985 study by Thun *et al.* due to confounding factors such as arsenic exposure and cigarette smoking (ATSDR 2012). Similarly, the WHO (2000) stated that evidence from recent studies suggest the unit risk from the Thun *et al.* study might be substantially overestimated owing to confounding by concomitant exposure to arsenic.

The WHO developed an air quality guideline of 0.005 µg/m³. This guideline was developed to prevent further increases of cadmium through dietary intake of plants grown in parts of Europe contaminated by past emissions of cadmium. The cadmium body burden of the general population in these parts of Europe could not be further increased without endangering renal function (WHO, 2011).

13.2 Oral Exposure Limits

13.2.1 Chronic Oral

Table B.13-3 Chronic Oral Exposure Limits for Cadmium

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL	TDI	REL	TDI	**RfD**	TDI
Exposure Limit Value (mg/kg bw/day)	0.0001	0.0010	0.0005	0.0005	**0.0010 (food)** **0.0005 (water)**	0.0010
Critical Organ or Effect	Kidney	Kidney	Kidney	Kidney	**Kidney**	Kidney
Species	Human	Human	Human and animal	Human	**Human and animal**	Human

Table B.13-3 Chronic Oral Exposure Limits for Cadmium

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Study	Multiple	JECFA 1989, 1993	Multiple	Multiple	**Multiple**	JECFA 1989, 1993
Source	ATSDR 2012	Health Canada 2010	OEHHA 2009	RIVM 2001	**US EPA 2012**	WHO 2011

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR derived a chronic-duration oral MRL of 0.0001 mg/kg/day for renal damage based on a meta-analysis of several studies (ATSDR 2012). A cadmium intake that would result in the $UCDL_{10}$ (0.5 µg/g creatinine) at age 55 was estimated using pharmacokinetic models. The more conservative resulting value of 0.00033 mg/kg/day for females was divided by an uncertainty factor of 3 for intraspecies variability.

Health Canada (2010) has established a provisional TDI of 0.0010 mg/kg bw/d for cadmium. The TDI was adopted from the WHO (2004) drinking water background document, which provides a provisional tolerable weekly intake of 0.007 mg/kg bw/d.

The OEHHA (2009) established a chronic oral REL of 0.0005 mg/kg bw/d based on the US EPA RfD.

RIVM (2001) established TDI of 0.0005 mg/kg bw/d based on the critical effect of renal tubular dysfunction. The RIVM derived this TDI based on studies that indicated the lowest level of cadmium in kidney cortex at which renal effects can be detected in approximately 4% of the population is 50 mg/kg. This corresponds to a daily intake of 1 µg/kg bw/d, assuming 40 to 50 years of intake of 50 µg of cadmium per day. An uncertainty factor of 2 was applied based on adverse effect level, resulting in an oral RfD of 0.0005 mg/kg bw/d. This value is comparable to the lower US EPA RfD, but less information is provided as to its basis.

The US EPA (2012, 1994) has developed an RfD for food consumption of 0.001 mg/kg bw/d and an RfD for water consumption of 0.0005 mg/kg bw/d based on significant proteinuria in human studies involving chronic exposures. A concentration of 200 µg cadmium/g wet human renal cortex was identified as the highest renal level not associated with significant proteinuria. A toxicokinetic model was used to calculate a NOAEL *via* food intake of 0.01 mg/kg bw/d associated with this cadmium tissue concentration, assuming that 0.01% of the cadmium burden is eliminated per day and 2.5% of cadmium in food is absorbed (US EPA 1994). A NOAEL of 0.005 mg/kg bw/d was calculated for

exposures *via* drinking water, assuming that 0.01% of the cadmium burden is eliminated per day and 5% of cadmium in water is absorbed (US EPA 1994). An uncertainty factor of 10 was applied to both NOAELs to account for intraspecies variability. The no effect concentration was based on multiple human and animal studies. These data also allowed for the calculation of pharmacokinetic parameters of cadmium absorption, distribution, metabolism and elimination. The available data resulted in a high degree of confidence in the database and a high degree of confidence in the RfD (US EPA 1994).

The WHO (2011) adopted a TDI derived from a provisional tolerable weekly intake reported by the WHO JECFA (1989, 1993) of 0.007 mg/kg bw/week (equivalent to a TDI of 0.001 mg/kg bw/day). This is based on a back-calculation of concentrations of cadmium in the renal cortex that are considered to be associated with minimal potential for adverse effects in the general population. Additional detail regarding the derivation of this value (*i.e.*, uncertainty factors) was not provided.

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14.0 CARBON MONOXIDE

14.1 Inhalation Exposure Limits

14.1.1 Acute Inhalation

Table B.14-1 Acute Inhalation Exposure Limits for Carbon Monoxide

AGENCY	AEP	ATSDR	HEALTH CANDA	OEHHA	TCEQ	US EPA	WHO
Exposure Limit Type	1-hour 8-hour AAQO	-	1-hour 8-hour NAAQO	1-hour REL	-	1-hour 8-hour NAAQS	1-hour 8-hour
Exposure Limit Value (µg/m^3)	**15,000** **6,000**	-	**15,000** **6,000**	23,000	-	40,000 10,000	30,000 10,000
Critical Organ or Effect	COHb blood level <1%	-	COHb blood level	COHb blood level, cardiovascular system	-	COHb blood level	COHb blood level
Species	Human	-	Human	Human	-	Human	
Study	Adopted NAAQO	-	Various epidemiological studies; PBPK modelling Coburn *et al.*, 1965	Aronow, 1981	-	Various epidemiological studies; PBPK modelling Coburn *et al.*, 1965	Various epidemiological studies; PBPK modelling Coburn *et al.*, 1965
Source	ESRD 2013	ATSDR 2013	Health Canada 1994; 2006	OEHHA 2013; 1999	TCEQ 2013	US EPA 2010; 2012	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

Health Canada (1994; 2006) developed a 1-hour NAAQO of 15,000 µg/m^3 and an 8-hour NAQQO of 6,000 µg/m^3 for carbon monoxide in ambient air. These objectives were the based on the maintenance of carboxyhemoglobin (COHb) levels in the blood below 1% or the upper end of the range of COHb resulting from endogenous production in humans. The 1-hour and 8-hour averaged air concentrations of carbon monoxide that correspond to <1% COHb were determined using the PBPK model of Coburn, Forster, and Kane (CFK) (Coburn *et al.* 1965). The NAAQOs established by Health Canada (1994; 2006) have been adopted by Alberta (ESRD 2013) as AAQOs for carbon monoxide.

The US EPA (2010; 2012) have developed 1-hour and 8-hour NAAQS for carbon monoxide of 40,000 µg/m³ and 10,000 µg/m³, respectively, to protect against COHb concentrations in the range at which adverse health effects could occur (>2%) based on the health outcomes reported in numerous epidemiological studies. The US EPA (2010) also utilized the CFK PBPK model (Cobrun *et al.* 1965) to determine these air quality standards.

The OEHHA (2013) derived a 1-hour REL of 23,000 µg/m³ for exposure to carbon monoxide. This exposure limit was set to achieve approximately 1% COHb, based on a LOAEL of 2% COHb reported by Aronow (1981) for the aggravation of angina in an epidemiological study (OEHHA 1999).

The WHO (2000) recommended 1-hour and 8-hour guidelines of 30,000 and 10,000 µg/m³, respectively, for exposure to carbon monoxide. These guidelines were based on the maintenance of COHb levels below 2.5% and were considered protective of non-smoking population groups with coronary artery disease against acute ischemic heart attacks and fetuses of non-smoking pregnant women against hypoxic effects (WHO, 2000).

The ATSDR (2013) has not developed minimal risk levels for adverse effects associated with acute carbon monoxide exposures. The following rationale was provided by the ATSDR (2012) for not developing acute MRLs at this time:

- Endogenous carbon monoxide production (production of CO within the body from endogenous precursors and as a result of oxidative metabolism of exogenous precursors) is physiologically regulated and plays a role in regulating various physiological processes, including those that may underlie the adverse effects observed in the available human clinical, epidemiological or animal studies (*e.g.*, brain and muscle oxygen storage and utilization).
- An exposure threshold, if one exists, would be at or near the endogenous production rate and therefore, any external CO exposure would have the potential for exceeding the threshold and producing potentially adverse effects.
- The available experimental studies that identify the lowest LOAELs do not identify NOAELs and should uncertainty factors be applied to the identified LOAELs the resultant MRLs would be within the range of ambient CO concentrations in the United States and would result in internal doses that would be similar to endogenous CO production.
- Considering the variation in heme production at different altitudes and the modes of action of carbon monoxide that involve competition with oxygen for heme binding sites, MRLs relevant to exposures at sea level would not necessarily apply at higher altitudes with lower oxygen partial pressures.

The NAAQO and AAAQO of 15,000 µg/m^3 (1-hour) and 6,000 µg/m^3 (8-hour), the lowest exposure limits identified for carbon monoxide, were selected for the assessment of the acute inhalation effects of carbon monoxide.

14.1.2 Chronic Inhalation

Table B.14-2 Chronic Inhalation Exposure Limits for Carbon Monoxide

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	-	-	-
Exposure Limit Value (µg/m^3)	-	-	-	-	-	-	-	-
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study	-	-	-	-	-	-	-	-
Source	ESRD 2013	ATSDR 2012	Health Canada 1994; 2006	OEHHA 2013; 1999	RIVM, 2001	TCEQ 2013	US EPA 2010; 2012	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

Chronic exposure limits have not been established for carbon monoxide by any of the regulatory agencies and therefore chronic exposure to carbon monoxide was not considered in the current assessment.

One study in rats reported cardiomegaly (enlarged heart) as a result of chronic carbon monoxide exposure (Sørhaug *et al.* 2006). This study suggests prolonged exposure to CO may produce effects on the heart that are not evident in acute exposure studies (ATSDR 2012). However, the majority of studies of adverse effects in humans, largely the result of tissue hypoxia, emphasize steady-state COHb% values following exposures of acute duration. The formation of COHb following exposure to a fixed concentration of CO was reported to reach steady state after 6-8 hours of exposure (WHO 2000).

14.2 Oral Exposure Limits

No chronic oral exposure limit was required for carbon monoxide as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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15.0 CHROMIUM III

15.1 Inhalation Exposure Limits

15.1.1 Acute Inhalation

Table B.15-1 Acute Inhalation Exposure Limits for Chromium III

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	1 hour AAQO	24 hour guideline	-	-	**1 hour ReV**	-
Exposure Limit Value (µg/m³)	1	1.5	-	-	**12**	-
Critical Organ or Effect	-	-	-	-	**Respiratory**	-
Species	-	-	-	-	**Hamsters, Rats**	-
Study	-	-	-	-	**Henderson *et al.* 1979**	-
Source	ESRD 2013	OMOE 2012	-	-	**TCEQ 2009**	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2009) derived an acute (1 hour) ReV of 12 µg/m³ for all chromium compounds (except chromium VI) based on a study in hamsters by Henderson *et al.* (1979). Syrian hamsters were exposed to chromium chloride for 30 minutes. Animals were sacrificed at different time points following exposure. A NOAEL of 77 mg/m³ (25 mg/m³ chromium III) was identified and adjusted for the duration of exposure (30/60 minutes) and for human equivalence *via* the US EPA Regional Deposited Dose Ratio (RDDR) approach. The resulting $NOAEL_{HEC}$ of 10.82 mg/m³ was divided by a cumulative uncertainty factor of 300 for interspecies variability (3), intraspecies variability (10), and database uncertainties (10). The result was a 1-hour ReV of 36 µg/m³ for chromium chloride and a 1-hour ReV of 12 µg/m³ for chromium III based on respiratory effects.

The OMOE (2012) has developed a 24-hour guideline of 1.5 µg/m³ for the metallic, di- and trivalent forms of chromium based on the potential for adverse health effects. Rationale for the guideline is not provided and, therefore, the OMOE's 24-hour guideline was not used in the acute effects assessment.

ESRD (2013) adopted a 1-hour AAQO of 1 µg/m³ from the TCEQ. Since no further details were provided and the TCEQ no longer uses this limit for chromium, it was not used in the acute assessment.

15.1.2 Chronic Inhalation

Table B.15-2 Chronic Inhalation Exposure Limits for Chromium III

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	RsC	-	TCA	**ReV**	-	-
Exposure Limit Value (µg/m³)	-	-	0.0009	-	60	**0.8 (chromium sulphate) 0.014 (chromium III)**	-	-
Critical Organ or Effect	-	-	Respiratory	-	Respiratory	**Respiratory**	-	-
Species	-	-	Human	-	Human	**Rats**	-	-
Study	-	-	Mancuso 1975	-	ATSDR 1998	**Derelanko *et al.* 1999**	-	-
Source	-	-	Health Canada 2010	-	RIVM 2001	**TCEQ 2009**	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Chromium (VI) Compounds are OSHA regulated chemicals and are classified as human carcinogens (Group 1) by IARC and as known human carcinogens (Group K) by NTP (OSU 2010). Chromium, metal and inorganic compounds as chromium, insoluble chromium VI compounds and water soluble chromium VI compounds are classified as known human carcinogens (Group K) by NTP and confirmed human carcinogens (Group A1) by ACGIH (OSU 2010).

Health Canada (2010) uses an inhalation unit risk of 11 per mg/m³ for total chromium, equivalent to an RsC of 0.0009 µg/m³. This value was derived from a TC_{05} of 4.6 µg/m³ based on a 5% increase in lung cancer in a human occupational study (Mancuso 1975). The study is based on workers in a chromate production plant who were exposed to total chromium, soluble (principally hexavalent) or insoluble (principally trivalent) chromium. The specific form of chromium responsible for the lung

cancer was not known and, therefore, this value was not used in the assessment of trivalent chromium.

The TCEQ (2009) has derived a chronic ReV of 0.8 µg/m³ for basic chromium sulphate or 0.014 µg/m³ for chromium III. The primary study was by Derelanko *et al*. (1999) on rats exposed by inhalation to chromic oxide particulate or basic chromium sulphate for 6 hours/day, 5 days/week for 13 weeks. Some animals from each group were permitted to recover for 13 weeks post-exposure. To ensure that any observed effects were attributable to chromium III compounds, the test materials were tested and verified to be free of hexavalent chromium (TCEQ 2009). The lowest exposure level (17 mg/m³) was identified as the LOAEL for basic chromium sulphate (TCEQ 2009). The study NOAEL for chromic oxide was determined to be 4.4 mg/m³ (equivalent to 3 mg/m³ chromium III). Benchmark dose modelling for the incidence of lung and trachea weight changes (in the presence of histological abnormalities) based on the chromium sulphate data set, resulted in a $BMCL_{10}$ of 3.4 mg/m³ for basic chromium sulphate and was used as the point of departure for the chronic ReV. The $BMCL_{10}$ was adjusted for continuous exposure (6/24 hours × 5/7 days). RDDR dosimetry modelling was completed, and a human equivalent $BMCL_{10(HEC)}$ of 0.8 mg/m³ was calculated from the adjusted $BMCL_{10}$ ($BMCL_{10(ADJ)}$ × RDDR of 1.31). A cumulative uncertainty factor of 1,000 was applied for interspecies variability (3), intraspecies variability (10), database uncertainties (3) and the use of subchronic data (10). A similar calculation was conducted by the TCEQ using the study LOAEL (17 mg/m³ chromium sulphate) for comparison purposes and the $BMCL_{10}$-based value was determined to be more robust since it incorporated the dose-response relationship. The result of the TCEQ analysis is a chronic ReV of 0.8 µg/m³ for chromium sulphate and 0.014 µg/m³ for chromium III.

The RIVM (2001) has established a TCA of 0.06 mg/m³ for metallic and insoluble chromium (III) compounds based on a NOAEC of 0.6 mg/m³. An uncertainty factor of 10 was applied to the NOAEC for intraspecies variability. A TCA was not derived for soluble chromium due to lack of appropriate data. As RIVM based its TCA of 60 µg/m³ on an ATSDR (1998) MRL that has since been updated, the RIVM value was not included in the chronic inhalation assessment.

15.2 Oral Exposure Limits

15.2.1 Chronic Oral

Table B.15-3 Chronic Oral Exposure Limits for Chromium III

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	TDI	-	TDI	**RfD**	-
Exposure Limit Value (mg/kg bw/day)	-	0.001	-	0.005	**1.5**	-
Critical Organ or Effect	-	Liver	-	-	**-**	-
Species	-	-	-	Rats	**Rats**	-
Study	-	-	-	Vermeire *et al.* 1991	**Ivankovic and Preussman 1975**	-
Source	-	Health Canada 2010	-	RIVM 2001	**US EPA 1998**	-

- not available

Bold – Exposure Limit selected for HHRA.

Chromium (VI) Compounds are OSHA regulated chemicals and are classified as human carcinogens (Group 1) by IARC, as known human carcinogens (Group K) by NTP (OSU 2010). Chromium, metal and inorganic compounds as chromium, insoluble chromium VI compounds and water soluble chromium VI compounds are classified as known human carcinogens (Group K) by NTP and confirmed human carcinogens (Group A1) by ACGIH (OSU 2010). Cr (III) was treated as a non-carcinogen by ingestion for this risk assessment.

The US EPA (1998) has derived an oral RfD of 1.5 mg/kg bw/d for chromium (III) insoluble salts based on a chronic rat feeding study (Ivankovic and Preussman 1975). No significant changes were reported at any dose level. The highest dose group (receiving 5% Cr2O3 in the diet for 600 feedings) was considered to be a NOAEL. The NOAEL was adjusted to a dose of 1,468 mg/kg bw/d based on the amount of ingested Cr (III) and feeding schedule. A cumulative uncertainty factor of 1,000 was applied to the $NOAEL_{ADJ}$ for interspecies variability (10), intraspecies variability (10) and database

deficiencies (10). The resulting oral RfD of 1.5 mg/kg bw/d was used in the chronic multiple pathway assessment; however, the toxicological endpoint of this value was not available.

Health Canada (2010) uses a TDI of 0.001 mg/kg bw/d for total chromium. Health Canada notes that Cr (III) is an essential element and the TDI for total chromium is based on Cr (VI) toxicity. This TDI is associated with the drinking water guideline for chromium (Health Canada 1986); however, limited rationale is provided for the derivation of this guideline in the supporting documentation. The species, dosing regime, duration of study and uncertainty factors were not known. This value was not used since it was based on Cr (VI) toxicity.

The RIVM (2001) derived a TDI of 0.005 mg/kg bw/d for soluble chromium (trivalent) compounds and metallic chromium. The TDI was derived from a NOAEL of 2.5 mg/kg bw/d in a rat study (Vermeire *et al.* 1991). A cumulative uncertainty factor of 500 was applied to the NOAEL to account for interspecies variability (10), intraspecies variability (10) and time of exposure (5). The RIVM did not provide the details of the study used to derive the oral exposure limit (*i.e.,* duration of exposure, effects observed). This oral limit was not used in the assessment.

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16.0 CHROMIUM VI

16.1 Inhalation Exposure Limits

16.1.1 Acute Inhalation

Table B.16-1 Acute Inhalation Exposure Limits for Chromium VI

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	1 hour AAQO	24 hour guideline	-	-	1 hour ESL	-
Exposure Limit Value (µg/m³)	1	0.07	-	-	0.1	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	ESRD 2013	OMOE 2012	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports a short term (1 hour) ESL for chromium (VI) compounds of 0.1 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit which is currently under review; therefore, it was not selected.

The OMOE (2012) has developed a 24-hour guideline of 0.07 µg/m³ for chromium compounds (hexavalent forms) based on the potential for adverse health effects. Rationale for the guideline is not provided and, therefore, the OMOE's 24-hour guideline was not used in the acute effects assessment.

ESRD (2013) adopted a 1-hour AAQO of 1 µg/m³ from the TCEQ. Since no further details were provided and the TCEQ no longer uses this limit for chromium, it was not used in the acute assessment.

Due to the lack of defensible acute inhalation exposure limits, lead was not assessed on an acute basis.

16.1.2 Chronic Inhalation

Table B.16-2 Chronic Inhalation Exposure Limits for Chromium VI

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	**RsC**	RsC REL	CR	ESL	RsC RfC	RsC
Exposure Limit Value ($\mu g/m^3$)	-	-	**0.00013**	0.00007 (RsC) 0.2 (REL)	0.0025	0.01	0.0008 (RsC) 0.1 (RfC)	0.00025
Critical Organ or Effect	-	-	**Respiratory**	Respiratory	-	-	Lung Cancer, Lung and Spleen Weight	-
Species	-	-	**Human**	Human (RsC) Rats (REL)	-	-	Humans, Rats	-
Study	-	-	**Mancuso 1975**	Mancuso 1975, Glaser *et al.* 1990	-	-	Glaser *et al.* 1990, Mancuso *et al.* 1975	-
Source	-	-	**Health Canada 2010**	OEHHA 2001, 2009	RIVM 2001	TCEQ 2014	US EPA 1998	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

Chromium (VI) Compounds are OSHA regulated chemicals and are classified as human carcinogens (Group 1) by IARC and as known human carcinogens (Group K) by NTP (OSU 2010). Chromium, metal and inorganic compounds as chromium, insoluble chromium VI compounds and water soluble chromium VI compounds are classified as known human carcinogens (Group K) by NTP and confirmed human carcinogens (Group A1) by ACGIH (OSU 2010).

The TCEQ (2014) reports a long term ESL for chromium (VI) compounds of 0.01 $\mu g/m^3$. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit which is currently under review; therefore, it was not selected.

Health Canada (2010) uses an inhalation unit risk of 76 per mg/m³ for total chromium, equivalent to an RsC of 0.00013 µg/m³. This value was derived from a TC_{05} of 0.66 µg/m³ based on a 5% increase in lung cancer in a human occupational study (Mancuso 1975). The study is based on workers in a chromate production plant who were exposed to total chromium, soluble (principally hexavalent) or insoluble (principally trivalent) chromium. Although the specific form of chromium responsible for the lung cancer was not known, this value was used in the assessment of hexavalent chromium since it represents the most conservative estimate.

The OEHHA (2001) derived a chronic REL of 0.2 µg/m³ for soluble hexavalent chromium compounds (other than chromic trioxide) from a study where male Wistar rats were exposed to hexavalent chromium in the form of sodium dichromate particulate aerosol for 22 hours/day, 7 days/week for 30 or 90 days (Glaser *et al.* 1990). Benchmark dose modelling was completed for the incidence of bronchoalveolar hyperplasia, as indicated by biomarkers of inflammation including increased total protein, lactate dehydrogenase and albumin concentrations in bronchoalveolar lavage. A BMC_{05} of 12.5 µg/m³ was calculated, adjusted for continuous exposure and converted to a human equivalent concentration of 24.47 µg/m³. A cumulative uncertainty factor of 100 was applied to account for the use of subchronic data (3), interspecies differences (3), and intrahuman variability (10) to derive the REL of 0.2 µg/m³. This value was not used due to the availability of defensible values based upon longer-term studies.

The OEHHA (2009) derived an inhalation unit risk of 1.5×10^{-1} per µg/m³, which equates to an RsC of 0.00007 µg/m³ for a 1 in 100, 000 cancer risk. This value is based on an occupational exposure study by Mancuso (1975). The RsC was derived using a multistage linearized procedure and was based on the 95% upper confidence limit for the relative risk. Due to limited information on how the inhalation URE was developed, this value was not selected for use in the assessment.

The US EPA (1998) derived a chronic RfC of 0.1 µg/m³ based on a study with male Wistar rats by Glaser *et al*. (1990). Benchmark dose modelling was completed by Malsch *et al*. (1994) for lung and spleen weight, lactate dehydrogenase and protein and albumin concentrations in bronchioalveolar fluid. A $BMCL_{10}$ of 0.016 mg/m³ was derived from the data, and was further adjusted for continuous exposure and human equivalency to 0.034 mg/m³. A cumulative uncertainty factor of 300 was applied to account for pharmacodynamics differences (3), less than lifetime exposure (10) and intraspecies variability (10).

The US EPA (1998) RsC was derived from an occupational study (Mancuso *et al.* 1975) in which the incidence of lung cancer was examined in 332 workers employed in a chromate plant from 1931 to 1951. Analysis of the data was completed using a multistage model to calculate an RsC of 0.0008 µg/m³. This value was not used since the Health Canada value which was derived from the same data set is more conservative.

The RIVM (2001) report an inhalation cancer risk of 0.0025 µg/m³. However, since study design, exposure or methodology were not described, it was not used in the assessment.

The WHO (2000) derived a unit risk estimate of 4×10^{-2} for hexavalent chromium based on an air concentration of 1 µg/m³, which is the geometric mean from a number of studies. The RsC for hexavalent chromium associated with 1 in 100,000 excess lifetime cancer risk equates to 2.5×10^{-4} µg/m³. This value was not selected due to the limited amount of supporting information.

16.2 Oral Exposure Limits

16.2.1 Chronic Oral

Table B.16-3 Chronic Oral Exposure Limits for Chromium VI

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	**MRL**		RsD REL	pTDI	RfD	
Exposure Limit Value (mg/kg bw/day)	**0.0009**		0.00002 (RsD) 0.020 (REL)	0.005	0.003	
Critical Organ or Effect	**Gastrointestinal**		Stomach Tumors, Reduction in Water Consumption	Reduction in Water Consumption	Reduction in Water Consumption	
Species	**Rats and Mice**		Mice	Rats	Rats	
Study	**NTP 2008**		Borneff *et al*. 1968, MacKenzie 1958	MacKenzie 1958	MacKenzie 1958	
Source	**ATSDR 2008**		OEHHA 2009, 2008	RIVM 2001	US EPA 1998	

- not available

Bold – Exposure Limit selected for HHRA.

Chromium (VI) Compounds are OSHA regulated chemicals and are classified as human carcinogens (Group 1) by IARC, as known human carcinogens (Group K) by NTP (OSU 2010). Chromium, metal and inorganic compounds as chromium, insoluble chromium VI compounds and water soluble

chromium VI compounds are classified as known human carcinogens (Group K) by NTP and confirmed human carcinogens (Group A1) by ACGIH (OSU 2010). Cr (III) was treated as a non-carcinogen by ingestion for this risk assessment.

The ATSDR (2012) derived a chronic oral MRL of 0.0009 mg/kg bw/d based on a study by the NTP (2008) in which rats and mice were exposed to sodium dichromate dihydrate for a duration of two years. Benchmark dose modelling was completed for all endpoints using the dose-response data. A BMCL10 of 0.09 mg/kg bw/d for diffuse epithelial hyperplasia of the duodenum was selected as the point of departure for the MRL. A cumulative uncertainty factor of 100 was applied to the MRL for interspecies (10) and intraspecies variability (10). This chronic MRL of 0.001 mg/kg bw/d based on gastrointestinal effects was selected for use in the assessment.

The US EPA (1998) derived a chronic oral exposure limit of 0.003 mg/kg bw/d based on a NOAEL of 25 mg/L from a drinking water study on rats (MacKenzie *et al.* 1958). No significant adverse effects were seen in appearance, weight gain, food consumption and blood or tissue pathology. Rats receiving 25 ppm of chromium showed an approximate 20% reduction in water consumption. The NOAEL was adjusted to a dose of 2.5 mg/kg bw/d based on the body weight of the rat and average daily drinking water consumption. A cumulative uncertainty factor of 900 was applied to the adjusted NOAEL to account for interspecies variability (10), intraspecies variability (10), less-than-lifetime exposure duration (3) and to account for concerns raised by another study in which gastrointestinal effects were observed at 20 mg/L (3). This value was not used due to the availability of more conservative values.

The OEHHA (2009) derived an oral slope factor of 4.2×10^{-1} per mg/kg bw/d, equivalent to an RsD of 0.00002 mg/kg bw/d, based on a study by Borneff *et al.* (1968). The study involved three generations of mice that were fed potassium chromate. This value was not selected for use in the assessment since it involved the administration of only one dose level and is based on the incidence of benign and malignant stomach tumours combined.

The OEHHA (2008) also derived a chronic oral REL of 0.020 mg/kg bw/d based on the same study as the US EPA value. Due to the availability of more conservative values with adequate documentation, this value was not used in the assessment.

The RIVM (2001) derived a provisional TDI of 0.005 mg/kg bw/d based on the same study as the US EPA. However, they applied a cumulative uncertainty factor of 500 for interspecies differences (10), intraspecies variability (10) and the use of subchronic data (5). Due to the availability of more conservative values, this TDI was not used.

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17.0 COAL DUST

17.1 Inhalation Exposure Limits

17.1.1 Acute Inhalation

Table B.17-1 Acute Inhalation Exposure Limits for Coal Dust

AGENCY	AEP	ATSDR	CCME	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	-	-
Critical Organ or Effect	-		-	-			-
Species	-	-	-	-	-	-	-
Study	-	-	-	-	-	-	-
Source	-	-	-	-	-	-	-

- not available

The TCEQ (2016) recommend applying the US National Ambient Air Quality Standards (NAAQS) for particulate matter (PM) as an acute inhalation target for coal dust (bituminous and lignite). The US EPA (2018) established a 24-hour primary standard (NAAQS) of 150 µg/m³ for PM_{10} (not to be exceeded more than once per year on average over 3 years).

WHO recommended guidelines and interim targets for PM_{10} to protect against harmful effects of coarse fragments. Due to insufficient quantitative evidence on coarse PM, the numerical guideline value for PM_{10} was based on studies using $PM_{2.5}$ as an indicator and a $PM_{2.5}$:PM_{10} ratio of 0.5 (WHO 2005). A 24-hour guideline of 50 µg/m³ for PM_{10} was recommended, based on the 99th percentile of the distribution of daily concentrations over a year for $PM_{2.5}$ (25 µg/m³) and the indicator ratio. The WHO recognizes this exposure limit may be difficult for some countries to attain and has recommended three interim 24-hour target levels of 150 µg/m³, 100 µg/m³ and 75 µg/m³ as a stepped approach for countries as they develop successive and sustained abatement measures to move towards eventual compliance with the 50 µg/m³ guideline (WHO 2005).

The WHO guideline of 50 µg/m³ (which is the most conservative of the agencies reviewed) was selected for the assessment of acute inhalation exposure to coal dust.

17.1.2 Chronic Inhalation

Table B.17-2 Chronic Inhalation Exposure Limits for Coal Dust

AGENCY	AEP	ATSDR	CCME	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	**ESL**	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	**0.9**	-	-
Critical Organ or Effect	-	-	-	-	**-**	-	-
Species	-	-	-	-	**-**	-	-
Study	-	-	-	-	**-**	-	-
Source	-	-	-	-	**TCEQ 2016**	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2016) reports a long term ESL for coal dust (bituminous and lignite) of 0.9 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_4 (particulate matter > 4 µm in diameter). No supporting data was available for this limit, however, due to no other long-term exposure limits being available for coal dust, it was applied.

17.2 Oral Exposure Limits

An oral exposure limit for coal dust was not investigated as constituents within coal dust (metals and PAHs) were adequately assessed on a chemical-by-chemical basis.

Specifically, independent analysis of the chemicals within fugitive dust (*e.g.*, individual metals) is considered a more accurate method of exposure assessment and modelled results are inclusive of coal contribution. Therefore, "coal-dust" as a COPC is reflected in the modelled data and does not require independent assessment as it pertains to multimedia exposure (oral pathway).

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18.0 COBALT

18.1 Inhalation Exposure Limits

18.1.1 Acute Inhalation

Table B.18-1 Acute Inhalation Exposure Limits for Cobalt

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 hour AAQC	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	0.1	-	-	0.2	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	-	OMOE 2012	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports an interim, short term (1 hour) ESL for cobalt and inorganic cobalt compounds of 0.2 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

The OMOE established a 24 hour AAQC of 0.1 µg/m³ (2012). Although the AAQC is based on health effects, no supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible acute inhalation exposure limits, cobalt was not assessed on an acute basis.

18.1.2 Chronic Inhalation

Table B.18-2 Chronic Inhalation Exposure Limits for Cobalt

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	MRL	-	-	TCA	ESL	**pRfC**	-
Exposure Limit Value (µg/m³)	-	0.1	-	-	0.5	0.02	**0.006**	-
Critical Organ or Effect	-	Respiratory	-	-	Lung	-	**Respiratory**	-
Species	-	Human	-	-	Human	-	**Human**	-
Study	-	Nemery *et al.* 1992	-	-	Sprince *et al*. 1988	-	**Nemery *et al.* 1992**	-
Source	-	ATSDR 2014	-	-	RIVM 2001	TCEQ 2014	**US EPA 2008**	-

- not available

Bold – Exposure Limit selected for HHRA.

Cobalt has been reported to act as a sensitizer associated with inhalation and oral exposure. Additionally, there appears to be an interrelationship between cobalt and nickel sensitisation. However, there is insufficient data to establish an exposure limit for this end point (US EPA, 2008).

Cobalt and cobalt compounds (as a group) are classified as possibly carcinogenic to humans (Group 2B) by IARC (2006) and as confirmed animal carcinogens with unknown relevance to humans (Group A3) by ACGIH (2007). However, no unit risk factors were available for cobalt exposure by inhalation. For this reason, cobalt was treated as a non-carcinogen by chronic inhalation for this risk assessment.

The ATSDR (2004) derived a chronic inhalation MRL of 0.1 µg/m³ for respiratory effects based on a cross-sectional study of diamond polishers (Nemery *et al.* 1992). Workers from the high exposure group exhibited reduced lung function and increased spirometric effects compared to the low exposure group and controls. A NOAEL of 5.3 µg/m³ was identified for decreased values on spirometric examination (ATSDR 2004). The NOAEL was adjusted for intermittent exposure (8/24 hours x 5/7 days) to 1.3 µg/m³. An uncertainty factor of 10 was applied to the duration adjusted NOAEL to account for intraspecies variability.

The RIVM (2001) derived a TCA of 0.5 µg/m^3 using the LOAEL of 0.05 mg/m^3 for interstitial lung disease in humans (Sprince *et al.* 1988). A cumulative uncertainty factor of 100 was applied, 10 for extrapolation from a LOAEL and 10 for intraspecies variability.

The TCEQ (2014) reports an interim, long term ESL for cobalt and inorganic cobalt compounds of 0.02 µg/m^3. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

The US EPA (2008) derived a provisional chronic RfC of 0.006 µg/m^3 based on a NOAEL of 5.3 µg/m^3 for effects on pulmonary function using the same study as the ATSDR (Nemery *et al.*, 1992). The NOAEL was adjusted for continuous exposure (1.9 µg/m^3) and uncertainty factors for database insufficiencies (10) and interspecies variability (10) were applied. For the chronic RfC, an additional uncertainty factor of 3 (total uncertainty factor of 300) was applied. Data on worker exposure duration were not available from the critical study and therefore subchronic exposure was assumed. It was noted that this RfC may not be protective for people with hypersensitivity to cobalt. Confidence in the key study was considered low, and confidence in the database was considered medium, for an overall low to medium confidence in the provisional RfC. This value was not used due to the availability of more conservative values.

18.2 Oral Exposure Limits

18.2.1 Chronic Oral

Table B.18-3 Chronic Oral Exposure Limits for Cobalt

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	-	-	**TDI**	pRfD	-
Exposure Limit Value (mg/kg bw/day)	-	-	-	**0.0014**	0.0003	-
Critical Organ or Effect	-	-	-	**Heart**	Thyroid	-
Species	-	-	-	**Humans**	-	-

Table B.18-3 Chronic Oral Exposure Limits for Cobalt

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Study	-	-	-	**Vermeire *et al.* 1991**	Roche and Layrisse, 1956	-
Source	-	-	-	**RIVM 2001**	US EPA 2008	-

- not available

Bold – Exposure Limit selected for HHRA.

Cobalt is an essential nutrient in humans, forming a component of vitamin B12. However, at high doses it may also have toxic effects (US EPA, 2005).

Cobalt and cobalt compounds (as a group) are classified as possibly carcinogenic to humans (Group 2B) by IARC (2006) and as confirmed animal carcinogens with unknown relevance to humans (Group A3) by ACGIH (2007). However, the studies evaluated did not look at oral exposure (IARC 1991). No slope factors were available for cobalt exposure by ingestion. For this reason, cobalt was treated as a non-carcinogen by ingestion for this risk assessment.

Cobalt has been reported to act as a sensitizer associated with inhalation and oral exposure. Additionally, there appears to be an interrelationship between cobalt and nickel sensitisation. However, there is insufficient data to establish an exposure limit for this end point (US EPA, 2008).

The RIVM has selected a TDI of 0.0014 mg/kg bw/d (RIVM 2001) based on an intermediate oral exposure study by Vermeire *et al.* (1991). The study reported a TDI of 0.0014 mg/kg bw/d based on a migration limit of 100 µg cobalt per day from packaging materials to humans. RIVM notes that no chronic oral studies on cobalt were available. The lowest available LOAEL (0.04 mg/kg bw/d) was for cardiomyopathy from a study involving an 8-month exposure *via* intake of cobalt beer. The study was based on a small population of humans and the simultaneous consumption of alcohol may have enhanced cardiac affects. The LOAEL for the general population was expected to be higher than 0.040 mg/kg bw/d. Application of the cumulative uncertainty factor of 30 for intraspecies variability (3) and for extrapolation from a LOAEL (10) to the NOAEL.

The US EPA has not published TRVs for cobalt in the Integrated Risk Information System (IRIS). However, a Provisional Peer Reviewed Toxicity Value has been published (US EPA 2008). A chronic provisional RfD of 0.0003 mg/kg-bw/d was derived based on reduced iodine uptake in the thyroid (Roche and Layrisse, 1956). A LOAEL of 1 mg/kg-bw/day for decreased iodine uptake in the thyroid was adjusted by uncertainty factors of 10 for use of a LOAEL, 10 for the protection of sensitive populations, 10 for use of a subchronic study (two week), and 3 to account for the lack of a multi-

generation toxicity study (cumulative uncertainty factor of 3,000). The US EPA (2008) considered confidence in the principal study to be low to medium, and confidence in the database to be low to medium, resulting in low confidence in the provisional RfD. This value is below the estimated background exposure to cobalt for the general Canadian public (Mitchell 2014) and, therefore, was not chosen.

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19.0 COPPER

19.1 Inhalation Exposure Limits

19.1.1 Acute Inhalation

Table B.19-1 Acute Inhalation Exposure Limits for Copper

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	**1 hour REL**	1 hour ESL	-
Exposure Limit Value (µg/m³)	-	-	**100**	10	-
Critical Organ or Effect	-	-	**Respiratory**	-	-
Species	-	-	**Humans**	-	-
Study	-	-	**ACGIH 2012**	-	-
Source	-	-	**OEHHA 2012, 2008**	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The OEHHA (2012, 2008) has adopted an acute (1 hour) REL of 100 µg/m³ based on mild adverse respiratory effects. The REL is reported by the ACGIH (2012) TLV-TWA of 1 mg/m³ for copper dust. The ACGIH-TLV was derived from the results of an unpublished study of occupational exposure by Whitman (1957). Consistent with the onset of symptoms of metal fume fever, exposure to 1 to 3 mg/m³ of copper dust for an unknown duration resulted in a detectable sweet taste being experienced by the workers, with no other symptoms. An uncertainty factor of 10 was applied to the NOAEL of 1 mg/m³ to account for intraspecies variability.

The TCEQ (2014) reports an interim, short term (1 hour) ESL for copper dusts and mists of 10 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

19.1.2 Chronic Inhalation

Table B.19-2 Chronic Inhalation Exposure Limits for Copper

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	**TCA**	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	**1**	1	-	-
Critical Organ or Effect	-	-	-	-	**Respiratory and Immunological Effects**	-	-	-
Species	-	-	-	-	**Humans**	-	-	-
Study	-	-	-	-	**Baars *et al.* 2001**	-	-	-
Source	-	-	-	-	**RIVM 2001**	TCEQ 2014	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The RIVM (2001) has developed a TCA in air of 1 µg/m³ for copper based on a NOAEC of 0.6 mg/m³ for respiratory and immunological effects. The NOAEC was derived from a subacute study in which rabbits were exposed to copper chloride for 6 hours/day, 5 days/week for 6 weeks (Baars *et al.* 2001). A correction factor was applied to the NOAEC for continuous exposure (x 6/24 hours x 5/7 days) and a cumulative uncertainty factor of 100, for interspecies variability (10) and intraspecies variability (10) was applied to the corrected NOAEC.

The TCEQ (2014) reports a long term ESL for copper dusts and mists of 1 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

19.2 Oral Exposure Limits

19.2.1 Chronic Oral

Table B.19-3 Chronic Oral Exposure Limits for Copper

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	**UL**	-	TDI	-	TDI
Exposure Limit Value (mg/kg bw/day)	-	**0.091 (0 - 4 yrs) 0.111 (5 - 11 yrs) 0.126 (12 - 19 yrs) 0.141 (20+ yrs)**	-	140	-	140
Critical Organ or Effect	-	**Liver and Gastrointestinal**	-	Liver and Gastrointestinal	-	Liver and Gastrointestinal
Species	-	**Humans**	-	Humans	-	Humans
Study	-	**Pratt *et al.* 1985; O'Donohue *et al.* 1993**	-	Vermeire *et al.* 1991	-	Pratt *et al.* 1985; O'Donohue *et al.* 1993
Source	-	**Health Canada 2010**	-	RIVM 2001	-	WHO 2004

- not available

Bold – Exposure Limit selected for HHRA.

Health Canada (2010) provides TDIs depending on the life stage of interest. From birth to 4 years the TDI is 0.091 mg/kg bw/d, from 5 to 11 years the TDI is 0.11 mg/kg bw/d, from 12 to 19 years the TDI is 0.126 mg/kg bw/d and for 20 years and older the TDI is 0.141 mg/kg bw/d. The Health Canada TDIs are based on a NOAEL of 10 mg/d identified by Institute of Medicine (IOM 2001) for hepatotoxicity. The IOM (2001) identified the NOAEL based on a review of the findings reported by Pratt *et al.* (1985) and O'Donohue *et al.* (1993). The Pratt *et al.* (1985) study was a clinical double-blind study which exposed seven adults to 10 mg/d of copper gluconate for 12 weeks, without effect on the liver. The O'Donohue *et al.* (1993) study was based on a self-intoxication which resulted in acute liver failure. The self-intoxication included exposure to 30 mg/d for 2 years, followed by 60 mg/d for an unspecified duration of copper tablets. Due to the substantial toxicological database that exists for human exposure to copper, which does not indicate any adverse effects from the daily consumption of 10 to 12 mg copper in foods, the IOM (2001) considered the Pratt *et al.* (1985) NOAEL protective of the general adult population without the application of any uncertainty factors. The IOM (2001) assumed the unadjusted NOAEL of 10 mg/d as its adult tolerable upper intake level (UL). The ULs

for the remaining life stage groups were calculated from the adult UL based on relative body weight. A UL for children less than 1 year of age was not identified by the IOM due to insufficient health effects data for this age group and uncertainty regarding the children's ability to cope with excess copper. Health Canada has adopted the TDI of 0.091 mg/kg bw/d for children aged 0 to 4 years (Health Canada, 2010). The age-appropriate TDIs for each life stage were based on liver and gastrointestinal effects.

The RIVM (2001) developed a TDI of 0.14 mg/kg bw/d based on observations that there is no convincing evidence for the genotoxic properties of copper, the proposed mechanism of toxic action suggests a threshold for toxic effects and copper deficiency lead to effects equally critical to human health as the toxic effects. A NOAEL of 8 mg/kg bw/d noted in experimental animals, with the application of a cumulative uncertainty factor of 100 (basis unspecified), would result in a TDI of 0.08 mg/kg bw/d. This TDI is only slightly higher than the daily demand for copper of 0.02 to 0.05 mg/kg bw/d (Vermeire *et al.*, 1991). Similarly, a LOAEL of 4.2 mg/kg bw/d, identified for decreased body weight in mice exposed to copper gluconate, would result in a TDI of 0.004 mg/kg bw/d with the application of a cumulative uncertainty factor of 1,000 to account for interspecies variability (10), intraspecies variability (10) and use of a LOAEL (10). This TDI would be below the minimum requirements of copper. Therefore, the RIVM (2001) adopted the maximal daily intake of the population of 0.14 mg/kg bw/d (Vermeire *et al.* 1991) as its TDI for copper. This TDI is above the minimum requirements for copper and leaves a margin of safety of 30 relative to the LOAEL of 4.2 mg/kg bw/d in experimental animals.

Based on the findings of the IOM (2001), the WHO (2004) uses the UL of 10 mg/kg (which equates to an adult TDI of 0.14 mg/kg bw/d) for setting its guideline for copper in drinking water. The WHO notes that there is still some uncertainty regarding long-term effects of copper in sensitive populations (2004).

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20.0 DIESEL PARTICULATE MATTER (DPM)

20.1 Inhalation Exposure Limits

20.1.1 Acute Inhalation

Table B.20-1 Acute Inhalation Exposure Limits for DPM

AGENCY	AEP	ATSDR	HEALTH CANADA	TCEQ	US EPA
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value ($\mu g/m^3$)	-	-	**10**	19	-
Critical Organ or Effect	-	-	Respiratory. Increased airway resistance and inflammation	Health	-
Species	-	-	Humans	-	-
Study	-	-	Behndig *et al*. 2006, 2011; Mudway *et al*. 2004; Riedl *et al*. 2012; Stenfors *et al*. 2004;	-	-
Source	AEP 2019	ATSDR 2019	Health Canada 2016	TCEQ 2016	US EPA 2002

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2016) currently recommends a short-term ESL of 19 $\mu g/m^3$ for DPM based on a health endpoint; no supporting documentation was provided (TCEQ 2016).

Health Canada (2016) recommends a short-term exposure value of 10 $\mu g/m^3$ for DPM. This guidance value was derived from controlled human exposure studies where short-term exposure to DPM can induce airway resistance and inflammation (neutrophilia, degranulation and mastocytosis) after participants were exposed to 100 $\mu g/m^3$ DPM for 2-hours (Behndig *et al*. 2006, 2011; Mudway *et al*. 2004; Riedl *et al*. 2012; Stenfors *et al*. 2004).

In the study by Mudway et al. (2004) 25 non-atopic subjects were exposed to filtered air and Volvo engine diesel exhaust in closed chamber for 2 hours. Following exposure, the subjects recorded symptoms and were tested for lung function and bronchoscopy and nasal lavage. Immediately following exposure to diesel exhaust subjected displayed an increase in subjective symptoms and

mild bronchoconstriction. Six hours after cessation – no inflammation or antioxidant depletion was seen. A similar study conducted by Stenfors et al. (2004) indicated similar results with increased airway resistance of similar magnitude following exposure to diesel exhaust.

Behndig *et al.* (2006) conducted a study specifically looking to examine whether in vitro responses to diesel exhaust caused an uregulation of antioxidants following low dose diesel exhaust exposure and how those exposures related to airway inflammation. Findings suggest that inflammation of the nasal and bronchial airways occur 6-h post-exposure but that the dose of particles penetrating to the peripheral lung is insufficient to elicit inflammation response due to predominance of protective anti-oxidant response at 100 μg/m^3. Following this study, Behndig *et al*. (2011) looked at 32 subjects with asthma (mild to moderate severity) and 23 healthy controls in a double-blinded crossover control study where participants were exposed to both filtered air and diesel exhaust (100 mg/m^3 PM10) for 2 h. Airway inflammation was assessed by bronchoscopy 18 h postexposure. In healthy control subjects a significant increase in submucosal neutrophils (p=0.004) was observed. Significant increases in neutrophil numbers, increase in the concentrations of interleukin 6 and myeloperoxidase were also seen in bronchial wash post diesel exhaust exposure relative to the control air challenge. No evidence of enhanced airway inflammation was observed in the subjects with asthma following the diesel exposure.

An overall commonality form these studies is that the dose of particles penetrating to the peripheral lung was insufficient to elicit inflammation due to the predominance of protective antioxidant response, that no evidence of oxidative stress was apparent and that asthmatic patients may have a more pronounced response to DPM exposures through heightened nonspecific bronchial hyperresponsiveness or enhanced reactivity but at levels considered consistent with roadside ambient exposures, a worsening of airway inflammation was not observed. Health Canada (2016) applied a 10-fold uncertainty factor to the LOAEL identified in these studies to account for further susceptibility in the population due to age, disease status or genetic factors and to account for extrapolation from a LOAEL to a NOAEL.

The Health Canada short-term exposure value of 10 μg/m^3 was considered the most appropriate health-based guideline for the assessment of acute exposure to DPM as it was based on human responses, incorporated both healthy and sensitive sub-population (asthmatics), and included variable time delay (6h and 18h) post-exposure response. DPM was included in the chemical groups for respiratory irritation as an acute threshold toxicant.

20.1.2 Chronic Inhalation

Table B.20-2 Chronic Inhalation Exposure Limits for DPM

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	REL	-	ESL	RfC	-
Exposure Limit Value ($\mu g/m^3$)	-	-	**5**	5	-	0.15	5	-
Critical Organ or Effect	-	-	Respiratory. Inflammation, histopathological and/or functional changes	Respiratory system	-	Health	Inflammatory and histopathological changes in lungs	-
Species	-	-	Rat	Rat	-	-	Rat	-
Study	-	-	Ishinishi *et al*. (1986, 1988)	-	-	-	-	-
Source	AEP 2019	ATSDR 2019	Health Canada 2016	OEHHA 2016	RIVM 2001	TCEQ 2016	US EPA 2002	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

IARC (2014) has classified diesel engine exhaust as carcinogenic to humans (Group 1). Health Canada (2016), the OEHHA (2016) and US EPA (2002) have established chronic inhalation guidelines based on evidence in rats of an association between chronic inhalation exposure to DPM and inflammatory and histopathological changes in lungs (Ishinishi *et al*. 1986, 1988). The TCEQ (2016) recommends a chronic ESL of 0.15 for DPM; however, no supporting documentation was provided for this exposure limit.

The OEHHA (2016) recommends an REL of 5 $\mu g/m^3$ for the non-carcinogenic effects of DPM following chronic exposure. This REL was developed under the Toxic Air Contaminant (TAC) program.

The US EPA (2002) recommends an RfC of 5 $\mu g/m^3$ for DPM based on inflammatory and histopathological changes in lungs following chronic exposure based on evidence of inflammatory and histopathological changes in the lungs of rat inhalation studies.

Health Canada (2016) developed a chronic guideline of 5 µg/m^3 for the non-carcinogenic effects of DPM following chronic exposure. This guideline was also based on the Ishini *et al.* (1986; 1988) inhalation studies reporting effects in the respiratory tract, including inflammation, histopathological changes and/or functional changes in rats exposed in a multi-dose exposure study. A NAOEL of 0.46 mg/m^3 was chosen as the departure point. Dosimetric modelling was performed to determine the chronic exposure guidance value. The Mult Path Particle Dosimetry model estimated a human equivalent concentration (HEC) for a 70-year lifetime exposure to be approximately 0.12 mg/m^3 of DPM. An uncertainty factor of was applied to account for sensitive individuals in the human population. Based on the HEC and uncertainty factor the chronic guidance value of 5 µg/m^3 was derived.

An acceptable unit risk and slope factor for DPM was not identified, however, the HHRA did assess the individual carcinogenic COPCs known to occur in diesel engine combustion emissions (*e.g.*, heavy metals, benzene, polycyclic aromatic hydrocarbons [PAHs]).

A unit risk and slope factor has been derived by the California Environmental Protection Agency (Cal EPA 1998b) for DPM (3×10^{-4} [µg/m^3]$^{-1}$) based on rat studies by Maulderly *et al.* (1987) and a review of the range of lifetime unit risk estimates from a number of human health studies that were strongly influenced by a retrospective cohort study of U.S. railroad workers by Garshick *et al.* (1988). Within this document, and noted elsewhere (US EPA 2002, 2003 and Health Canada 2016), there are substantial uncertainties that must be considered when extrapolating rat findings to humans, and, on balance, that even the human data had apparent confounding factors which were not accounted for.

In 2002, the US EPA released a human health assessment document for diesel engine exhaust. Within this document the US EPA reviewed a number of epidemiologic studies, and while causality of increased incidence of lung cancer was noted, the generally small increase in carcinogenic risk (1.2 to 1.5, *i.e.*, less than 2) was considered to potentially weaken the evidence of a causal relationship when consideration of confounders (*e.g.*, smoking, asbestos exposure) was made. It was concluded that considerable uncertainty in the available exposure-response data exists and that unit risk/cancer potency for DPM could not be derived. Specifically, the range of values in development of a lifetime cancer risk is attended by numerous uncertainties, and the range is not suitable for a definitive characterization of risk. This lack in confidence of the underlying studies was further substantiated in the Integrated Risk Information System (IRIS) chemical assessment of DPM (US EPA 2003), which indicated that the evidence for the presence or absence of an exposure response relationship from the studies of railroad workers, and current exposure uncertainty for truck drivers, lead to low confidence and too much uncertainty in derivation of a carcinogenic unit risk (US EPA 2003).

In 2016, Health Canada released the report entitled "*Human Health Risk Assessment for Diesel Exhaust*", which includes direct reference to both the Cal EPA (1998), US EPA (2002) and International Agency

on Cancer Research (IARC 2013) published literature on the subject of DPM exposure (Health Canada 2016). In the risk assessment HC (2016) included an update to the original epidemiological database presented in Cal EPA (1998) and US EPA (2002) with a detailed document review of studies published between January 1, 2000 and June 15, 2012. The epidemiological database included in Health Canada's review increased the number of studies significantly and updated the previously cohort studies of US railroad workers and trucking industry workers as referenced by Cal EPA (1998b) with the Diesel Exhaust in Miners Study (DEMS) study which addressed key limitations in the pre-existing database. Following Health Canada's review, it was identified that causality between DPM exposure and lung cancer exists, but the magnitude of the risk estimate is low (less than 3); a finding which is in alignment with those presented by the US EPA (2002). Health Canada did not conduct a carcinogenic assessment of exposure to DPM, nor recommend the use of a unit risk (UR) or slope factor (SF) (Health Canada 2016) rather it deferred to the results of the Health Effects Institute (HEI's) Epidemiology Project Panel regarding future diesel emission risk assessments.

The HEI conducted a detailed review of both the miners and truckers epidemiological studies to determine their usefulness in quantitative risk assessment for exposure to diesel emissions (HEI 2015a). The panel reported the studies to have many strengths and that they would be useful for assessment of older diesel engines; however, their application to emissions from newer, cleaner engines would require caution due to some key uncertainties and limitations. HEI recommend that risk assessment of future projects should consider the mitigative impacts associated with technological advances that have been made since the epidemiological studies were conducted (*e.g.*, new diesel fuel products, new diesel engines, aftertreatment technologies) (HEI 2015a). A second publication in the same year reported a substantial reduction of PM and other chemical emissions from modern diesel engines (HEI 2015b).

As the 1998 CalEPA UR and SFs lack scientific justification in their derivation, (US EPA 2002, Health Canada 2016) and current epidemiological studies are not representative of emissions from newer diesel engines, a carcinogenic assessment of DPM using the CalEPa UR was considered inappropriate and was not conducted. Until such time that the US EPA, Health Canada, or another agency such as the World Health Organization (WHO) has come to an agreement on the best path forward for assessing DPM as a carcinogenic contaminant, the currently acceptable deterministic RfC of 5 $\mu g/m^3$ (as supported by both the US EPA 2003, and Health Canada 2016) is considered the most appropriate guidance value for an assessment of future emissions. The carcinogenic potential can still be estimated through assessment of the individual carcinogens predicted to occur in diesel emissions (*e.g.*, heavy metals, benzene, polycyclic aromatic hydrocarbons [PAHs]) as was conducted in the HHRA.

DPM was included in the chemical group for respiratory histopathological and/or function changes following chronic inhalation exposures.

20.2 Oral Exposure Limits

No chronic oral exposure limit was required for DPM as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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21.0 FLUORANTHENE

21.1 Inhalation Exposure Limits

21.1.1 Acute Inhalation Exposure Limits

Table B.21-1 Acute Inhalation Exposure Limits for Fluoranthene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	0.5	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An interim acute ESL of 0.5 µg/m³ was recommended for fluoranthene as a fraction of exhaust PM_{10} by TCEQ (2013), however no supporting documentation was provided for this exposure limit. No short-term occupational exposure limits have been developed for fluoranthene (OSHA 2013).

Fluoranthene is a C16 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to fluoranthene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

21.1.2 Chronic Inhalation

Table B.21-2 Chronic Inhalation Exposure Limits for Fluoranthene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.05	-	-

Table B.21-2 Chronic Inhalation Exposure Limits for Fluoranthene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013	Health Canada 2010	OEHHA 2013	RIVM 2001	TCEQ 2013	US EPA 1994	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA

An interim chronic ESL of 0.05 µg/m^3 was recommended for fluoranthene as a fraction of exhaust PM_{10} by TCEQ (2013); however, no supporting documentation was provided for this exposure limit. The US EPA (1994) and ATSDR (1995) determined there were insufficient data for the purpose of deriving a chronic inhalation exposure concentration for fluoranthene.

In the absence of a chronic inhalation exposure limit specific to fluoranthene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

Health Canada (2012) has recommended potency equivalency factors (PEF) for carcinogenic PAH, including fluoranthene, sharing a common mode of action with B[a]P.

For the purpose of this assessment, fluoranthene was also treated as a carcinogen following chronic inhalation exposure and was evaluated as part of the B[a]P equivalent group. Further details are provided in the toxicity profile for B[a]P.

21.2 Oral Exposure Limits

21.2.1 Chronic Oral Exposure Limit

Table B.21-3 Chronic Oral Exposure Limits for Fluoranthene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL (adjusted)	-	-	CR	**RfD**	-
Exposure Limit Value (mg/kg bw/day)	0.04	-	-	0.05	**0.04**	0.0125
Critical Organ or Effect	Liver, Kidney	-	-	Cancer potency relative to B[a]P	**Liver, Kidney**	Liver, Kidney
Species	Mice	-	-	Rat	**Mice**	Mice
Study	US EPA 1988	-	-	Kroese *et al.* 1999	**US EPA 1988**	-
Source	ATSDR 1995	Health Canada 2010	OEHHA 2013	RIVM 2001	**US EPA 1993**	WHO 2003

- not available

Bold – Exposure Limit selected for HHRA

The ATSDR (2013) recommend an intermediate oral MRL of 0.4 mg/kg body weight/day based on a LOAEL of 125 mg/kg body weight/day for liver effects in mice following 90 days gavage exposure to fluoranthene (US EPA 1988; ATSDR 1995). The US EPA (1990) identified the same LOAEL for fluoranthene. Adjusting the ATSDR intermediate MRL by an uncertainty factor of 10 for subchronic to chronic extrapolation would result in a chronic exposure limit of 0.04 mg/kg body weight/day. This approach was taken by the US EPA in their establishment of a chronic oral RfD of 0.04 mg/kg body weight/day for fluoranthene (US EPA 1993).

The RIVM (2001) recommend a CR of 50 µg/kg body weight/day for fluoranthene based on a relative carcinogenic potency to benzo[a]pyrene of 0.01 and an excess lifetime cancer risk of 1 in 10,000.

In their drinking water guideline document, the WHO identified a NOAEL of 125 mg/kg body weight/day for liver and kidney effects in mice following 13-weeks oral gavage exposure to fluoranthene, which is the most commonly detected PAH in drinking water (WHO 2003). An

uncertainty factor of 10,000 was recommended for this NOAEL to account for variation in response within and between species (100), subchronic to chronic extrapolation (10), an inadequate database and clear evidence of co-carcinogenicity with BaP in mouse skin painting studies (10). This would have resulted in an exposure limit of 0.0125 mg/kg body weight/day for fluoranthene and a drinking water guideline of 4 μg/L. The WHO did not recommend this guideline for fluoranthene in drinking water as the resultant concentration was well above fluoranthene concentrations normally found in drinking-water.

The RfD of 0.04 mg/kg body weight/day (ATSDR 1995; US EPA 1993) was selected for the assessment of non-carcinogenic effects following chronic oral exposure to fluoranthene. Fluoranthene was included in the chemical groups for liver and kidney effects following oral exposures. The carcinogenic potential of fluoranthene following chronic oral exposure was also assessed as part of the B[a]P equivalent group. Further details are provided in the toxicity profile for B[a]P.

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22.0 FLUORENE

22.1 Inhalation Exposure Limits

22.1.1 Acute Inhalation Exposure Limits

Table B.22-1 Acute Inhalation Exposure Limits for Fluorene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	10	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

An interim acute ESL of 10 $\mu g/m^3$ was recommended for fluorene as a fraction of exhaust PM_{10} by TCEQ (2013); however no supporting documentation was provided for this exposure limit. No short-term occupational exposure limits have been developed for fluorene (OSHA 2013).

Fluorene is a C13 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to fluorene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

22.1.2 Chronic Inhalation

Table B.22-2 Chronic Inhalation Exposure Limits for Fluorene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	-	-	1	-	-

Table B.22-2 Chronic Inhalation Exposure Limits for Fluorene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013	Health Canada 2010	OEHHA 2011	RIVM 2009	TCEQ 2013	US EPA 1990	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

An interim chronic ESL of 1 µg/m^3 was recommended for fluorene as a fraction of exhaust PM_{10} by TCEQ (2013); however, no supporting documentation was provided for this exposure limit. The US EPA (1990) and ATSDR (1995) determined that there were insufficient data for the purpose of deriving a chronic inhalation exposure concentration for fluorene.

In the absence of a chronic inhalation exposure limit specific to fluorene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this C13 aromatic hydrocarbon. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

22.2 Oral Exposure Limits

22.2.1 Chronic Oral Exposure Limit

Table B.22-3 Chronic Oral Exposure Limits for Fluorene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Exposure Limit Type	MRL (adjusted)	-	-	TDI	**RfD**
Exposure Limit Value (mg/kg bw/day)	0.04	-	-	0.04	**0.04**
Critical Organ or Effect	Liver, kidney, hematological effects	-	-	Body weight	**Liver, kidney, hematological effects**

Table B.22-3 Chronic Oral Exposure Limits for Fluorene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Species	Mice	-	-	Rat	**Mice**
Study	US EPA 1989	-	-	Various; TPHCWG 1997	**US EPA 1989**
Source	ATSDR 1995	Health Canada 2010	OEHHA 2013	RIVM 2001	**US EPA 1990**

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (2013) identified an intermediate oral MRL of 0.4 mg/kg body weight/day based on a LOAEL of 125 mg/kg body weight/day for increased relative liver and kidney weights and hematological effects in mice following 90 days gavage exposure to fluorene (US EPA 1989; ATSDR 1995). The US EPA (1990) identified the same LOAEL for fluorene. Adjusting the ATSDR intermediate MRL by an additional uncertainty factor of 10 for subchronic to chronic extrapolation would result in a chronic exposure limit of 0.04 mg/kg body weight/day. This approach was taken by the US EPA in their establishment of a chronic oral RfD of 0.04 mg/kg body weight/day for fluorene (US EPA 1990).

The RIVM (2001) has developed a tolerable daily intake of 0.04 mg/kg body weight/day for non-carcinogenic aromatic compounds with equivalent carbon number >9 to 16, including fluorene. This TDI was adopted from TPHCWG (1997) which identified a range of reported oral RfD values for decreased bodyweight (from 30 to 300 µg/kg body weight/day) in rats following exposure to 8 aromatic compounds within this range; 4 of the 8 RfD values being 40 µg/kg body weight/day.

The RfD of 0.04 mg/kg body weight/day (ATSDR 1995; RIVM 2001; US EPA 1990) was selected to evaluate chronic oral risks associated with fluorene. Fluorene was included in the chemical groups for liver and kidney effects following oral exposures.

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23.0 FORMALDEHYDE

23.1 Inhalation Exposure Limits

23.1.1 Acute Inhalation

Table B.23-1 Acute Inhalation Exposure Limits for Formaldehyde

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	AAQO 1-hour	**MRL 2-hour**	REL 1-hour 8-hour	ReV 1-hour	AQG 30 min
Exposure Limit Value (µg/m³)	65	**50**	55 9	50	100
Critical Organ or Effect	Respiratory irritation	**Eye and nasal irritation**	Eye irritation Respiratory irritation	Eye and nasal irritation	Eye and respiratory irritation
Species	Human	**Human**	Human	Human	Human
Study	Adopted from TCEQ	**Pazdrak *et al.* 1993**	Kulle *et al.* 1987 Wilhelmsson and Holmstrom, 1992	Pazdrak *et al.* 1993; Krakowiak *et al.* 1998	Various
Source	ESRD 2013	**ATSDR 2013; 1999**	OEHHA 2013; OEHHA 2008	TCEQ 2008	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The ESRD (2013) recommend a 1-hour AAQO of 65 µg/m³ for acute inhalation exposure to formaldehyde. The AAQO was adopted from Texas in 1999, reportedly for human respiratory effects, however the study on which the guideline was based was not provided (AENV 2006; 2008).

The ATSDR (2013) recommend an acute inhalation MRL of 50 µg/m³ for formaldehyde. The MRL was based on a study by Pazdrak *et al.* (1993) which reported eye and nose irritation in human volunteers, including individuals with skin sensitivity to formaldehyde, following 2 hours exposure to 0.4 ppm (0.5 mg/m³) formaldehyde. A 10-fold uncertainty factor was applied to the exposure concentration to account for use of a LOAEL (3) and variability in human response (3) (ATSDR 1999).

A 1-hour ReV of 50 µg/m³ was recommended by the TCEQ (2008) for acute exposure to formaldehyde. Similar to the ATSDR (1999), this ReV was based on eye and nose irritation in human volunteers, including individuals with skin sensitivity to formaldehyde (Pazdrak *et al.* 1993) as well as individuals with asthmatic symptoms (Krakowiak *et al*. 1998) following 2 hours exposure to

0.5 mg/m^3 formaldehyde. A 10-fold uncertainty factor was applied to the exposure concentration (0.5 mg/m^3) to account for use of a LOAEL (3) and variability in human response (3) (TCEQ 2008).

The OEHHA (2013) recommend a 1-hour REL of 55 µg/m^3 and an 8-hour REL of 9 µg/m^3 as acute exposure limits for formaldehyde. The 1-hour REL of 55 µg/m^3 (0.044 ppm) is based on a NOAEL of 0.5 ppm for mild to moderate eye irritation in nonasthmatic humans exposed to 0.5-3.0 ppm formaldehyde for a 3-hour period (Kulle *et al.* 1987). The OEHHA (2008) calculated a $BMCL_{05}$ of 0.44 ppm for eye irritation which was adjusted by an uncertainty factor of 10 to account for potential asthma exacerbation.

The OEHHA 8-hour REL of 9 µg/m^3 was based on an occupational study (Wilhelmsson and Holmstrom 1992) reporting nasal, eye and respiratory tract irritation in chemical plant workers exposed to a mean air concentration of 0.26 mg/m^3 formaldehyde over an average of 10 years (OEHHA 2008). A NOAEL of 0.09 mg/m^3 was identified from the study and an uncertainty factor of 10 was applied to account for variability in human response (OEHHA 2008).

The WHO (2000) recommend an acute air quality guideline of 100 µg/m^3 over a 30 minute period for formaldehyde. This guideline is based on reports of significant irritation of the eyes, nose and throat in healthy subjects exposed to air concentrations above 100 µg/m^3 formaldehyde.

The lowest 1-hour guideline of 50 µg/m^3 (ATSDR, 1999) was selected for the current assessment of acute inhalation exposure to formaldehyde. Formaldehyde was included in the chemical groups for eye irritation and nasal irritation following acute inhalation exposures.

23.1.2 Chronic Inhalation

Table B.23-2 Chronic Inhalation Exposure Limits for Formaldehyde

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	MRL	RsC	REL RsC	-	ReV RsC	RsC	-
Exposure Limit Value (µg/m^3)	-	10	1.9	9 **2**	-	**11** 18	0.8	-
Critical Organ or Effect	-	Eye and respiratory irritation	Nasal tumours	Respiratory irritation	-	Respiratory irritation Cell proliferation[1]	Nasal tumours	-

Table B.23-2 Chronic Inhalation Exposure Limits for Formaldehyde

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Species	-	Human	Rat	Human Rat	-	Human	Rat	-
Study	-	Holmstrom *et al.* 1989	Monticello *et al.* 1996	Wilhelmsson and Holmstrom, 1992 Kerns *et al.* 1983	-	Wilhelmsson and Holmstrom, 1992 Schlosser *et al*. 2003	Kerns *et al.* 1983	-
Source	ESRD 2013	ATSDR 2013; 1999	Health Canada 2001	OEHHA 2008 2011	RIVM 2001	TCEQ 2008	US EPA 1991	WHO 2000

- not available

[1] Key precursor event to tumorigenesis

Bold – Exposure Limit selected for HHRA.

The ATSDR (2013) recommend a chronic MRL of 10 µg/m^3 (0.008 ppm) for formaldehyde. This MRL was based on a LOAEL of 0.24 ppm as an average 8-hour TWA for mild irritation of the eye and respiratory tract and mild damage to nasal epithelium in chemical plant workers occupationally exposed to formaldehyde for an average of 10.4 years (Holmstrom *et al.* 1989). The LOAEL was adjusted by an uncertainty factor of 30 for use of a LOAEL for mild effects (3) and human variability (10). No adjustment was made for extrapolation to continuous exposure based on evidence provided by Wilmer *et al.* (1987) that formaldehyde exposure concentration was more important than the product of exposure duration and concentration for determining the severity of epithelial damage of the upper respiratory tract (ATSDR 1999).

The OEHHA (2013) recommend a chronic REL of 9 µg/m^3 for noncarcinogenic effects following chronic exposure to formaldehyde. This exposure limit is based on the same study (Wilhelmsson and Holmstrom 1992), NOAEL (0.09 mg/m^3) and uncertainty factor (10) identified for the 8-hour REL for nasal, eye and respiratory tract irritation in chemical plant workers exposed to formaldehyde (OEHHA 2008).

The TCEQ (2008) recommend a chronic ReV of 11 µg/m^3 for noncarcinogenic effects associated with chronic exposure to formaldehyde. This exposure limit is based on the same study (Wilhelmsson and Holmstrom 1992) and NOAEL (0.09 mg/m^3) identified by the OEHHA (2008) for nasal, eye and respiratory tract irritation in chemical plant workers exposed to formaldehyde for 8 hours/day, 5 days/week over an average of 10 years. The NOAEL was adjusted for continuous exposure

(0.032 mg/m^3) and an uncertainty factor of 3 was applied to account for human variability (TCEQ 2008).

IARC (2013) has classified formaldehyde as carcinogenic to humans (Group 1).

Health Canada, OHEHHA (2011), TECQ (2007) and US EPA (1991) have developed chronic inhalation exposure limits based on the carcinogenic potential of formaldehyde.

The US EPA (1991) identified an inhalation unit risk of 1.3×10^{-5} per µg/m^3 from a study reporting nasal squamous cell carcinomas in rats following chronic (2 year) inhalation exposure to formaldehyde (Kerns *et al.* 1983). This unit risk is equivalent to an RsC of 0.8 µg/m^3 assuming a 1 in 100,000 incremental cancer risk level. It is noted that the potential inhalation toxicity of formaldehyde is currently under review by the US EPA with a draft human health assessment released on June 2, 2010 for independent peer review and public comment (US EPA 2012).

The OEHHA (2011) derived an inhalation unit risk of 6×10^{-6} per µg/m^3 using the Kerns *et al.* (1983) data for nasal squamous cell carcinomas in rats. The OEHHA unit risk is equivalent to an RsC of 2 µg/m^3 for an incremental cancer risk of 1 in 100,000. The upper range of cancer risks predicted by the OEHHA (2011) using the rat bioassay data were determined to be consistent with lung cancer mortality risk estimates for workers (cohort of over 26,000) exposed to formaldehyde (Blair *et al.* 1986).

Health Canada (2001) determined a TC_{05} of 9.5 mg/m^3 using data for the incidence of nasal squamous tumours in a more recent study in rats (Monticello *et al.* 1996). This air concentration is associated with a 5% (1 in 20) increase in tumour incidence over background. Dividing the TC_{05} by a factor of 5,000 results in an RsC of 1.9 µg/m^3 for a 1 in 100,000 incremental cancer risk level.

The TCEQ (2008) recommend an RsC of 18 µg/m^3 for formaldehyde assuming a 1 in 100,000 cancer risk level. This exposure limit was derived from Schlosser *et al*. (2003) who reported BMC and POD values for tumour incidence and cell proliferation in 3 data sets (including Kerns *et al.* 1983) describing these effects in rats following chronic formaldehyde inhalation. Nasal cell proliferation was the POD selected for guideline development as it represents a key event in formaldehyde-induced carcinogenesis. A POD_{HEC} of 0.44 ppm, representing the 95% $BMCL_{01}$, was determined for this endpoint. The RsC of 0.015 ppm (18 µg/m^3) was developed by applying an uncertainty factor of 30 to the POD to account for extrapolation from animal data (3) and human variability (10).

An exposure limit of 9 µg/m^3, recommended by the OEHHA and supported by the ATSDR and TCEQ limits, was selected for the evaluation of non-carcinogenic effects following chronic inhalation exposure to formaldehyde. Formaldehyde was included in the chemical groups for nasal and eye irritation following chronic inhalation exposures.

An exposure limit of 2 μg/m^3, recommended by the OEHHA and supported by the limit derived by Health Canada, was selected for the evaluation of carcinogenic effects following chronic inhalation exposure to formaldehyde. Although the US EPA provided the most conservative guideline (currently under review), the OEHHA and Health Canada conducted more recent evaluations of the available data and considered the results of animal as well as human studies. Formaldehyde was included in the chemical group for nasal tumours following chronic inhalation exposures.

23.2 Oral Exposure Limits

23.2.1 Chronic Oral Exposure Limit

Table B.23-3 Chronic Oral Exposure Limits for Formaldehyde

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA
Exposure Limit Type	MRL	**TDI**	RsD	-	RfD
Exposure Limit Value (mg/kg bw/day)	0.2	**0.15**	0.00048	-	0.2
Critical Organ or Effect	GI tract	**GI tract**	Route extrapolation	-	GI tract
Species	Rat	**Rat**	Rat	-	Rat
Study	Til *et al*. 1989	**Til *et al*. 1989**	Kerns *et al*. 1983	-	Til *et al*. 1989
Source	ATSDR 2013; 1999	**Health Canada 2001**	OEHHA 2013	RIVM 2001	US EPA 1990

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (2013), Health Canada (2001) and US EPA (1990) have all developed oral exposure limits for formaldehyde based on the same study (Til *et al.* 1989) reporting stomach irritation in rats following chronic exposure to formaldehyde in drinking water.

The ATSDR (1999) and US EPA (1990) both identified a NOAEL of 15 mg/kg bw/day from the Til *et al.* (1989) study for histopathological changes in the gastrointestinal tract of rats following 2 years exposure to formaldehyde in drinking water. An uncertainty factor of 100 was applied to this NOEAL to account for extrapolation from an animal study (10) and human variability (10). The final MRL and RfD values were rounded up from 0.15 to 0.2 mg/kg bw/day, resulting in chronic exposure limits of 0.2 mg/kg bw/day (ATSDR 1999; US EPA 1990).

Health Canada (2001) identified the same NOAEL of 15 mg/kg bw/day from the Til *et al.* (1989) study for histopathological effects in the forestomach and glandular stomach. An uncertainty factor of 100 was applied to account for extrapolation from an animal study (10) and human variability (10). There was no rounding of the final value, resulting in a chronic exposure limit of 0.15 mg/kg bw/day.

The OEHHA (2011) recommend an oral slope factor of 0.021 per mg/kg bw/day for formaldehyde. This slope factor was derived from the chronic inhalation cancer risk estimate described earlier (based on Kerns *et al.* 1983) for nasal squamous cell carcinomas in rats. The OEHHA oral slope factor is equivalent to an RsD of 0.00048 mg/kg bw/day assuming a 1 in 100,000 cancer risk level.

Gastric irritation was the critical effect identified by the ATSDR, Health Canada and US EPA following chronic ingestion exposure to formaldehyde. No treatment-related tumours were reported by Til *et al.* (1989). Therefore, the lowest exposure limit recommended from the drinking water study (*i.e.,* 0.15 mg/kg bw/day) was selected for the current assessment of oral exposures to formaldehyde. Formaldehyde was included in the chemical group for kidney effects following chronic oral exposures.

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24.0 LEAD

24.1 Inhalation Exposure Limits

24.1.1 Acute Inhalation

Table B.24-1 Acute Inhalation Exposure Limits for Lead

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	AAQO	24 hr standard 30 d standard	-	-	-	-
Exposure Limit Value (µg/m³)	1.5	0.5 0.2	-	-	-	-
Critical Organ or Effect	-	Neurological	-	-	-	-
Species	-	Human Children	-	-	-	-
Study	-	Cal EPA 2001	-	-	-	-
Source	Alberta Government 2013	OMOE 2007	-	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The OMOE (2007) has a 30-day standard of 0.2 µg/m³ for lead and lead compounds based on neurological effects in children. The 30-day standard was derived using a model developed by the California Environmental Protection Agency (Cal EPA) to determine the air lead concentration associated with a 5% probability of children in a reference population exceeding a blood lead level of concern of 10 µg/dL. This LOC is considered to be out of date with respect to the state of science surrounding blood lead concentrations and potential adverse effects. The OMOE 24 hour value is derived from the 30-day standard.

The Alberta Government (2013) provides an AAQO of 1.5 µg/m³ for a 1-hour averaging period, which was adopted from the Texas Natural Resource Conservation Commission, but no specific basis is provided.

Due to the lack of defensible acute inhalation exposure limits, lead was not assessed on an acute basis.

24.1.2 Chronic Inhalation

Table B.24-2 Chronic Inhalation Exposure Limits for Lead

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	TC	RsC	-	-	**NAAQS***	AQG
Exposure Limit Value (µg/m³)	-	-	0.1	0.8	-	-	**0.15**	0.5
Critical Organ or Effect	-	-	-	Kidneys	-	-	**-**	-
Species	-	-	-	Rats	-	-	**-**	-
Study	-	-	Oral toxicity conversion	Azar 1973	-	-	**-**	-
Source	-	-	Health Canada (2015)	OEHHA 2009	-	-	**US EPA 2008**	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.
* NAAQS – National Ambient Air Quality Standard.

Lead and inorganic lead compounds are classified as probably carcinogenic to humans (Group 2A) by IARC, as reasonably anticipated to be human carcinogens (Group K) by NTP and as confirmed animal carcinogens with unknown relevance to humans (Group A3) by ACGIH (OSU, 2010). However, the data for establishing an RSD was considered weak (US EPA 2004), and potential neurological effects has been identified as a more sensitive end point than carcinogenicity (Health Canada, pers comm. 2015). For this reason, lead was treated as a non-carcinogen by inhalation for this risk assessment and an RsD was calculated.

The WHO (2000) inhalation guideline of 0.5 µg/m³ is based on the recommendation that the annual average air concentration of lead not exceed 0.5 µg/m³. This guideline was based on the assumption that the upper limit of non-anthropogenic blood lead levels is 30 µg/L. Recent scientific evidence indicates that this assumption may not be protective against potential neurological effects (Health Canada 2013).

The OEHHA (2009) has derived an inhalation unit risk estimate of 1.2×10^{-5} $(\mu g/m^3)^{-1}$ (equivalent to an RsC of about 0.8 µg/m³). This cancer-based value was derived from an oral rat study, where male and

female rats were administered lead acetate in the diet for a duration of 2 years (Azar *et al.*, 1973). Significant incidences of kidney tumours were observed in the animals. A linearized multistage model was used to fit the male tumour incidence data, and human equivalent doses were calculated. This value was not selected as it was not considered to be protective against potential neurological effects (Health Canada 2013).

The US EPA has not reported an RsC due to insufficient data (US EPA, 2004). An estimate of carcinogenic risk was not derived by the US EPA from the oral exposure studies by Azar *et al.* (1973).

Based on the *Clean Air Act*, which indicates a primary standard is to be set at the maximum permissible ambient air level which will protect the health of any [sensitive] group of the population, the US EPA revised the primary national ambient air quality standards (NAAQS) for lead to 0.15 μg/m^3 (US EPA, 2008). This limit is set to be protective of air emission and multi-exposure pathways. The NAAQS was set to provide increased protection for children and other at-risk populations against an array of adverse effects in children, including neurocognitive and neurobehavioral effects. The averaging time for the primary NAAQS was revised to a rolling 3-month period with a maximum (not-to-be-exceeded) form, evaluated over a 3-year period. The NAAQS was derived from a blood lead level of 10 μg/dL (100 μg/L) in consideration of studies assessing potential adverse health effects in association with measured blood lead concentrations. The US EPA primary standard was intended to include an adequate margin of safety to address uncertainties associated with inconclusive scientific and technical information available at the time of standard setting. It was also intended to provide a reasonable degree of protection against hazards that research has not yet identified. As this limit is currently the lowest limit defined for inhalation of lead and data indicating blood lead concentrations are most sensitive to oral exposure rather than inhalation of air (OEHHA 2007), the US EPA NAAQS was selected for the current assessment.

A chronic inhalation TC of 0.1 μg/m^3 was calculated from the oral exposure limit of 0.0005 mg/kg bw/day recommended by Health Canada (pers. comm. 2015). Discussion of the basis for the oral exposure limit is provided below. The calculated TC is slightly lower than the US EPA NAAQS; however, it was not selected for the current assessment, as it is an estimation of an inhalation TRV from oral exposure data. The US EPA NAAQS is derived from inhalation exposure data.

The calculation of the chronic inhalation exposure for the toddler age group (generally the most sensitive life stages) is as follows:

$$TC = \frac{oral\ exposure\ limit}{IR} \times BW$$

TC = Tolerable concentration (µg/m^3)
IR = Inhalation rate (m^3/d)
BW = Body weight (kg)

$$TC = \frac{0.0005 mg/kg/d}{8.3\ m^3/d} \times 16.5 kg \times \frac{1000 \mu g}{mg} = 1 \mu g/m^3$$

24.2 Oral Exposure Limits

24.2.1 Chronic Oral

Table B.24-3 Chronic Oral Exposure Limits for Lead

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	**BMDL$_{01}$**	RsD	TDI	-	-
Exposure Limit Value (mg/kg bw/day)	-	**0.0005**	0.0012	0.0036	-	-
Critical Organ or Effect	-	**Neurotoxicity**	Kidney tumors		-	-
Species	-	**Human children**	Male rats		-	-
Study	-	**-**	-		-	-
Source	-	**Health Canada, pers comm. 2015**	OEHHA 2009	RIVM 2001	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Lead and inorganic lead compounds are classified as probably carcinogenic to humans (Group 2A) by IARC, as reasonably anticipated to be human carcinogens (Group K) by NTP and as confirmed animal carcinogens with unknown relevance to humans (Group A3) by ACGIH (OSU, 2010).

However, potential neurological effects has been identified as a more sensitive end point than carcinogenicity (Health Canada, pers comm. 2015; US EPA, 2004, 2008). For this reason, lead was treated as a non-carcinogen by ingestion for this risk assessment.

Health Canada (2013) has concluded that their previous provisional tolerable weekly intake of 0.025 mg/kg bw/day for lead could no longer be considered protective of human health since there is no evidence of a threshold for critical lead-induced health effects. Health Canada recommends the use of the $BMDL_{01}$ of 0.0005 mg/kg bw/d derived by the European Food Safety Authority (EFSA 2010) from a blood lead level of 12 µg/L for developmental neurotoxicity in children (Health Canada, pers comm. 2015). This value was used for the assessment.

The RIVM (2001) provides an oral exposure limit of 0.0036 mg/kg bw/d based on the TDI established by the WHO (2003).

The WHO (2003) derived a TDI of 0.0036 mg/kg bw/d developed from the provisional tolerable weekly intake (PTWI) of 0.025 mg/kg bw/d. This PTWI has been recently withdrawn, based on scientific evidence that it is no longer considered protective (JECFA/FAO 2011; EFSA 2010). Because the dose–response analyses do not provide any indication of a threshold for the key effects of lead, JECFA concluded that it was not possible to establish a new PTWI that would be considered to be health protective.

The OEHHA (2009) derived a chronic oral slope factor of 8.5×10^{-3} $(mg/kg/d)^{-1}$ (equivalent to an RsD of 0.0012 mg/kg bw/d) based on the incidence of kidney tumours in male rats.

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25.0 MANGANESE

25.1 Inhalation Exposure Limits

25.1.1 Acute Inhalation

Table B.25-1 Acute Inhalation Exposure Limits for Manganese

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	1 hour AAQO	24 hour Guideline	-	-	1 hour ESL	-
Exposure Limit Value (µg/m³)	2	2.5	-	-	2	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	ESRD 2005	OMOE 2012	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The ESRD (2005) adopted a 1-hour AAQO (Alberta Ambient Air Quality Objective) of 2 µg/m³ from the Texas Natural Resource Conservation Commission. Supporting documentation is not available for this value.

The OMOE (2012) has developed a 24-hour guideline of 2.5 µg/m³; however, the basis of the derivation is not provided.

The TCEQ (2014) reports an interim short term (1 hour) ESL for manganese dust and inorganic compounds of 2 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible acute inhalation exposure limits, manganese was not assessed on an acute basis.

25.1.2 Chronic Inhalation

Table B.25-2 Chronic Inhalation Exposure Limits for Manganese

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	AAQO	MRL	-	**REL**	-	ESL	RfC	TCA
Exposure Limit Value (µg/m³)	0.2	0.3	-	**0.09**	-	0.2	0.05	0.15
Critical Organ or Effect	-	Nervous System	-	**Nervous System**	-	-	Nervous System	
Species	-	Humans	-	**Humans**	-	-	Humans	Humans
Study	-	Roels *et al.* 1992	-	**Roels *et al.* 1992**	-	-	Roels *et al.* 1992	Roels *et al.* 1992
Source	ESRD 2005	ATSDR 2012	-	**OEHHA 2014**	-	TCEQ 2014	US EPA 1993	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The ESRD (2005) reports an annual AAQO for manganese of 0.2 µg/m³ based on values reported by the TCEQ and the California EPA.

The TCEQ (2014) reports an interim long term ESL for manganese dust and inorganic compounds of 0.2 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

In 2014, OEHHA provided a chronic REL of 0.09 µg/m³ based on a study by Roels *et al.* (1992) in which workers were exposed for an average of 5.3 years to an average concentration of 215 µg/m³ respirable dust and 948 µg/m³ total dust. Various tests, including an audio-verbal short-term memory test, a simple visual reaction time test and three manual tests of hand steadiness, coordination and dexterity were used to measure neurological function. Exposed workers showed significant impairment in the neurobehavioral tests. Exposure concentrations were calculated by dividing the integrated respirable dust levels by exposure durations for each worker (Roels *et al.* 1992). The OEHHA (2014) used the benchmark dose approach to derive a BMCL0.5 (lower 95% confidence bound benchmark confidence level) of 72 µg/m³ for the incidence of neurological effects. The BMCL0.5 was time-adjusted to a concentration of 26 µg/m³ (× 72 × 10/20 m³/d × 5/7 days). A total

uncertainty factor of 300 was applied to account for subchronic to chronic conversion (√10), intraspecies toxicokinetic (10) and intraspecies toxicodynamic (10) variability.

The ATSDR (2012) reports an MRL of 0.3 μg/m³ for neurological effects also using the study by Roels *et al.* (1992). Various benchmark dose models were used to fit the incidence data for abnormal hand-eye coordination scores in workers exposed to respirable manganese. Both 5% and 10% extra risk levels were considered – BMC10, BMC05, BMCL10 and BMCL05 values were calculated and compared. The value associated with the model with the best fit was determined to be the BMCL10 of 142 μg/m³ from the logistic model and was selected as the point of departure for the MRL derivation. Adjustments were made for intermittent to continuous exposure (8/24 hours × 5/7 days), resulting in an adjusted BMCL10 of 33 μg/m³. An uncertainty factor of 100 was applied to the adjusted BMCL10 to account for intraspecies differences (10), and limitations and uncertainties associated with the database of human inhalation data for manganese (10).

The US EPA (1993) also used the study by Roels *et al.* (1992) to derive an RfC of 0.05 mg/m³, based on a LOAEL TWA of 0.15 mg/m³. The LOAEL was derived from an occupational-lifetime integrated respirable dust (IRD) concentration of manganese dioxide (8-hour TWA occupational exposure multiplied by individual work histories in years). The geometric mean of the IRD concentration (0.793 mg/m³ x years) was divided by the average duration of MnO_2 exposure (5.3 years) to obtain a LOAEL TWA of 0.15 mg/m³. The LOAEL(HEC), adjusted for continuous exposure, was 0.05 mg/m³. Applying an uncertainty factor of 1,000, (10 to protect sensitive individuals, 10 for use of a LOAEL, and 10 for database limitations), resulted an RfC of 0.05 μg/m³. The US EPA RfC was not used, as more recently derived values that employed benchmark dose modelling are available using the same key study.

The WHO (2000) uses a value of 0.15 μg/m³, also based on the Roels *et al.* (1992) study. Benchmark dose modelling was completed for neurotoxicity. The lower 95% confidence limits for the best concentration estimate giving a 10% (BMDL10) and 5% (BMDL5) effect were calculated, resulting in values of 74 μg/m³ and 30 μg/m³, respectively. The lower value (BMDL5) was chosen as the NOAEL. This value was adjusted for continuous exposure by dividing by a factor of 4.2 (8/24 hours × 5/7 days). An uncertainty factor of 50 was applied to account for the sensitivity of children (5) and intraspecies variability (10).

25.2 Oral Exposure Limits

25.2.1 Chronic Oral

Table B.25-3 Chronic Oral Exposure Limits for Manganese

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	TDI	-	-	**RfD**	TDI
Exposure Limit Value (mg/kg bw/day)	-	0.136 (0 to 4 yrs) 0.122 (5 to 11 yrs) 0.142 (12 to 19 yrs) 0.156 (20+ yrs)	-	-	**0.140 (food) 0.047 (soil and water)**	0.06
Critical Organ or Effect	-	Nervous System	-	-	**Nervous System**	Upper Range of Intake
Species	-	Human	-	-	**Human**	Human
Study	-	IOM 2002 (based on Greger 1999)	-	-	**NRC, 1989; Freeland-Graves *et al.*, 1987; WHO, 1973**	Greger, 1999; IOM, 2002
Source	-	Health Canada, 2010	-	-	**US EPA 1996**	WHO 2011

- not available

Bold – Exposure Limit selected for HHRA.

Health Canada (2010) gives Upper Limits of daily intakes for manganese on an age-specific basis. The maximum Upper Limit for daily intake by adults over 20 years of age is 0.156 mg/kg bw/d, for 12 to 19 years is 0.142 mg/kg bw/d, for 5 to 11 is 0.122 mg/kg bw/d and for 0 to 4 years is 0.136 mg/kg bw/d. These values are based on a NOAEL of 11 mg/d derived from epidemiological and experimental studies in humans. However, the exposure concentrations and durations associated with this value are not clear. The NOAEL that is the basis of the Health Canada value is a no-effect level; it is not clear at which concentration the threshold for adverse effects might be.

The US EPA (1996) uses an oral RfD of 0.140 mg/kg bw/d based on a NOAEL of 10 mg/d (0.14 mg/kg bw/d for a 70 kg adult). The NOAEL was derived using several studies based on central nervous system effects in humans. Since the data was obtained from large populations consuming normal diets over an extended period of time with no adverse health effects, an uncertainty factor of

one was applied to the NOAEL; however, a modifying factor of 3 was recommended when assessing exposure from drinking water or soil due to possible increased uptake of manganese, possible adverse health effects associated with a lifetime exposure through drinking water, possible increased exposure to infants through powdered formula and possible increased absorption and decreased excretion of manganese in neonates.

The World Health Organization (WHO 2011) presents a TDI of 0.06 mg/kg bw/d based on the upper range manganese intake value of 11 mg/day observed in the general population. The TDI was calculated by dividing the NOAEL of 11 mg/day by an uncertainty factor of 3 (to allow for the possible increased bioavailability of manganese from water) and an adult body weight of 60 kg. This value was not used since the threshold concentration for adverse effects was not clear.

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26.0 MERCURY

26.1 Inhalation Exposure Limits

26.1.1 Acute Inhalation

Table B.26-1 Acute Inhalation Exposure Limits for Mercury

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 hour AAQC	-	**1 hour REL**	1 hour ESL	-
Exposure Limit Value (µg/m³)	-	2	-	**0.6**	0.25	-
Critical Organ or Effect	-	Not Available	-	**Nervous System**	-	-
Species	-	Not Available	-	**Rats**	-	-
Study	-	Not Available	-	**Danielsson *et al.* 1993**	-	-
Source	-	OMOE 2012	-	**OEHHA 2014**	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

California's OEHHA (2014) has developed an acute 1-hour REL for elemental mercury of 0.6 µg/m³ based on developmental neurotoxicity. In the primary study on which the acute REL is based (Danielsson *et al.* 1993), groups of 12 pregnant rats were exposed by inhalation to 1.8 mg/m³ of metallic mercury vapour for 1 or 3 hours/day during gestational days 11-14 and 17-21, with the dose level selected to avoid maternal toxicity. Motor activity in offspring aged 3 to 7 months showed significant dose-dependent deficits compared to the control group. A cumulative uncertainty factor of 3,000 was used to account for the use of a LOAEL instead of a NOAEL (10), interspecies differences in toxicokinetics (3), interspecies differences in toxicodynamics (10), and intraspecies variability in toxicokinetics (3) and toxicodynamics (3) to obtain the 1-hour REL of 0.6 µg/m³.

The OMOE (2012) provides an ambient air quality criteria (AAQC) of 2 µg/m³ based on a 24-hour averaging period; however, no supporting documentation is available.

The TCEQ (2014) reports an interim, short term (1 hour) ESL for mercury metal and inorganic forms of 0.25 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM10. No supporting data was available for this limit; therefore, it was not selected.

26.1.2 Chronic Inhalation

Table B.26-2 Chronic Inhalation Exposure Limits for Mercury

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	MRL	-	**REL**	TCA	ESL	RfC	RfC
Exposure Limit Value (µg/m³)	-	0.2	-	**0.03**	0.2	0.025	0.3	1
Critical Organ or Effect	-	Nervous System	-	**Nervous System**	Nervous System	-	Nervous System	Nervous System, Kidneys and Non-Specific
Species	-	Male Humans	-	**Humans**	Humans	-	Humans	Humans
Study	-	Multiple	-	**Multiple**	Multiple	-	Multiple	Multiple
Source	-	ATSDR 1999	-	**OEHHA 2014**	RIVM 2001	TCEQ 2014	US EPA 1995	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The US EPA has developed an RfC for elemental mercury of 0.3 µg/m³ (US EPA 1995). The RfC is derived from a LOAEL of 0.025 mg/m³ for neurobehavioral effects in occupationally exposed males based on various studies. The LOAEL was derived from an 8-hour TWA occupational exposure and was adjusted to the LOAELHEC of 0.009 mg/m³ for continuous exposure. A cumulative uncertainty factor of 30 was applied to account for the protection of sensitive subpopulations and the use of a LOAEL (10) as well as database deficiencies (3), resulting in an RfC of 0.3 µg/m³.

The ATSDR (1999) provides a chronic inhalation MRL of 0.2 µg/m³ for metallic (elemental) mercury vapour based on a study by Fawer *et al.* (1983) on a group of 26 exposed workers from three industries. A significant increase in the occurrence of tremors was observed upon exposure to low levels of mercury for an average of 15.3 years. The LOAEL of 0.026 mg/m³ was adjusted to continuous exposure to obtain an adjusted LOAEL of 0.0062 mg/m³. A cumulative uncertainty factor

of 30 was applied to the adjusted LOAEL to account for intra-species variability (10) and for use of a LOAEL (3).

The OEHHA (2014) has derived a chronic REL of 0.03 µg/m³ based upon neurotoxicity to humans. The chronic REL was calculated based on various neurotoxicity studies with long-term exposures. A LOAEL of approximately 0.025 mg/m³ was derived from the studies and adjusted for worker ventilation and workweek exposure to 9 µg/m³ (25 µg/m³ x 10 m3/20 m3 x 5 d/7 d). A cumulative uncertainty factor of 300 was applied, for the use of a LOAEL (10), for intraspecies toxicokinetic (√10) and toxicodynamic (10) variability, to derive the chronic REL of 0.03 µg/m³.

The RIVM (2001) appears to have adopted the ATSDR's MRL of 0.2 µg/m³ as its TCA for metallic mercury but minimal information is provided regarding the RIVM interpretation of the value.

The TCEQ (2014) reports a long term ESL for mercury metal and inorganic forms of 0.025 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

The WHO (2000) value is based upon a range of LOAELs for mercury vapour (10 to 30 µg/m³) associated with neurological, renal and non-specific effects in exposed workers from various studies. A cumulative uncertainty factor of 20 was applied to account for intrahuman variability (10) and the use of a LOAEL (2) to derive the RfC of 1 µg/m³.

26.2 Oral Exposure Limits

26.2.1 Chronic Oral

Table B.26-3 Chronic Oral Exposure Limits for Mercury

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	RfD	-	TDI	**RfD**	TDI
Exposure Limit Value (mg/kg bw/day)	-	0.0003	-	0.002	**0.0003**	0.002
Critical Organ or Effect	-	Kidney	-	Kidney	**Kidney**	Kidney
Species	-	Rats	-	Rats	**Rats**	Rats

Table B.26-3 Chronic Oral Exposure Limits for Mercury

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Study	-	US EPA 1987	-	NTP 1993	**US EPA 1987**	ICPS 2003
Source	-	Health Canada 2010	-	RIVM 2001	**US EPA 1995**	WHO 2005

- not available

Bold – Exposure Limit selected for HHRA.

The US EPA (1995) derived its RfD of 0.0003 mg/kg bw/d based on a drinking water equivalent level (DWEL) of 0.010 mg/L, which was derived from studies using rats exposed to mercuric chloride *via* ingestion or subcutaneous injection (US EPA 1987). Back calculation from the DWEL, assuming a daily water intake of 2 L and an average body weight of 70 kg, resulted in a RfD of 0.0003 mg/kg/day for autoimmune glomerulonephritis. The DWEL and back calculated RfD were derived from an intensive review and workshop discussions of the entire inorganic mercury database (US EPA, 1987). A cumulative uncertainty factor of 1,000 was applied to the LOAELs of the three rat studies used (0.226 mg/kg/day, 0.317 mg/kg/day and 0.633 mg/kg/day) to account for LOAEL to NOAEL conversion (10), use of subchronic studies (10) and both intra and interspecies variability (10).

Health Canada (2010) has adopted the US EPA's RfD of 0.0003 mg/kg bw/d (described above) as its TDI for mercury.

The RIVM (2001) provides an oral TDI of 0.002 mg/kg bw/day for inorganic mercury, derived from an NTP (1993) study with rats that identifies a NOAEL of 0.23 mg/kg bw/day for renal effects. A cumulative uncertainty factor of 100 was applied for interspecies (10) and intraspecies (10) variation to obtain a TDI of 0.002 mg/kg bw/day for kidney effects.

The WHO (2005) adopted a TDI of 0.002 mg/kg bw/day for inorganic as recommended by an IPCS Working Group (IPCS 2003). The TDI was based on a LOAEL of 1.9 mg/kg/day for kidney effects in rats exposed to inorganic mercury for 2 years. A cumulative uncertainty factor of 1,000 was applied to account for interspecies differences (10), intrahuman variability (10), and for the use of a LOAEL (10).

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27.0 MOLYBDENUM

27.1 Inhalation Exposure Limits

27.1.1 Acute Inhalation

Table B.27-1 Acute Inhalation Exposure Limits for Molybdenum

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 hour Guideline	-	-	1 hour ESL	-
Exposure Limit Value (µg/m³)	-	120	-	-	30	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	-	OMOE 2012	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The OMOE (2012) has developed a 24-hour acute guideline for molybdenum particulates of 120 µg/m³. The OMOE does not provide the scientific basis for this limit; therefore, the value was not considered for use in the assessment.

The TCEQ (2014) reports an interim short term (1 hour) ESL for molybdenum of 30 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible acute inhalation exposure limits, manganese was not assessed on an acute basis.

27.1.2 Chronic Inhalation

Table B.27-2 Chronic Inhalation Exposure Limits for Molybdenum

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	**TCA**	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	**12**	3	-	-
Critical Organ or Effect	-	-	-	-	**Body Weight**	-	-	-
Species	-	-	-	-	**Rats and Mice**	-	-	-
Study	-	-	-	-	**NTP 1997**	-	-	-
Source	-	-	-	-	**RIVM 2001**	TCEQ 2014	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Molybdenum as Mo (soluble compounds) is classified as a confirmed animal carcinogen with unknown relevance to humans (Group A3) by ACGIH (2007). However, no unit risk factors were available for molybdenum exposure by inhalation. For this reason, molybdenum was treated as a non-carcinogen by chronic inhalation for this risk assessment.

The RIVM (2001) reported an inhalation TCA of 12 µg/m³ based on a subchronic study on rats and mice exposed to molybdenum trioxide *via* inhalation (NTP 1997). Body weight effects were observed at 300 mg/m³, with a NOAEC of 100 mg/m³. The NOAEC was adjusted for continuous exposure to 12 mg/m³. A cumulative uncertainty factor of 1,000 was applied to the duration-adjusted NOAEC to account for interspecies variability (10), intraspecies variability (10) and extrapolation from sub-chronic to chronic exposure (10).

The TCEQ (2014) reports an interim long term ESL for molybdenum of 3 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

27.2 Oral Exposure Limits

27.2.1 Chronic Oral

Table B.27-3 Chronic Oral Exposure Limits for Molybdenum

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	UL	-	TDI	**RfD**	TDI
Exposure Limit Value (mg/kg bw/day)	-	0.023 (0 - 11 yrs) 0.027 (12 - 19 yrs) 0.028 (≥ 19 yrs)	-	0.010	**0.005**	0.004
Critical Organ or Effect	-	Reproductive Effects	-	-	**Serum Uric Acid Levels**	Adverse Health Effects
Species	-	Rats	-	Rats	**Human**	Human
Study	-	Fungwe *et al.*, 1990	-	Vermeire *et al* 1991	**Kovalskiy *et al.* 1961**	Chappell 1979
Source	-	Health Canada 2010	-	RIVM 2001	**US EPA 1993**	WHO 2011

- not available

Bold – Exposure Limit selected for HHRA.

Molybdenum is an essential dietary nutrient which is a constituent of several mammalian enzymes. The Food and Nutrition Board of the Subcommittee on the Tenth Edition of the RDAs has established ESAADI values for molybdenum of 0.0025 to 0.00445 mg/kg bw/day for infants, 0.00195 to 0.00536 mg/kg bw/day for children, and 0.0015 to 0.0036 mg/kg bw/day for adolescents and adults (NRC, 1989). These values were derived from the Second National Health and Nutrition Examination Survey (NHANES II). Values for infants and children were extrapolated from the adult values on the basis of body weight.

Molybdenum as Mo (soluble compounds) is classified as a confirmed animal carcinogen with unknown relevance to humans (Group A3) by ACGIH (2007). No slope factors were available for molybdenum exposure by ingestion. For this reason, molybdenum was treated as a non-carcinogen by ingestion for this risk assessment.

Health Canada (2010) has derived a range of TDIs from Tolerable Upper Intake Levels (ULs) reported by the Institute of Medicine (IOM). ULs are "the highest level of daily intake likely to pose no risk of

adverse health effects for almost all individuals in the specified life stage group". The IOM used the NOAEL of 0.9 mg/kg/d for reproductive effects from a rat study to calculate the adult UL of 0.028 mg/kg bw/d. The IOM (2001) calculated the adult UL by dividing the NOAEL by a cumulative uncertainty factor of 30 (10 for interspecies and 3 for intraspecies variability). Health Canada adjusted the IOM ULs for age group and body weight to derive ULs of 0.028 mg/kg bw/day for humans 19 years of age and older, 0.027 mg/kg bw/day for 12 to 19 years, 0.023 mg/kg bw/day for 0 to 11 years (Health Canada, 2010).

The RIVM state that available data does not suggest that molybdenum is a genotoxic compound (2001). They do not provide a toxicological basis for the TDI of 0.010 mg/kg bw/d other than a NOAEL of 1 mg/kg/day in rats (Vermeire *et al*. 1991). Due to the minimal amount of information available, this value was not used.

The US EPA (1993) derived an oral RfD of 0.005 mg/kg bw/d based on increased serum uric acid levels in a human dietary exposure study in Armenia (Kovalskiy *et al.* 1961). The 6-year to lifetime dietary exposure study correlated the dietary intake of molybdenum with serum uric acid levels. The average daily intake of molybdenum was estimated to range from 0.14 to 0.21 mg/kg bw/day for an adult (US EPA 1993). Based on the results of the study, a molybdenum intake of 0.14 mg/kg bw/day could result in serum uric acid levels elevated above the average range of the adult population; this level was designated as a LOAEL. The US EPA (1993) applied a cumulative uncertainty factor of 30 to account for the use of a LOAEL (10) and sensitive individuals (3). A full factor of 10 was not used for the protection of sensitive individuals since the study was conducted in a relatively large human population, resulting in a chronic oral value of 0.005 mg/kg bw/d based on increased serum uric acid levels. This exposure limit was selected over the Health Canada ULs as it was derived from a studies of human exposure and is also the lower, more conservative value.

The WHO (2011) derived a TDI of 0.004 mg/kg bw/d from a 2-year study in Colorado based on humans exposed to molybdenum *via* drinking water (Chappell 1979). People were evaluated in one of two groups: low-molybdenum group (0.001 to 0.050 mg/L molybdenum in drinking water) and high-molybdenum group (≥ 0.2 mg/L in drinking water). No adverse health effects or abnormal serum uric acid or ceruloplasmin concentrations were observed in the low-molybdenum group. Increased urinary molybdenum and mean serum ceruloplasmin concentrations and decreased mean serum uric acid were observed in the high exposure group. However, since no adverse effects were observed in the high-exposure group, a NOAEL of 0.2 mg/L was identified. An uncertainty factor of 3 was applied by the WHO (2011) to account for intraspecies variability. A factor of 3 was considered adequate since molybdenum is an essential element. The WHO TDI was not used due to concerns about the quality of the primary study on which it was based (WHO 2011).

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28.0 NAPHTHALENE

28.1 Inhalation Exposure Limits

28.1.1 Acute Inhalation

Table B.28-1 Acute Inhalation Exposure Limits for Naphthalene

AGENCY	AEP	ATSDR	OMOE	OEHHA	ACGIH	TCEQ	WHO
Exposure Limit Type	-	-	Ambient Air Quality Criteria	-	**Short-term occupational exposure limit**	ESL	-
Exposure Limit Value (µg/m^3)	-	-	22.5	-	**570**[a]	200	-
Critical Organ or Effect	-	-	-	-	**Eye**	Odour	-
Species	-	-	-	-	**-**	-	-
Study	-	-	-	-	**Robbins 1951**	-	-
Source	AEP 2019	ATSDR 2013; 2005	OMOE 2012	OEHHA 2013	**ACGIH 2018**	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

[a]Adjusted from a STEL value of 75,000 µg/m^3 (NIOSH).

The TCEQ have recommended an ESL of 200 µg/m3 for short–term exposure to naphthalene based on odour (TCEQ 2013). This guideline is not health-based and no supporting documentation was provided for the odour threshold identified.

An occupational exposure limit for short-term exposure to naphthalene has been developed by NIOSH based on the potential for eye irritation. NIOSH (2016) recommends a short-term exposure limit (STEL) of 75 mg/m^3 for naphthalene.

The 15 minute STEL is set as the limit not to be exceeded during the course of a working day and was therefore determined to be an appropriate acute exposure limit. A 1 hour exposure limit was determined from the 15 minute STEL using the following equation, assuming neutral atmospheric conditions (*i.e.,* exponent equal to 0.2) (Duffee *et al.,* 1991):

$$Equivalent\ 1-hr\ Concentration = \frac{15\ \text{min}\ Concentration}{(60\ min/15min)^{0.2}}$$

The above calculation follows Haber's rule which assumes the inhalation toxic potential of a chemical is a constant that is a function of time and exposure concentration. The STEL adjusted to a 1 hour concentration is 57 mg/m^3 (rounded). Occupational exposure studies are considered less favorable as they are generally developed for the protection of adult workers, and as such, the procedures used to develop them are quite distinct from those used to protect the general public (Health Canada 2010). The NIOSH (2016) STEL was adjusted to a concentration of 570 µg/m^3 after an uncertainty factor of 100 (10 for use of an occupational exposure study and 10 for sensitive individuals within the population) was applied. The acute inhalation exposure limit of 570 µg/m^3 was selected for naphthalene within the current human health risk assessment (HHRA).

The TCEQ recommends an ESL of 440 µg/m^3 for short–term exposure to naphthalene based on odour (TCEQ 2015). This guideline is not health-based and no supporting documentation was provided for the odour threshold identified, therefore this value was not selected.

The OMOE recommends an Ambient Air Quality Criteria (AAQC) of 22.5 µg/m^3 based on a desirable concentration of contaminant in the air to protect against adverse health or environmental effects (OMOE 2012). The scientific documentation supporting the derivation of this guideline and its health endpoints was not available. This use of the OMOE value was requested by the JRP in IR 4.11 (May 3, 2019).

The ACGIH STEL of 570 µg/m^3 is still considered the most appropriate TRV for use as a surrogate as evaluation of acute inhalation exposure limits is based on Robbins (1951) study.

Naphthalene was included in the chemical groups for eye irritants following acute inhalation exposures.

28.1.2 Chronic Inhalation

Table B.26-2 Chronic Inhalation Exposure Limits for Naphthalene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	MRL	RfC	RfC RsC	-	-	**RfC**	-
Exposure Limit Value (µg/m³)	-	4	10	9 **0.3**	-	-	**3**	-
Critical Organ or Effect	-	Nasal lesions	Nasal cytotoxicity	Nasal lesions Nasal tumors	-	-	**Nasal lesions**	-
Species	-	Mouse, Rat	Rats	Mouse Rats	-	-	**Mouse**	-
Study	-	NTP 1992; Abdo *et al.*, 2001; NTP 2000	NTP 2000	NTP 1992 NTP 2000	-	-	**NTP, 1992**	-
Source	AEP 2019	ATSDR 2013; 2005	Health Canada 2013	OEHHA 2000; 2011	RIVM 2001	TCEQ 2013	**US EPA 1998**	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (2005) recommend a chronic inhalation MRL of 4 µg/m³ for naphthalene. This MRL was based on the occurrence of nasal lesions as reported in two chronic inhalation studies in mice (NTP 1992) and rats (Abdo *et al.* 2001; NTP 2000). Nasal lesions were observed at the lowest exposure levels (10 ppm; 45 mg/m³) in both studies. An increased incidence of lung tumours was reported in female mice but not observed in rats, however, an increased incidence of nasal tumors was reported in rats but not in mice (ATSDR 2005).

An RfC of 9 µg/m³ is recommended by the OEHHA (2000) for non-carcinogenic effects following chronic inhalation exposure to naphthalene. This RfC was based on the NTP (1992) LOAEL of 45 mg/m³ for respiratory lesions in mice. The OEHHA (2011) also recommend a unit risk value of 0.034 per mg/m³ for carcinogenic effects following chronic inhalation exposure to naphthalene. This corresponds to an RsC of 0.3 µg/m³ assuming a 1 in 100,000 (1x10-5) excess lifetime cancer risk. Unit risk factors were developed for naphthalene using benchmark dose methodology and tumour incidence data for female mice, male rats and female rats (NTP 1992; 2000). The selected unit risk

factor was for the male rat (NTP 2000), the species most sensitive to naphthalene exposure *via* inhalation (OEHHA 2011).

IARC (2013) has classified naphthalene as possibly carcinogenic to humans (Group 2B). The NTP (2011) concluded that naphthalene is reasonably anticipated to be a human carcinogen based on sufficient evidence from studies in experimental animals. This evidence was provided in the NTP (2000) study in which chronic exposure to naphthalene produced highly malignant and extremely rare tumors of the lining of the nose of rats. The mechanism for naphthalene carcinogenesis is not clear but formation of a specific stereoisomer of naphthalene oxide (1R,2S-) as well as oxidative damage and DNA breakage may play a role (NTP 2011).

The US EPA (1998) developed an RfC of 3 $\mu g/m^3$ for naphthalene based on nasal lesions in mice (hyperplasia and metaplasia) as reported by NTP (1992). Although this study reported tumours in the female mouse lung (alveolar/bronchiolar carcinomas), the US EPA did not consider the tumour incidence to be related to naphthalene exposure as it was within the range of incidence in historical controls.

Health Canada (2010) is reviewing the TC for naphthalene and no value is currently available. Health Canada (2013) recommends a chronic RfC of 10 $\mu g/m^3$ as the chronic exposure limit for naphthalene in the indoor residential environment. This value is based on a chronic LOAEL of 52 mg/m^3 for nasal cytotoxicity from an NTP (2000) study using rats. The LOAEL was adjusted to 9.3 mg/m^3 for continuous exposure and divided by a cumulative uncertainty factor of 1,000 for database deficiencies (10), interspecies variability (10) and intraspecies variability.

It is noted that a more recent review of the inhalation cancer assessment for naphthalene was conducted by US EPA (2004) in which a draft unit risk value was provided, based on the increased incidence of nasal tumors in rats reported by NTP (2000). However, this document was archived in 2004 (US EPA 2004) and as of May 2015 no changes have been made to the IRIS inhalation assessment for naphthalene as a result of this assessment. The US EPA has determined a toxicological review of naphthalene should be conducted; the process has not yet started (US EPA 2015).

The majority of agencies have developed chronic inhalation exposure limits based on the non-carcinogenic effects (nasal lesions) of naphthalene reported in mice and rats. However, the NTP (2011) suggest naphthalene could be carcinogenic to humans and the OEHHA (2011) has recommended a unit risk value for naphthalene based on the carcinogenic effects in rats (nasal tumours) reported by the NTP (2000).

For the purpose of this assessment both carcinogenic and noncarcinogenic endpoints for naphthalene were evaluated. The OEHHA (2011) RsC of 0.3 $\mu g/m^3$ was selected for the assessment of carcinogenic

effects and the US EPA RfC of 3 μg/m³ was selected for the assessment of noncarcinogenic effects following chronic inhalation exposure to naphthalene. Naphthalene was included in the chemical groups for nasal tumors and nasal irritation following chronic inhalation exposures.

28.2 Oral Exposure Limits

No chronic oral exposure limit was required for naphthalene as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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29.0 NICKEL

29.1 Inhalation Exposure Limits

29.1.1 Acute Inhalation

Table B.29-1 Acute Inhalation Exposure Limits for Nickel

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	1 hour AAQO	24 hour AAQC	-	**1 hour REL**	1 hour ReV	-
Exposure Limit Value (µg/m³)	6	0.1 (PM_{10}) 0.2 (TSP)	-	**0.2**	1.1	-
Critical Organ or Effect	-	Adverse Health Effects	-	**Immune System**	Respiratory	-
Species	-	-	-	**Mice**	Human	-
Study	-	-	-	**Graham *et al.* 1978**	Cirla *et al.* 1985	-
Source	Alberta Government 2013	OMOE 2012	-	**OEHHA 2012b**	TCEQ 2011	-

- not available

Bold – Exposure Limit selected for HHRA.

ESRD (2013) uses an AAQO of 6 µg/m³ for a 1-hour averaging period. This value was adopted from an outdated OEHHA value (OEHHA 2008). Since the OEHHA has changed its REL, the ESRD AAQO was not used in the current assessment.

The OMOE uses an AAQC of 0.1 µg/m³ (PM10) and 0.2 µg/m³ (TSP) for a 24-hour averaging period for nickel (OMOE 2012). This criterion is based on adverse health effects; however, the specific derivation is unclear.

The OEHHA (2012b) report an acute REL of 0.2 µg/m³ for nickel and common nickel compounds, with the exception of nickel carbonyl due its unique toxicity. The OEHHA reports available human studies were limited to case reports and small occupational clinical studies with limited reporting and inadequate exposure data. Therefore, the 1-hour REL was based on an inhalation study using mice (Graham *et al.* 1978), with the critical effect being a depressed antibody response. The dose response data from the Graham *et al.* (1978) study was used to calculate a BMDL of 165 µg Ni/m³ and an

extrapolated 1-hour concentration of 233 µg Ni/m³ was derived. A cumulative uncertainty factor of 1000 was applied to the extrapolated 1-hour concentration to account for uncertainty related to the benchmark response rate (√10), interspecies differences (10) and intraspecies variability (30). The resultant 1-hour REL of 0.2 µg Ni/m³ was used for the acute inhalation assessment. An 8-hour REL of 0.06 µg/m³ was also reported but was not used in the assessment since it was based on repeated 8-hour exposures.

The TCEQ (2011) derived a 1-hour ReV of 1.1 µg/m³ for inorganic, soluble and metallic nickel compounds. Organic nickel compounds such as nickel carbonyl are not covered by this ReV. Acute inhalation studies suggest that nickel sulphate is the most toxic inorganic form. The 1-hour ReV was derived based on a human study by Cirla *et al.* (1985), with support from an animal study by Graham *et al.* (1978). The human exposure study was based on a group of seven metal plating workers with occupational asthma who were evaluated for atopy and pulmonary function challenge in response to inhalational challenge with nickel sulfate hexahydrate and other metals. A LOAEL of 67 µg/m³ from the Cirla *et al*. (1985) study was associated with significant bronchoconstriction. This LOAEL was chosen since it was based on a human study which involved a sensitive population (occupational asthmatics). The LOAEL from the primary human study was adjusted for continuous exposure to 33.5 µg/m³. A cumulative uncertainty factor of 30 was applied to account for the use of a LOAEL (10) and for database uncertainties (3), resulting in a human-based 1-hour ReV of 1.1 µg/m³.

29.1.2 Chronic Inhalation

Table B.29-2 Chronic Inhalation Exposure Limits for Nickel

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	AAQO	MRL	**RsC** **TC**	RsC REL	TCA	RsC ReV	RsC	RsC
Exposure Limit Value (µg/m³)	0.05	0.09	0.0077 (RsC, oxidic/sulphidic/soluble) 0.014 (RsC, soluble) 0.02 (TC, oxidic) 0.018 (TC, subsulphide) **0.0035 (TC, sulphate)** 0.018 (TC, metallic)	0.04 (RsC) 0.014 (REL, nickel and compounds) 0.02 (REL, nickel oxide)	0.05	0.059 (RsC) 0.23 (ReV)	0.04 (refinery dust) 0.02 (subsulphide)	0.025

Table B.29-2 Chronic Inhalation Exposure Limits for Nickel

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	Lung	Lung	**Lung Cancer** **Lung**	Lung and Nasal Cancers Lung	Lung	Lung Cancer	Lung Cancer	Lung Cancer
Species	Rats	Rats	**Human (cancer)** **Mice, rats, rabbits (non cancer)**	Human (cancer) Rat (non cancer)	-	Human	Human	Human
Study	NTP 1996	NTP 1996	**Doll *et al.* 1990 (cancer)** **Multiple (non cancer)**	Multiple (cancer) NTP 1994 (non cancer)	-	Multiple (cancer) NTP 1996 (non cancer)	Multiple	-
Source	ESRD 2013	ATSDR 2005	**Health Canada 2010**	OEHHA 2002 (cancer) OEHHA 2012 a,b (non cancer)	-	TCEQ 2011	US EPA 1991a and 1991b	Anderson *et al.* 1992 and 1996

- not available

Bold – Exposure Limit selected for HHRA.

Nickel compounds are classified as carcinogenic to humans by IARC (Group 1) and NTP (Group K); insoluble nickel compounds are classified as confirmed human carcinogens by ACGIH (Group A1); and ,metallic nickel and alloys are considered to be possible human carcinogens by IARC (Group 2B) and as reasonably expected to be human carcinogens by NTP (Group R). Several cancer based and non-cancer based exposure limits have been derived for nickel.

Health Canada (2010) derived a combined inhalation unit risk of 1.3 per mg/m^3 for oxidic, sulphidic and soluble nickel, which equates to an RsC of 0.0077 µg/m^3. Health Canada also derived a unit risk estimate of 0.71 per mg/m^3 for soluble forms of nickel (equivalent to an RsC of 0.014) based on the same epidemiological data set (Doll *et al.* 1990), although this limit was not selected since it is less conservative. The unit risk of 1.3 per mg/m^3 (for combined forms of nickel) was based on lung cancer mortality data collected from epidemiological studies of exposed workers. The unit risk was derived from a TC05 (5% increase in mortality due to lung cancer) of 0.04 mg/m^3. This value corresponds to

an excess lifetime risk of one in 100,000. The corresponding inhalation RsC of 0.0077 µg/m³ based on lung cancer was used in the chronic carcinogenic assessment of nickel.

The TCEQ (2011) derived a unit risk of 1.7 x 10-4 per mg/m³ for nickel, which equates to an RsC of 0.059 µg/m³. The unit risk was based on the incidence of lung cancers in two human occupational studies (Grimsrud *et al.* 2003 and Enterline and Marsh 1982). The data sets were adjusted for continuous exposure due to the differences in exposure frequency between workers and the general population. Poisson regression and maximum likelihood estimates were used to estimate the dose-response relationship in support of the derivation of a combined URE. The ESL was derived from the combined URE of 1.74 × 10-4 per µg/m³, which is equivalent to an RsC of 0.059 µg/m³. This value was not used, due to the availability of the more conservative Health Canada RsC value.

The OEHHA (2002) derived a cancer unit risk estimate of 2.6 x 10-4 (µg/m³)-1, equivalent to an RsC of 0.04 µg/m³, for nickel and nickel compounds. This value is based on human epidemiological data (Chovil *et al.* 1981, Roberts *et al.* 1983, Muir *et al.* 1984 and ICNCM 1990) for occupational workers from a nickel refinery in Ontario and are based on mortalities from lung and nasal cancers. A linear relative risk model was used to fit the data. Excess cancer risk for smokers was assumed to be the same as for non-smokers. Standard mortality ratios were plotted against cumulative exposure. The 95% upper confidence limit of the slope of the linear regression data was determined to be 11.26. This value was adjusted for continuous exposure (8/24 days × 5/7 days/week × 48/52 weeks/year) and the upper bound unit risk value of 2.6 x 10-4 (µg/m³)-1 was calculated. Since the Health Canada value is more conservative, this value was not selected.

The US EPA (1991a, 1991b) derived RsC values for both refinery dust and nickel subsulfide. The RsC for refinery dust was determined using data sets from studies at four different nickel refineries (Chovil *et al.* 1981, Peto *et al*. 1984, Magnus *et al*. 1982, Enterline and Marsh 1982). Additive and multiplicative excess risk models were fitted to each data set whenever possible. The unit risk estimates ranged from 0.000011 µg/m³ to 0.00046 µg/m³, with the midpoint of 0.00024 µg/m³ being considered the best estimate. This URE equates to an RsC of 0.04 µg/m³. The RsC for nickel subsulfide was derived using the same four data sets from occupationally exposed workers at nickel refineries. Since nickel subsulfide is a major component of nickel refinery dust and produces the highest incidence of tumors for nickel compounds in animals (US EPA 1991b), the incremental unit risk estimate of nickel refinery dust (0.00024 µg/m³) was used with a multiplication factor of 2 to account for the roughly 50% nickel subsulfide composition. The URE of 0.00048 is equivalent to an RsC of 0.02 µg/m³. The US EPA RsCs were not selected since the Health Canada value is more conservative and considered several forms of nickel.

The WHO (2000) derived an RsC of 0.025 µg/m³ for nickel using studies with occupationally exposed humans (Anderson *et al.* 1992 and 1996). An incremental risk of 3.8 × 10-4 was estimated for 1 µg/m³

of nickel in air, based on exposure and risk information estimated for industrial populations. This value was not used since supporting documentation describing study details was not available.

The RIVM (2001) derived a chronic TCA of 0.05 µg/m³ based on a NOAEC of 30 µg/m³ for the incidence of alveolar macrophage activity. However, the basis for this value is not presented, therefore, the RIVM value was not selected.

The OEHHA (2012a, b) derived a chronic REL of 0.014 µg/m³ for nickel and its compounds and 0.02 µg/m³ for nickel oxide, both based on lung inflammation. Minimal differences were observed in the toxicological data between insoluble and soluble nickel compounds, with the exception of nickel oxide. The chronic REL for nickel and nickel compounds is based on a NTP inhalation study (NTP 1994) using rats. Benchmark dose analysis identified a BMDL05 of 30.5 µg Ni/m³ based on alveolar proteinosis in male and female rats. The BMDL05 was adjusted for chronic exposure to 5.4 µg Ni/m³ and a human equivalent concentration of 1.4 µg Ni/m³was calculated. A cumulative uncertainty factor of 100 was applied for interspecies variability (√10) and intraspecies variability (30). The chronic REL for nickel oxide is based on a NTP inhalation study (NTP 1996) in which male and female rats and mice were exposed to nickel oxide/m³ by inhalation. A BMDL05 of 117 µg Ni/m³ was identified based on alveolar proteinosis. A human equivalent concentration of 2.0 µg Ni/m³ was calculated, to which a cumulative uncertainty factor of 100 was applied for intraspecies and interspecies variability, resulting in a final REL of 0.02 µg Ni/m³.

Health Canada (2010) also derived non-carcinogenic values for various forms of nickel compounds based on respiratory effects. Tolerable concentrations of 0.020 µg/m³ (nickel oxide), 0.018 µg/m³ (nickel subsulphide), 0.0035 µg/m³ (nickel sulphate), and 0.018 µg/m³ (metallic nickel) were derived based on various studies (Spiegelberg *et al.* 1984, Benson *et al.* 1990, Dunnick *et al.* 1989, Johansson *et al.* 1983) on mice, rats or rabbits.

The TCEQ (2011) derived a chronic ReV for inorganic and metallic nickel compounds of 0.23 µg/m³. In the key study, male and female rats and mice were exposed to nickel sulphate hexahydrate for 6 hours plus 8 minutes/day, 5 days/week for a duration of 104 weeks (NTP 1996). A NOAEL of 0.03 mg/m³ for respiratory inflammation was identified. Benchmark dose modelling was completed on macrophage hyperplasia and alveolar proteinosis data sets. This analysis revealed that the BMC were very similar to the NOAEL, and thus the NOAEL was selected as the POD for the calculation of the ReV. The NOAEL was adjusted for continuous exposure to 5 µg/m³ and a human equivalent of 7 µg/m³ was calculated. A cumulative uncertainty factor of 30 was applied to account for interspecies differences (3), and intraspecies differences (10), resulting in the chronic ReV of 0.23 µg/m³. Because the OEHHA REL is more conservative, the TCEQ ReV was not used.

The ATSDR (2005) derived a chronic MRL of 0.09 µg/m³ based on lung inflammation and fibrosis in rats (NTP 1996). Male and female rats were exposed to nickel sulphate hexahydrate. The lowest exposure concentration of 0.03 mg nickel/m³ was selected by the ATSDR as a NOAEL for respiratory effects. This NOAEL was adjusted for continuous exposure to a NOAELADJ of 0.0054 mg nickel/m³ and for human exposure to a NOAELHEC of 0.0027 mg nickel/m³. A cumulative uncertainty factor of 30 was applied to the NOAELHEC to account for interspecies differences (3) and intraspecies variability (10). The ATSDR value was not used in the assessment since the OEHHA value is more conservative.

The ESRD (2013) AAQO of 0.05 µg/m³ was adopted from an outdated OEHHA REL for nickel and compounds.

29.2 Oral Exposure Limits

29.2.1 Chronic Oral

Table B.29-3 Chronic Oral Exposure Limits for Nickel

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	TDI	**REL**	RfD	RfD	TDI
Exposure Limit Value (mg/kg bw/day)	-	0.010 (nickel chloride) 0.010 (nickel sulphate)	**0.011**	0.050	0.020	0.012
Critical Organ or Effect	-	Perinatal mortality	**Perinatal mortality**	-	Body Weight	Body Weight
Species	-	Rats	**Rats**	Rats	Rats	Human
Study	-	SLI 2000	**NiPERA 2000**	Vermeire *et al.* 1991	Ambrose *et al.* 1976	Nielsen *et al.* 1999
Source	-	Health Canada 2010	**OEHHA 2012b**	RIVM 2001	UA EPA 1996	WHO 2005

- not available

Bold – Exposure Limit selected for HHRA.

Nickel compounds are classified as carcinogenic to humans by IARC (Group 1) and NTP (Group K); insoluble nickel compounds are classified as confirmed human carcinogens by ACGIH (Group A1); and ,metallic nickel and alloys are considered to be possible human carcinogens by IARC (Group 2B)

and as reasonably expected to be human carcinogens by NTP (Group R). No defensible slope factors were available for Nickel exposure by ingestion. For this reason, Nickel was treated as a non-carcinogen by ingestion for this risk assessment.

The OEHHA (2012b) derived a chronic oral REL of 0.011 mg/kg bw/day based on a study of male and female Sprague Dawley rats exposed to nickel *via* aqueous gavage (NiPERA 2000). The OEHHA identified 1.12 mg/kg/day as the study NOAEL based on perinatal mortality. A cumulative uncertainty factor of 100 was applied to account for interspecies (10) and intraspecies (10) variations. This value was selected for use in the assessment of nickel over the WHO value, due to limitations in the design of the study used by WHO.

The WHO (2005) derived a TDI of 0.012 mg/kg bw/d based on a study with 12 adult females with known nickel sensitivity (Nielsen *et al.* 1999). In this study, nickel was administered as a single dose at a level that is much higher than would normally be possible through drinking-water and/or with the presence of food in the stomach, which would significantly reduce the absorption. No uncertainty factors were applied to the LOAEL of 0.012 mg/kg bw/d in the derivation of the TDI since the LOAEL was based on a highly sensitive human population. Due to limitations of study design (acute duration, small number of subjects, single-blinding), this TDI was not selected for use in the assessment.

Health Canada (2010) uses a TDI of 0.011 mg/kg bw/d for nickel chloride and nickel sulphate. The WHO (2005) is cited as the source of the TDI based on a study with rats (SLI 2000). This value was not selected since the WHO uses a TDI based on human studies (WHO 2005).

The US EPA (1996) derived an oral RfD of 0.020 mg/kg bw/d for nickel soluble salts. The primary study (Ambrose *et al*. 1976) involved rats that were fed nickel in their diet over 2 years. No adverse effects on body weight and organ weights were observed. A NOAEL of 5 mg/kg bw/d was identified for decreased body and organ weights. A cumulative uncertainty factor of 300 was applied to the NOAEL to account for interspecies variability (10), intraspecies variability (10) and to account for inadequacies in the reproductive studies (3). Several limitations in study design (low statistical power) and a poor survival rate over the study duration were highlighted by the US EPA. As a result, the US EPA value was not selected.

The RIVM (2001) provide a TDI of 0.050 mg/kg/day based on a subchronic study of nickel sulphate in rats. A NOAEL of 5 mg/kg/day was identified but details of the supporting study were not provided; therefore, this value was not selected.

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30.0 NITROGEN DIOXIDE

30.1 Inhalation Exposure Limits

30.1.1 Acute Inhalation

Table B.30-1 Acute Inhalation Exposure Limits for Nitrogen Dioxide

AGENCY	AEP	ATSDR	CCME[1]	HEALTH CANADA	OEHHA	TCEQ	US EPA	WHO
Exposure Limit Type	1-hour AAQO	-	1-hour CAAQS	-	1-hour REL	-	**1-hour NAAQS**	1-hour
Exposure Limit Value ($\mu g/m^3$)	300	-	79	-	470	-	**188**	200
Critical Organ or Effect	Respiratory system	-	-	-	Respiratory system		**Respiratory system**	Respiratory system
Species	Human	-	-	-	Human	-	**Human**	Human
Study	Various	-	-	-	CARB, 1992	-	**Various**	Various
Source	AEP 2019	ATSDR 2013	CCME 2014	-	OEHHA 2008; 2013	TCEQ 2013	**US EPA 2008; 2012**	WHO 2005

- not available

Bold – Exposure Limit selected for HHRA.

1 CCME CAAQS were included in the HHRA in response to IR HC-3 (Addendum 6, CEAA #70, April 30 2018).

Clinical studies of controlled human exposure have reported increased airway responsiveness to inhaled allergens in sensitive individuals as a result of acute exposure to nitrogen dioxide while epidemiological studies have correlated ambient nitrogen dioxide exposure with increased respiratory symptoms, emergency department visits and hospital admissions (AENV 2011; 2007; US EPA 2008).

Alberta currently recommends a 1-hour air quality objective of 300 $\mu g/m^3$ for nitrogen dioxide to protect against respiratory effects (AEP 2019). The US EPA (2008; 2012) has implemented a 1-hour NAAQS of 188 $\mu g/m^3$ to protect against the respiratory effects of nitrogen dioxide. This standard considers the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum nitrogen dioxide concentrations.

The OEHHA (2008; 2013) recommends a 1-hour REL of 470 µg/m^3. This REL was equivalent to a NOAEL for increased airway reactivity in asthmatics exposed to nitrogen dioxide for 1 hour (CARB, 1992).

In controlled exposure studies, acute effects on the pulmonary function of asthmatics were observed at nitrogen dioxide concentrations levels greater than 500 µg/m^3, with one meta-analysis suggesting an increase in bronchial responsiveness in asthmatics exposed to air concentrations above 200 µg/m^3 (Folinsbee, 1992; WHO 2005). The WHO (2005) has therefore set a 1-hour exposure limit of 200 µg/m^3 for short-term exposure to nitrogen dioxide.

Considering the weight of available evidence for airway reactivity of susceptible individuals (*i.e.*, asthmatics) exposed to nitrogen dioxide, the lowest reported exposure limit, US EPA NAAQS of 188 µg/m^3, was selected for use in the acute effects assessment of nitrogen dioxide. Nitrogen dioxide was included in the chemical group for respiratory irritation following acute inhalation exposures.

In answer to IR HC-3 (Addendum 6, CEAA #70, April 30 2018) the CCME CAAQS were also included. The Government of Alberta does not support the use of CAAQS for assessment of predictive (modelled) air data.

Additionally, in their assessment of potential risk associated with ambient exposure to NO_2, Health Canada conducted a detailed review of the available data (Health Canada 2016). Health Canada concluded that potential effects have been demonstrated at concentrations lower than the ambient standards previously used for air quality assessment and that there was no clear evidence of a threshold dose below which no adverse health effects were reported. For this reason, CAAQS were recommended by Health Canada (Health Canada 2016) and established by CCME in 2017. The health basis and calculations of the CCME CAAQS have not be published; therefore, an assessment of the basis for the selected CAAQS as protective of health could not be conducted.

30.1.2 Chronic Inhalation

Table B.30-2 Chronic Inhalation Exposure Limits for Nitrogen Dioxide

AGENCY	AEP	ATSDR	CCME[1]	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	Annual average	-	Annual CAAQs	-	-	-	-	Annual Average NAAQS	**Annual Average-**

Table B.30-2 Chronic Inhalation Exposure Limits for Nitrogen Dioxide

AGENCY	AEP	ATSDR	CCME[1]	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Value (µg/m³)	45	-	23	-	-	-	-	100	**40**
Critical Organ or Effect	Vegetation effects	-	-	-	-	-	-	Respiratory system	**Respiratory system**
Species	Plant	-	-	-	-	-	-	Human	**Human**
Study	-	-	-	-	-	-	-	Various	**Various**
Source	AEP 2013	ATSDR 2013	CCME 2014	-	OEHHA 2013	RIVM, 2001	TCEQ 2013	US EPA 2008; 2012	**WHO 2005; 2000**

- not available

Bold – Exposure Limit selected for HHRA.

1 CCME CAAQS were included in the HHRA in response to IR HC-3 (Addendum 6, CEAA #70, April 30 2018).

The AEP (2019) has established an annual average guideline of 45 µg/m³ for nitrogen dioxide. This exposure limit was based on potential effects on vegetation (AENV 2011).

The WHO (2000; 2005) established an annual average guideline value of 40 µg/m³ for nitrogen dioxide. In the absence of a particular study or set of studies that clearly support an annual average guideline, the WHO considered background ambient levels of 15 µg/m³ and evidence of a 20% increase in respiratory illness in primary children with an increase of 28 µg/m³ nitrogen dioxide indoors (averaged over 1 year) (WHO 1997).

The US EPA (2012) annual standard for nitrogen dioxide is 100 µg/m³. This exposure limit is based on limited evidence to support a link between long-term exposure to nitrogen dioxide and adverse respiratory effects, particularly for persons with pre-existing pulmonary dysfunction (US EPA 2008).

The lowest reported annual exposure limit (WHO guideline of 40 µg/m³) was selected for the assessment of chronic inhalation exposure to nitrogen dioxide.

As discussed in the section above, the CCME CAAQS were included in answer to IR HC-3 (Addendum 6, CEAA #70, April 30, 2018).

30.2 Oral Exposure Limits

No chronic oral exposure limit was required for nitrogen dioxide as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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31.0 PARTICULATE MATTER <2.5 μM IN DIAMETER (PM2.5)

31.1 Inhalation Exposure Limits

31.1.1 Acute Inhalation

Table B.31-1 Acute Inhalation Exposure Limits for $PM_{2.5}$

AGENCY	AEP	ATSDR	CCME	CARB	TCEQ	US EPA	WHO
Exposure Limit Type	24-hour AAQO	-	24-hour CAAQS	-	-	24-hour	24-hour
Exposure Limit Value ($\mu g/m^3$)	30	-	**27**-30	-	-	35	25
Critical Organ or Effect	Adopted 2000 CWS		Population mortality and morbidity			Population mortality and morbidity	Population mortality and morbidity
Species	Human	-	Human	-	-	Human	Human
Study	Various	-	Various	-	-	Various	Various
Source	ESRD 2013	ATSDR 2013	CCME 2000; 2012	CARB 2009	TCEQ 2013	US EPA 2012; 2009	WHO 2005

- not available

Bold – Exposure Limit selected for HHRA.

The CCME (2000) developed a 24-hour Canada Wide Standard (CWS) of 30 $\mu g/m^3$ for $PM_{2.5}$ based on the 3-year average of the annual 98th percentile of the 24-hour average concentrations. The impetus behind the development of a guideline for fine particulate matter (PM<2.5 μm) was the weight of available evidence for an association between acute exposure to ambient fine particulate matter and increased population mortality and morbidity, reported in numerous epidemiological studies from the US, Canada, Britain and Europe (WGAQOG 1998; Health Canada 2000; 2006).

In May 2013, Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$ were published in the Canada Gazette (Vol 147, No. 21). The CAAQS will replace the existing CWS for fine particulate matter. The 24-hour standard to be achieved by 2015 will be 28 $\mu g/m^3$ (3 year average of the annual 98th percentile of the 24-hour average concentrations) with a slightly more stringent standard of 27 $\mu g/m^3$ recommended for 2020 (CCME 2012).

The US EPA (2012) implemented a 24-hour primary standard (NAAQS) of 35 $\mu g/m^3$ for $PM_{2.5}$ based on the 3-year average of 98th percentile concentrations. This standard is intended to increase

protection against adverse health effects associated with acute exposure to respirable particles, including premature mortality and increased hospital admission and emergency room visits (US EPA 2009).

The WHO (2005) established a 24-hour guideline of 25 µg/m^3 for $PM_{2.5}$, representing the 99th percentile of the distribution of daily concentrations over a year. Epidemiological studies have established a link between short-term PM exposure and measures of mortality and morbidity while toxicological research has proposed various mechanisms by which PM may exacerbate acute diseases, a central mechanism being inflammation due to the production of reactive oxygen species (WHO 2005). The WHO recognizes this exposure limit may be difficult for some countries to attain and has recommended three interim 24-hour target levels of 75 µg/m^3, 50 µg/m^3 and 37.5 50 µg/m^3 as a stepped approach for countries as they develop successive and sustained abatement measures to move towards eventual compliance with the 25 µg/m^3 guideline (WHO 2005).

The CAAQS of 27 µg/m^3 was selected for the assessment of acute inhalation exposure to $PM_{2.5}$.

31.1.2 Chronic Inhalation

Table B.31-2 Chronic Inhalation Exposure Limits for $PM_{2.5}$

AGENCY	AEP	ATSDR	CCME	CARB	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	Annual Average CAAQS	Annual Average	-	-	Annual Average NAAQS	Annual Average
Exposure Limit Value (µg/m^3)	-	-	**8.8**-10	12	-	-	12	10
Critical Organ or Effect	-	-	Premature mortality	Population mortality and morbidity	-	-	Population mortality and morbidity	Population mortality and morbidity
Species	-	-	Human	Human	-	-	Human	Human
Study	-	-	Various	Various	-	-	Various	Pope *et al.*, 2002 and others
Source	ESRD 2013	ATSDR 2013	CCME 2012	CARB 2009	RIVM, 2001	TCEQ 2013	US EPA 2012; 2009	WHO 2005; 2000

- not available

Bold – Exposure Limit selected for HHRA.

Annual average CAAQS for $PM_{2.5}$ were also published in the Canada Gazette in May 2013. The annual average standard to be achieved by 2015 will be 10 $\mu g/m^3$ (3 year average of the annual average concentrations) with a slightly more stringent standard of 8.8 $\mu g/m^3$ recommended for 2020 (CCME 2012).

The California Air Resources Board (CARB, 2009) have established an annual ambient air quality standard of 12 $\mu g/m^3$ (arithmetic mean) for $PM_{2.5}$ to protect against: increased risk of hospitalization for lung and heart-related illness; premature death of the elderly and individuals with compromised pulmonary function, and; reduced lung function or increased respiratory symptoms/illness in children.

The US EPA (2012) has implemented a primary annual standard (NAAQS) of 12 $\mu g/m^3$ for $PM_{2.5}$ based on the 3-year average of 98th percentile concentrations. The annual standard is intended to continue protection against adverse health effects associated with chronic exposure to respirable particles, including premature mortality and development of chronic respiratory disease (US EPA 2009).

The WHO (2005) have established an annual mean guideline of 10 $\mu g/m^3$ for $PM_{2.5}$, representing the lower end of the air concentration range in the American Cancer Society (ACS) epidemiological study at which robust associations were reported between mortality and long-term exposure to $PM_{2.5}$ (Pope *et al.*, 2002). In addition to this guideline the WHO has recommended three interim target levels of 35, 25 and 15 $\mu g/m^3$ as a stepped approach for countries as they develop successive and sustained abatement measures to move towards eventual compliance with the 10 $\mu g/m^3$ guideline (WHO 2005). Adherence to the annual average guideline is recommended over 24-hour targets for $PM_{2.5}$, however, the 24-hour average is intended to protect against peaks of pollution that would lead to substantial excess morbidity or mortality (WHO 2005).

The CAAQS of 8.8 $\mu g/m^3$ was selected for the assessment of chronic inhalation exposure to $PM_{2.5}$.

31.2 Oral Exposure Limits

The adverse health effects of $PM_{2.5}$ are mediated through inhalation and therefore no evaluation of oral exposure was conducted.

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32.0 PARTICULATE MATTER >10 μM IN DIAMETER (PM_{10})

32.1 Inhalation Exposure Limits

32.1.1 Acute Inhalation

Table B.32-1 Acute Inhalation Exposure Limits for PM_{10}

AGENCY	AEP	ATSDR	CCME	CARB	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	24-hour	-	24-hour	**24-hour**
Exposure Limit Value ($\mu g/m^3$)	-	-	-	50	-	150	**50**
Critical Organ or Effect	-		-	Population mortality and morbidity		Population mortality and morbidity	**Population mortality and morbidity**
Species	-	-	-	-	-	Human	**Human**
Study	-	-	-	-	-	Various	**Various $PM_{2.5}$ studies**
Source	-	-	-	CARB 2009	-	US EPA 2012; 2010	**WHO 2005**

- not available

Bold – Exposure Limit selected for HHRA.

CARB has established a 24-hour standard for PM_{10} of 50 $\mu g/m^3$ (2009).

The US EPA (2012) established a 24-hour primary standard (NAAQS) of 150 $\mu g/m^3$ for PM_{10} (not to be exceeded more than once per year on average over 3 years).

The WHO recommended guidelines and interim targets for PM_{10} to protect against harmful effects of coarse fragments. Due to insufficient quantitative evidence on coarse PM, the numerical guideline value for PM_{10} was based on studies using $PM_{2.5}$ as an indicator and a $PM_{2.5}$:PM_{10} ratio of 0.5 (WHO 2005). A 24-hour guideline of 50 $\mu g/m^3$ for PM_{10} was recommended, based on the 99th percentile of the distribution of daily concentrations over a year for $PM_{2.5}$ (25 $\mu g/m^3$) and the indicator ratio. The WHO recognizes this exposure limit may be difficult for some countries to attain and has recommended three interim 24-hour target levels of 150 $\mu g/m^3$, 100 $\mu g/m^3$ and 75 $\mu g/m^3$ as a stepped approach for

countries as they develop successive and sustained abatement measures to move towards eventual compliance with the 50 μg/m³ guideline (WHO 2005).

The WHO guideline of 50 μg/m³ was selected for the assessment of acute inhalation exposure to PM_{10}.

32.1.2 Chronic Inhalation

Table B.32-2 Chronic Inhalation Exposure Limits for PM_{10}

AGENCY	AEP	ATSDR	CCME	CARB	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	Annual Average	-	-	-	**Annual Average**
Exposure Limit Value (μg/m³)	-	-	-	20	-	-	-	**20**
Critical Organ or Effect	-	-	-	Population mortality and morbidity	-	-	-	**Population mortality and morbidity**
Species	-	-	-	Human	-	-	-	**Human**
Study	-	-	-	Various	-	-	-	**Various $PM_{2.5}$ studies**
Source	-	-	-	CARB 2009	-	-	-	**WHO 2005**

- not available

Bold – Exposure Limit selected for HHRA.

CARB has established an annual average standard for PM_{10} of 20 μg/m³ (2009).

The US EPA (2012) revoked the annual standard for PM_{10} because available evidence generally did not suggest a link between long-term exposure to current ambient levels of coarse particles and health welfare effects (US EPA 2010).

Due to insufficient quantitative evidence on coarse PM, the numerical guideline value for PM_{10} was based on studies using $PM_{2.5}$ as an indicator and a $PM_{2.5}$:PM_{10} ratio of 0.5 (WHO 2005). An annual guideline of 20 μg/m³ for PM_{10} was recommended, based on the 99th percentile of the distribution of daily concentrations over a year for $PM_{2.5}$ (10 μg/m³) and the indicator ratio. The WHO recognizes this exposure limit may be difficult for some countries to attain and has recommended three interim annual target levels of 70 μg/m³, 50 μg/m³ and 30 μg/m³ as a stepped approach for countries as they

develop successive and sustained abatement measures to move towards eventual compliance with the 20 μg/m^3 guideline (WHO 2005).

The WHO guideline of 20 μg/m^3 was selected for the assessment of chronic inhalation exposure to PM_{10}.

32.2 Oral Exposure Limits

The adverse health effects of PM_{10} are mediated through inhalation and therefore no evaluation of oral exposure was conducted.

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33.0 PETROLEUM HYDROCARBONS

Complex mixtures of petroleum hydrocarbons (PHC) with limited data to describe toxicological properties have been separated into aromatic and aliphatic groups (fractions) according to size to facilitate the development of exposure limits representative of each group of hydrocarbons (MA DEP 1994; TPHCWG 1997; MA DEP 2003; CCME 2008). The Massachusetts Department of Environmental Protection (MA DEP) introduced the concept of using size-based fractions for evaluation of human health effects associated with petroleum hydrocarbons with the development of oral toxicity values representative of groups of aliphatic (C5-C8, C9-C18, and C19-C32) and aromatic (C9-C32) PHC. In 2002, the MA DEP revised their oral exposure limits and developed inhalation exposure limits for their aliphatic and aromatic PHC groups (MA DEP 2003).

In 1997 the Total Petroleum Hydrocarbon (TPH) Criteria Working Group identified oral as well as inhalation exposure limits for similar aliphatic (C5-C8, C9-C16, and C17-C35) and aromatic (C9-C16 and C17-C35) PHC groups (TPHCWG 1997). The ATSDR (1999a) identified chronic inhalation and/or oral MRLs using surrogate chemicals to represent aliphatic (C5-C8 and C9-C16) and aromatic (C5-C9, C10-C16, and C17-C35) PHC groups.

The CCME (2008) separated PHC into the following aliphatic and aromatic fractions: C6-C10; C11-C16; C17-C34; and C34+. The CCME adopted the TPHCWG (1997) chronic oral and inhalation toxicological endpoints in their development of Canada Wide Standards for PHC in soil (CCME 2008). For the purpose of the current assessment, PHC were separated into the following groups: aliphatic C5-C8, C9-C16 and C17-C34 and aromatic C9-C16 and C17-C34. The exposure limits identified to represent each PHC group are described below.

34.0 ALIPHATIC C5-C8 PETROLEUM HYDROCARBONS

34.1 Inhalation Exposure Limits

34.1.1 Acute Inhalation

Table B.34-1 Acute Inhalation Exposure Limits for Aliphatic C5-C8 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	TCEQ	TPHCWG
Exposure Limit Type	-	-	-	**1-hour ReV (n-pentane)**	-
Exposure Limit Value (µg/m³)	-	-	-	**200,000**	-
Critical Organ or Effect	-	-	-	**Neurological**	-
Species	-	-	-	**Rat**	-
Study	-	-	-	**Lammers *et al.*, 2011**	-
Source	ATSDR 2013	CCME 2008	MA DEP 2003	**TCEQ 2013**	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

No acute inhalation exposure limits have been developed for aliphatic C5-C8 hydrocarbons by the MA DEP (1994; 2003), TPHCWG (1997), ATSDR (2013) or CCME (2008). The available exposure limits for individual chemicals within the aliphatic C5-C8 range were reviewed for the purpose of identifying a surrogate limit to represent the group.

The TCEQ was the only agency to report short-term ESL values for aliphatic C5-C8 substances and substituted forms thereof (including cycloheptane, cyclohexane , cyclohexene, cyclooctane, cyclopentane, cyclopentene, heptane, heptene, n-hexane, hexene, octane, pentane, pentenes) (TCEQ 2013). However, the majority of these were not accompanied by supporting documentation of the health effects observed and the basis for the short-term ESL derived.

Development support documents were available to describe derivation of ESLs for n-hexane, pentane and pentene (TCEQ 2007a; 2007b; 2011); however, data were insufficient for the development of health-based inhalation ReVs for n-hexane and pentene (TCEQ 2007a; 2007b). An acute exposure limit with supporting documentation was available for pentane and all its isomers (TCEQ 2011). A 1-hour ReV of 200,000 µg/m³ was recommended based on a NOAEL for neurological effects (clinical,

motor activity and neurobehavioral) in rats exposed *via* inhalation to up to 20,000 mg/m^3 of n-pentane for 8 hours per day for three consecutive days. An uncertainty factor of 100 was applied to the NOAEL to account for use of animal study (3), variation in human response (10) and database deficiencies (3) (TCEQ 2011).

The CCME (2008), RIVM (2001) and TPHCWG (1997) have reported that the n-hexane content in petroleum products is low and use of n-hexane as a surrogate for aliphatic C5-C8 petroleum hydrocarbons would probably overstate the toxicity of hydrocarbons in this group. The TPHCWG (1997) describe a study comparing the neurotoxicity of C5-C8 aliphatic hydrocarbons (*i.e.*, n-hexane, n-pentane, cyclohexane, 2-methylpentane and 3-methylpentane) where neurotoxic effects were only associated with n-hexane. The peripheral neurotoxicity observed with n-hexane was shown to be mediated through a gamma diketone metabolite (2,5-hexanedione) which has not been observed in metabolism studies with other C5-C8 alkane/cycloalkane compounds (TPHCWG 1997).

As described by the CCME (2008), several C6-C8 aliphatics (*i.e.*, n-heptane, 3-methyl hexane, 3,4-dimethyl hexane and n-nonane) could form neurotoxic metabolites; however, the limited data available suggests the neurotoxic potential of these aliphatics would be significantly lower than that of n-hexane. For the purpose of the current assessment, n-hexane was assessed individually and not grouped with aliphatic C5-C8 hydrocarbons.

The TCEQ 1-hour ReV of 200,000 µg/m^3 for pentane was selected to represent the acute inhalation toxicity of the aliphatic C5-C8 hydrocarbon group. This group was included in the chemical group for neurological effects following acute inhalation exposures.

34.1.2 Chronic Inhalation

Table B.34-2 Chronic Inhalation Exposure Limits for Aliphatic C5-C8 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	MRL	RfC	RfC	**TCA**	RfC
Exposure Limit Value (µg/m^3)	2,000	18,400	200	**18,400**	18,400
Critical Organ or Effect	Neurological	NOAEL neurological, developmental, reproductive, liver	Neurological	**NOAEL neurological, developmental, reproductive, liver**	NOAEL neurological, developmental, reproductive, liver
Species	Human	Rat, mouse	Human	**Rat, mouse**	Rat, mouse

Table B.34-2 Chronic Inhalation Exposure Limits for Aliphatic C5-C8 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Study	Sanagi *et al.*, 1980	Adopted TPHCWG 1997	Sanagi *et al.*, 1980	**Adopted TPHCWG 1997**	various
Source	ATSDR 1999a; 1999b	CCME 2008	MA DEP 2003	**RIVM, 2001**	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

The MA DEP (2003) recommends a chronic inhalation toxicity value of 200 µg/m^3 for the aliphatic C5-C8 PHC group based on an occupational study by Sanagi *et al*. (1980) reporting a LOAEL of 73 mg/m^3 for neurotoxic effects from chronic inhalation exposure to n-hexane. This exposure limit was adopted from the 1990 US EPA RfC for n-hexane. The US EPA (2005) have since revised their RfC for n-hexane due to concerns with the Sanagi *et al.* (1980) study, principally co-exposure with acetone which has been shown to potentiate n-hexane metabolism and neurotoxicity. The current US EPA (IRIS) RfC for n-hexane is 700 µg/m^3 (US EPA 2005).

The ATSDR (1999a) recommend a chronic inhalation MRL of 2,000 µg/m^3 for the aliphatic C5-C8 PHC group. This MRL was also based on n-hexane neurotoxicity using the same Sanagi *et al.* (1980) study (ATSDR 1999b). The ATSDR MRL is higher than the former US EPA and MA DEP values as the ATSDR did not adjust the Sanagi *et al.* (1980) study LOAEL by an uncertainty factor to account for continuous exposure, based on evidence of steady-state conditions for n-hexane in blood within 100 minutes of exposure.

The TPHCWG (1997) RfC of 18,400 µg/m^3 is based on a NOAEL of 1,840 mg/m^3 derived from a range of studies in mice and rats exposed *via* inhalation to commercial hexane (containing 53% n-hexane, 16% 3-methylpentane, 14% methylcyclopentane, 12% 2-methylpentane, 3% cyclohexane, 1% 2,3-dimethylbutane, and <1% several minor compounds). A 100-fold uncertainty factor was applied to NOAEL of 1,840 mg/m^3 to account for use of an animal study (10) and variation in human response (10) (TPHCWG 1997). No adverse neurological, reproductive, developmental or hepatic effects were reported in these studies at the NOAEL identified. The results of these studies suggest the potential neurotoxicity of n-hexane is influenced (reduced) by the presence of other hydrocarbons (TPHCWG 1997). The RIVM (2001) and CCME (2008) adopted the TPHCWG (1997) chronic inhalation exposure limit of 18,400 µg/m^3 for aliphatic C6-C8 hydrocarbons.

The TPHCWG RfC of 18,400 µg/m^3 was used to evaluate chronic inhalation risks associated with the aliphatic C5-C8 group. The aliphatic C5-C8 group was included in the chemical group for neurological effects following chronic inhalation exposures.

34.2 Oral Exposure Limits

34.2.1 Chronic Oral

Table B.34-3 Chronic Oral Exposure Limits for Aliphatic C5-C8 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	-	TDI	RfD	TDI	**RfD**
Exposure Limit Value (µg/kg bw/day)	-	5,000	40	5,000	**5,000**
Critical Organ or Effect	-	Derived from Chronic RfC	Neurotoxicity	Derived from Chronic RfC	**Derived from Chronic RfC**
Species	-	Rat, mouse	Rat	Rat, mouse	**Rat, mouse**
Study	-	Adopted TPHCWG 1997	Krasavage *et al.* 1980	Adopted TPHCWG 1997	**various**
Source	ATSDR 1999a	CCME 2008;	MA DEP 2003	RIVM, 2001	**TPHCWG 1997**

- not available

Bold – Exposure Limit selected for HHRA.

The TPHCWG (1997) recommend an RfD of 5,000 µg/kg body weight/day for oral exposure to aliphatic C5-C8 hydrocarbons. This RfD was derived from the inhalation RfC for this group (*i.e.,* 18.4 mg/m^3 for commercial hexane) assuming 100% absorption and an inhalation rate of 20 m^3/day for a 70 kg human (TPHCWG 1997).

The MA DEP (2003) developed an RfD of 40 µg/kg body weight/day for oral exposure to aliphatic C5-C8 hydrocarbons. This RfD was based on a LOAEL of 570 mg/kg bw/day for peripheral neurotoxicity in rats gavaged with n-hexane daily for 5 days/week over a 90 or 120 day period (Krasavage *et al.* 1980). The LOAEL was adjusted for continuous exposure and an uncertainty factor of 10,000 was applied to account for extrapolation from an animal study (10), use of a subchronic study (10), use of a LOAEL (10) and variability in human response (10) (MA DEP 2003).

The CCME (2008) and RIVM (2001) have adopted the TPHCWG (1997) chronic oral exposure limit of 5,000 µg/kg body weight/day. The RfD for n-hexane (Krasavage *et al.* 1980) was not considered representative (*i.e.,* would overestimates the risks) of the aliphatic C5-C8 hydrocarbons within this group (RIVM 2001; CCME 2008).

The TPHCWG RfC of 5,000 µg/kg body weight/day was used to evaluate chronic oral risks associated with the aliphatic C5-C8 group. The aliphatic C5-C8 group was included in the chemical group for neurological effects following chronic oral exposures.

35.0 ALIPHATIC C9-C16 PETROLEUM HYDROCARBONS

35.1 Inhalation Exposure Limits

35.1.1 Acute Inhalation

Table B.35-1 Acute Inhalation Exposure Limits for Aliphatic C9-C16 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	TCEQ	TPHCWG
Exposure Limit Type	**Intermediate MRL**	-	-	-	-
Exposure Limit Value (µg/m³)	**9,000**	-	-	-	-
Critical Organ or Effect	**Liver**	-	-	-	-
Species	**Mouse**	-	-	-	-
Study	**Air Force 1984**	-	-	-	-
Source	**ATSDR 1999a; 1995a**	CCME 2008	MA DEP 2003	TCEQ 2013	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

No acute inhalation exposure limits have been developed for aliphatic C9-C16 hydrocarbons by the MA DEP (1994; 2003), TPHCWG (1997), ATSDR (1999a) or CCME (2008). The ATSDR (1999a) considered jet fuel JP-4 or JP-7 to be representative of the toxicity of the aliphatic C9-C16 fraction. An intermediate MRL has been developed for jet fuel JP-4 which is distilled from crude oil and consists of a wide array of hydrocarbons in the C4 to C16 range (ATSDR 1995a; 1999a).

An intermediate MRL of 9,000 ug/m3 was established for JP-4 based on observed liver toxicity in mice continuously exposed (24-hrs/day) for 90 days to 500 mg/m³ JP-4. This LOAEL was adjusted by a human equivalency dose factor of 5.7 and a 300-fold uncertainty factor to account for interspecies extrapolation (3) and human variability (10) as well as use of a LOAEL (10) (ATSDR 1995a).

The intermediate MRL was selected as a screening value for 24-hour concentrations of aliphatic C9-C16 hydrocarbons for the purpose of this assessment, although this exposure limit may be overly conservative in the prediction of human health risks following acute inhalation exposures to aliphatic C9-C16 hydrocarbons.

35.1.2 Chronic Inhalation

Table B.35-2 Chronic Inhalation Exposure Limits for Aliphatic C9-C16 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	MRL	RfC	**RfC**	TCA	RfC
Exposure Limit Value (µg/m³)	300	1,000	**200**	1,000	1,000
Critical Organ or Effect	Liver	Liver, blood	**Neurological**	Liver, blood	Liver
Species	Rat	Rat, mouse	**Rat**	Rat, mouse	Rat, mouse
Study	Air Force 1991	Adopted TPHCWG 1997	**Lund *et al.* 1995**	Adopted TPHCWG 1997	Phillips and Egan, 1984 Mattie *et al.*, 1991
Source	ATSDR 1999a; 1995a	CCME 2008	**MA DEP 2003**	RIVM, 2001	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1995a) developed a chronic inhalation MRL for jet fuel JP-7, considered representative of aliphatic C9-C16 toxicity (ATSDR 1999a). JP-7 is a blend of kerosene distillates consisting predominately of hydrocarbons in the C9-C16 range with a maximum aromatic content of 5% by volume (ATSDR 1995a; 1999a). A chronic MRL of 300 µg/m³ was established for JP-7 based on observed liver toxicity in rats exposed to 150 mg/m³ JP-7 for 6 hours/day, 5 days/week (Air Force 1991). An uncertainty factor of 300 was applied to the LOAEL of 150 mg/m³ to account for interspecies extrapolation (3), use of a LOAEL (10) and human variability (10) (ATSDR 1995a).

The TPHCWG (1997) recommend an RfC of 1,000 µg/m³ for inhalation exposure to aliphatic C9-C16 hydrocarbons. This RfC was developed from NOAELs reported in sub-chronic inhalation studies of rats exposed to de-aromatized petroleum streams for 6 hours/day, 5 days/week over 12 weeks (Phillips and Egan, 1984) or rats and mice continuously exposed to jet fuel JP-8 for 90 days (Mattie *et al.*, 1991). Thioe RIVM (2001) and CCME (2008) have adopted the chronic inhalation exposure limit of 1,000 µg/m³ for aliphatic C9-C16 hydrocarbons from the TPHCWG (1997).

The MA DEP (2003) recommends a chronic inhalation toxicity value of 200 µg/m³ for the aliphatic C9-C18 petroleum hydrocarbon group. This exposure limit was based on a LOAEL of 2,620 mg/m³

for neurological effects in rats exposed to de-aromatized white spirit (DAWS) for 6 hours/day, 5 days/week over 6 months (Lund *et al.* 1995). The LOAEL was adjusted for continuous exposure and an uncertainty factor of 3,000 applied to account for human variability (10), extrapolation from an animal study (10), use of a LOAEL (10) and less than lifetime exposure (3). The MA DEP also evaluated the study on JP-8 by Mattie *et al.* (1991), however this study was not selected based on concerns of a higher aromatic content in JP-8 (up to 20%) compared to other petroleum streams (<0.1 to 1.5%) (MA DEP 2003).

For the current assessment, the most conservative RfC of 200 µg/m³ was selected to evaluate chronic inhalation risks associated with the aliphatic C9-C16 group. The aliphatic C9-C16 group was included in the chemical group for neurological effects following chronic inhalation exposures.

35.2 Oral Exposure Limits

35.2.1 Chronic Oral

Table B.35-3 Chronic Oral Exposure Limits for Aliphatic C9-C16 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	-	TDI	RfD	TDI	**RfD**
Exposure Limit Value (mg/kg bw/day)	-	0.1	0.1	0.1	**0.1**
Critical Organ or Effect	-	Liver	Liver	Liver	**Liver**
Species	-	Rat	Rat	Rat	**Rat**
Study	-	Adopted TPHCWG 1997	Various	Adopted TPHCWG 1997	**Various**
Source	ATSDR 1999a; 1995a	CCME 2008;	MA DEP 2003	RIVM, 2001	**TPHCWG 1997**

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1999a) have not recommended an oral exposure limit for aliphatic C9-C16 petroleum hydrocarbons as no chronic oral exposure studies were identified for JP-4 or JP-7 jet fuel (1995a).

The TPHCWG (1997) recommend an RfD of 0.1 mg/kg body weight/day for oral exposure to aliphatic C9-C16 hydrocarbons. This RfD was based on the result of several sub-chronic studies of rats exposed by oral gavage to de-aromatized petroleum streams or jet fuel JP-8. These studies identified LOAEL and NOAEL for liver effects as described in TPHCWG (1997). The RIVM (2001) and CCME (2008) have adopted the chronic oral exposure limit of 0.1 mg/ kg body weight/day for aliphatic C9-C16 hydrocarbons from the TPHCWG (1997).

The MA DEP (2003) also developed an RfD of 0.1 mg/kg body weight/day for oral exposure to aliphatic C9-C18 hydrocarbons based on the results of sub-chronic studies of rats exposed to de-aromatized petroleum streams. These studies reported LOAEL or NOAEL for changes in serum chemistry and liver weight (MA DEP 2003).

For the current assessment, an RfD of 0.1 mg/kg body weight/day was selected to evaluate chronic oral risks associated with the aliphatic C9-C16 group. The aliphatic C9-C16 group was included in the chemical group for liver effects following oral exposures.

36.0 ALIPHATIC C17-C34 PETROLEUM HYDROCARBONS

36.1 Inhalation Exposure Limits

No inhalation exposure limits were recommended for the aliphatic C17-C34 hydrocarbon group by the ATSDR (1999a), MA DEP (1994; 2003) or TPHCWG (1997). Aliphatic hydrocarbons in this group range would have extremely low volatility and therefore inhalation was not considered to be a relevant exposure pathway (TPHCWG 1997; RIVM 2001; CCME 2008).

36.2 Oral Exposure Limits

36.2.1 Chronic Oral

Table B.36-1 Chronic Oral Exposure Limits for Aliphatic C17-C34 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	-	TDI	RfC	TDI	RfC
Exposure Limit Value (mg/kg bw/day)	-	2	2	2	2
Critical Organ or Effect	-	Liver	Liver	Liver	Liver
Species	-	Rat	Rat	Rat	Rat
Study	-	Adopted TPHCWG 1997	Smith *et al.*, 1996	Adopted TPHCWG 1997	Smith *et al.*, 1996
Source	ATSDR 1999a	CCME 2008;	MA DEP 2003	RIVM, 2001	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1999a) suggest the use of mineral oils as a surrogate for aliphatic C17-C34 hydrocarbons but do not recommended any oral MRLs. The TPHCWG (1997) used toxicity data available for white mineral oils to develop an RfD for aliphatic hydrocarbons C17-C21 and C22-C35. White mineral oils are essentially pure aliphatic hydrocarbons and have virtually no aromatic components or other contaminants (TPHCWG 1997). An oral RfD of 2 mg/kg body weight/day was recommended based on a subchronic feeding study which reported no adverse liver effects in rats fed up to 200 mg/kg/day of the lower molecular weight white mineral oils (Smith *et al.*, 1996). An uncertainty factor of 100 was applied to this NOAEL to account for extrapolation from an animal study (3), human variability (10)

and use of a subchronic NOAEL (3) (TPHCWG 1997). The TPHCWG (1997) RfD was adopted by the CCME (2008) and RIVM (2001).

An oral RfD of 2 mg/kg body weight/day was also developed by the MA DEP (2003) for aliphatic C19-C32 hydrocarbons using the same NOAEL from the Smith *et al.* (1996) study and the same uncertainty factor identified by the TPHCWG (1997).

An RfD of 2 mg/kg body weight/day was selected to evaluate chronic oral risks associated with the aliphatic C17-C34 group. These hydrocarbons were included in the chemical group for liver effects following oral exposures.

37.0 AROMATIC C9-C16 PETROLEUM HYDROCARBONS

37.1 Inhalation Exposure Limits

37.1.1 Acute Inhalation

Table B.37-1 Acute Inhalation Exposure Limits for Aromatic C9-C16 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	TCEQ	TPHCWG
Exposure Limit Type	-	-	-	-	-
Exposure Limit Value (µg/m^3)	-	-	-	-	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ATSDR 1999a	CCME 2008	MA DEP 2003	TCEQ 2013	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

No acute inhalation exposure limits have been derived for aromatic C9-C16 petroleum hydrocarbons. The ATSDR (1999a) have recommended naphthalene (aromatic C10) as a surrogate for this group but do not provide an acute inhalation MRL for naphthalene. An occupational exposure limit for short-term exposure to naphthalene has been developed by the American Conference of Governmental Industrial Hygienists (ACGIH).

The ACGIH recommend a 15 minute or short-term exposure limit (STEL) of 79 mg/m^3 for naphthalene based on the potential for eye and respiratory tract irritation (OSHA 2013). The ACGIH STEL, based on a 15-minute exposure period, was converted to a 1-hour acute air concentration (X) using the following equation:

15 minute STEL of 79 mg/m^3 x 15 min = 1-hour acute exposure limit (X) x 60 min

The above calculation follows Habers rule which assumes the inhalation toxic potential of a chemical is a constant that is a function of time and exposure concentration. Therefore, a 4-fold increase in exposure duration necessitates a 4-fold decrease in the exposure concentration. Using this assumption, an acute exposure limit of 20 mg/m^3 was determined for 1-hour exposure to naphthalene. A 10-fold uncertainty factor was applied to account for the response of sensitive individuals, resulting

in an acute (1-hour) inhalation exposure limit of 2 mg/m^3 or 2,000 µg/m^3 for aromatic C9-C16 petroleum hydrocarbons. These hydrocarbons were included in the chemical groups for eye irritants and respiratory irritants following acute inhalation exposures.

37.1.2 Chronic Inhalation

Table B.37-2 Chronic Inhalation Exposure Limits for Aromatic C9-C16 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	MRL	RfC	**RfC**	TCA	RfC
Exposure Limit Value (µg/m^3)	4	200	**50**	200	200
Critical Organ or Effect	Nasal	Liver, kidney	**Liver, kidney**	Liver, kidney	Liver, kidney
Species	Rat, mouse	Rats	**Rats**	Rats	Rats
Study	Abdo *et al.*, 2001; NTP 1992; 2000	Adopted TPHCWG 1997	**Clark *et al.*, 1989**	Adopted TPHCWG 1997	Clark *et al.*, 1989
Source	ATSDR 2013; 2005	CCME 2008;	**MA DEP 2003**	RIVM, 2001	TPHCWG 1997

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1999a) suggest the use of naphthalene as a surrogate for aromatic C9-C16 hydrocarbons. A chronic inhalation MRL of 4 µg/m^3 is recommended for naphthalene based on the occurrence of nasal lesions in rats and mice following long-term inhalation exposures (ATSDR 2005; Abdo *et al.*, 2001; NTP 1992; 2000).

The TPHCWG (1997) recommend an RfC of 200 µg/m^3 for inhalation exposure to aromatic C9-C16 hydrocarbons. This RfC was developed from a NOAEL of 900 mg/m^3 for increased liver and kidney weights in rats following inhalation exposure to aromatic C9 hydrocarbon mixtures for 6 hours/day, 5 days/week over 12 months (Clark *et al.*, 1989). A 1,000-fold uncertainty factor was applied to the NOAEL to account for extrapolation from an animal study (10), human variability (10) and less than chronic exposure (10) (TPHCWG, 1997). The RIVM (2001) and CCME (2008) have adopted the chronic inhalation exposure limit of 200 µg/m^3 for aromatic C9-C16 hydrocarbons from the TPHCWG (1997).

The MA DEP (2003) recommends a chronic RfC of 50 µg/m³ for the aromatic C9-C18 petroleum hydrocarbon group based on the same rat inhalation study of aromatic C9 hydrocarbon mixtures (high flash aromatic naphtha) by Clark *et al.* (1989). An additional 3-fold uncertainty factor was applied to the study NOAEL of 900 mg/m³ to account for lack of toxicity information on non-PAH compounds in the C9 – C16 aromatic fraction range (MA DEP 2003). It is noted the MA DEP (2003) deemed the inhalation toxicity of naphthalene unduly conservative to represent the toxicity of the aromatic C9-C18 range.

For the current assessment, the MA DEP RfC of 50 µg/m³ was selected to evaluate chronic inhalation risks associated with the aromatic C9-C16 group. This group was included in the chemical groups for liver and kidney effects following chronic inhalation exposures.

37.2 Oral Exposure Limits

37.2.1 Chronic Oral

Table B.37-3 Chronic Oral Exposure Limits for Aromatic C9-C16 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	MRL (adjusted)	TDI	RfC	TDI	**RfD**
Exposure Limit Value (mg/kg bw/day)	0.06	0.04	0.03	0.04	**0.04**
Critical Organ or Effect	Body weight	Body weight	Kidney	Body weight	**Body weight**
Species	Rat	Rat	Mice	Rat	**Rat**
Study	NTP 1980a	Adopted TPHCWG 1997	US EPA 1989a	Adopted TPHCWG 1997	**Various**
Source	ATSDR 2005	CCME 2008	MA DEP 2003	RIVM, 2001	**TPHCWG 1997**

- not available
Bold – Exposure Limit selected for HHRA.

The ATSDR (2005) has developed an intermediate duration oral MRL value of 0.06 mg/kg body weight/day for naphthalene. This MRL considered NOAEL and LOAEL values from three exposure studies where reduced body and organ weights were reported in rats (NTP 1980a) or mice (NTP 1980b; Shopp *et al.* 1984) following 90-days gavage exposure to naphthalene. The strongest evidence of toxicity was for body weight changes in rats (NTP 1980a) with a NOAEL of 100 mg/kg/day was

determined from this study. Adjusting the ATSDR intermediate MRL by an uncertainty factor of 10 for subchronic to chronic extrapolation would result in a chronic exposure limit of 0.06 mg/kg body weight/day for naphthalene.

The TPHCWG (1997) developed a tolerable daily intake of 0.04 mg/kg body weight/day for decreased bodyweights in rats following oral exposure to aromatic C9-C16 hydrocarbons. Eight RfD values were identified for aromatic C9-C16 hydrocarbons, ranging from 30 to 300 µg/kg body weight/day (TPHCWG 1997). The TPHCWG RfD was adopted by the CCME (2008) and RIVM (2001).

The MA DEP (2003) selected pyrene (a C17 aromatic hydrocarbon) as a surrogate to represent chronic oral exposure to aromatic petroleum hydrocarbons in the C9-C32 range. The RfD of 30 µg/kg body weight/day was adopted from the US EPA (1993a) and derived from a NOAEL of 75 mg/kg body weight/day for kidney effects in mice following subchronic gavage exposure to pyrene (US EPA 1989a).

An RfD of 0.04 mg/kg body weight/day was selected to evaluate chronic oral risks associated with the aromatic C9-C16 group.

38.0 AROMATIC C17-C34 PETROLEUM HYDROCARBONS

38.1 Inhalation Exposure Limits

No inhalation exposure limits were recommended for the aromatic C17-C34 hydrocarbon group by the ATSDR (1999a), MA DEP (1994; 2003) or TPHCWG (1997). Aromatic hydrocarbons in this group range would have extremely low volatility and therefore inhalation was not considered to be a relevant exposure pathway (TPHCWG 1997; RIVM 2001; CCME 2008).

38.2 Oral Exposure Limits

38.2.1 Chronic Oral

Table B.38-1 Chronic Oral Exposure Limits for Aromatic C17-C34 Hydrocarbons

AGENCY	ATSDR	CCME	MA DEP	RIVM	TPHCWG
Exposure Limit Type	MRL (adjusted)	TDI	RfD	TDI	**RfD**
Exposure Limit Value (mg/kg bw/day)	0.04	0.03	0.03	0.03	**0.03**
Critical Organ or Effect	Liver, Hematological effects	Kidney	Kidney	Kidney	**Kidney**
Species	Mice	Mice	Mice	Mice	**Mice**
Study	US EPA 1988; 1989b	Adopted TPHCWG 1997	US EPA 1989b	Adopted TPHCWG 1997	**US EPA 1989b**
Source	ATSDR 1999a; 1995b	CCME 2008	MA DEP 2003	RIVM, 2001	**TPHCWG 1997**

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1999a) recommend use of the intermediate oral MRLs for fluorene and fluoranthene as a surrogate for aromatic C17-C35 petroleum hydrocarbons. An intermediate oral MRL of 0.4 mg/kg body weight/day was recommended for fluoranthene based on a LOAEL of 125 mg/kg body weight/day for liver effects in mice following 90 days gavage exposure to fluoranthene (US EPA 1988; ATSDR 1995b). The same LOAEL and MRL were identified for mice orally exposed for 90 days to fluorene; increased relative liver weights and hematological effects were the critical effects associated with the fluorene LOAEL (US EPA 1989b; ATSDR 1995b). Adjusting the ATSDR intermediate MRL

for fluoranthene and fluorene by an uncertainty factor of 10 for subchronic to chronic extrapolation would result in a chronic exposure limit of 0.04 mg/kg body weight/day for aromatic C17-C35 petroleum hydrocarbons. This approach was taken by the US EPA (IRIS) in their establishment of chronic oral RfDs of 0.04 mg/kg body weight/day for fluorene and fluoranthene (US EPA 1990; 1993b).

The TPHCWG (1997) selected pyrene (C17) as a surrogate to represent chronic oral exposure to aromatic C17-C35 petroleum hydrocarbons. The RfD of 0.03 mg/kg body weight/day was derived for pyrene by the US EPA (1993a) and adopted by the TPHCWG (1997). This RfD was derived from a NOAEL of 75 mg/kg body weight/day for kidney effects observed in a subchronic gavage study in mice (US EPA 1989a). The US EPA and TPHCWG RfD was adopted by the CCME (2008) and RIVM (2001).

The MA DEP (2003) also recommends pyrene and the US EPA (1993a) oral RfD of 0.03 mg/kg body weight/day as a surrogate for evaluating chronic oral exposures to aromatic C9-C32 hydrocarbons.

An RfD of 0.03 mg/kg body weight/day was selected to evaluate chronic oral risks associated with the aromatic C17-C34 group. These hydrocarbons were included in the chemical group for kidney effects following chronic oral exposures.

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39.0 PHENANTHRENE

39.1 Inhalation Exposure Limits

39.1.1 Acute Inhalation Exposure Limits

Table B.39-1 Acute Inhalation Exposure Limits for Phenanthrene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	0.5	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013; 1995	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports a short term ESL for phenanthrene of 0.5 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit and it is currently under review; therefore, it was not selected.

No short-term occupational exposure limits have been developed for phenanthrene (OSHA 2013).

Phenanthrene is a C14 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to phenanthrene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

39.1.2 Chronic Inhalation

Table B.39-2 Chronic Inhalation Exposure Limits for Phenanthrene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.05	-	-
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013; 1995	Health Canada 2010	OEHHA 2013	RIVM 2009	TCEQ 2013	US EPA 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1995) determined there were no adequate dose-response data for the purpose of deriving chronic inhalation MRLs for polycyclic aromatic hydrocarbons.

The TCEQ (2014) reports a long term ESL for phenanthrene of 0.05 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit and it is currently under review; therefore, it was not selected.

In the absence of a chronic inhalation exposure limit specific to phenanthrene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

IARC (2013) has classified phenanthrene as possibly carcinogenic to humans (Group 2B). Health Canada (2012) has recommended potency equivalency factors (PEF) for carcinogenic PAH, including phenanthrene, sharing a common mode of action with B[a]P. For the purpose of this assessment, phenanthrene was also treated as a carcinogen following chronic inhalation exposure and was evaluated as part of the B[a]P equivalent group. Further details are provided in the toxicity profile for B[a]P.

39.2 Oral Exposure Limits

39.2.1 Chronic Oral

Table B.39-3 Chronic Oral Exposure Limits for Phenanthrene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	-	-	TDI	-	-
Exposure Limit Value (mg/kg bw/day)	-	-	-	0.04	-	-
Critical Organ or Effect	-	-	-	Body weight	-	-
Species	-	-	-	Rat	-	-
Study	-	-	-	Adopted TPHCWG 1997	-	-
Source	ATSDR 2005	Health Canada 2010	OEHHA 2013	RIVM, 2001	US EPA 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The RIVM (2001) recommend a tolerable daily intake of 40 µg/kg body weight/day for phenanthrene. This TDI was adopted from the TPHCWG (1997) which reported decreased bodyweights in rats following oral exposure to aromatic C9-C16 hydrocarbons.

The TDI of 0.04 mg/kg body weight/day was selected for the assessment of non-carcinogenic effects following chronic oral exposure to phenanthrene. The carcinogenic potential of phenanthrene following chronic oral exposure was also assessed as part of the B[a]P equivalent group. Further details are provided in the toxicity profile for B[a]P.

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40.0 PROPYLENE (PROPENE)

40.1 Inhalation Exposure Limits

40.1.1 Acute Inhalation

Table B.40-1 Acute Inhalation Exposure Limits for Propylene

AGENCY	AEP	ATSDR	OEHHA	TCEQ
Exposure Limit Type	-	-	-	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	-
Critical Organ or Effect	-	-	-	-
Species	-	-	-	-
Study	-	-	-	-
Source	-	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

No exposure limits for acute inhalation exposure to propylene were available. Propylene has a low order of acute toxicity by the inhalation route of exposure. The lower flammability limit for propylene is 2% or 20,000 ppm. The threshold for narcosis in humans is 46,000 ppm. Thus, the explosive range of airborne concentrations for propylene is reached before any acute narcotic effects can be manifested (IOMC, 2012) and assessment of the potential acute effects was not required for the HHRA.

40.1.2 Chronic Inhalation

Table B.40-2 Chronic Inhalation Exposure Limits for Propylene

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	**RfC**	-	-	-	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	**3,000**	-	-	-	-
Critical Organ or Effect	-	-	-	**Metaplasia, Hyperplasia and Inflammation**	-	-	-	-
Species	-	-	-	**Rats**	-	-	-	-
Study	-	-	-	**Quest *et al.*, 1984**	-	-	-	-
Source	-	-	-	**OEHHA, 2000**	-	-	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The OEHHA (2000) recommends an RfC of 3,000 $\mu g/m^3$ for propylene. This RfC was based on a 2-year study in F344/N rats and B6C3F1 mice (Quest *et al.*, 1984). In exposed rats, treatment-related chronic effects were observed in the nasal cavity. In female rats, epithelial hyperplasia and squamous metaplasia were observed. In male rats, squamous metaplasia and inflammatory changes, characterized by an influx of lymphocytes, macrophages and granulocytes into the submucosa and granulocytes into the lumen, were observed.

40.2 Oral Exposure Limits

No chronic oral exposure limit was required for propylene as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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41.0 PYRENE

41.1 Inhalation Exposure Limits

41.1.1 Acute Inhalation Exposure Limits

Table B.41-1 Acute Inhalation Exposure Limits for Pyrene

AGENCY	AEP	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	ESL	-
Exposure Limit Value ($\mu g/m^3$)	-	-	-	0.5	-
Critical Organ or Effect	-	-	-	-	-
Species	-	-	-	-	-
Study	-	-	-	-	-
Source	ESRD 2013	ATSDR 2013; 1995	OEHHA 2013	TCEQ 2013	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports an interim short term ESL for pyrene of 0.5 $\mu g/m^3$. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

No short-term occupational exposure limits have been developed for pyrene (OSHA 2013).

Pyrene is a C11 aromatic hydrocarbon. In the absence of an acute inhalation exposure limit specific to pyrene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this chemical. Details on the acute inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

41.1.2 Chronic Inhalation

Table B.41-2 Chronic Inhalation Exposure Limits for Pyrene

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.05	-	-
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study		-	-	-	-	-	-	
Source	ESRD 2013	ATSDR 2013; 1995	Health Canada 2010	OEHHA 2013	RIVM 2009	TCEQ 2013	US EPA 1993	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The ATSDR (1995) determined that there were no adequate dose-response data for the purpose of deriving chronic inhalation MRLs for polycyclic aromatic hydrocarbons.

The TCEQ (2013) reports an interim long term ESL for pyrene of 0.05 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

In the absence of a chronic inhalation exposure limit specific to pyrene, the exposure limit developed for the aromatic C9-C16 hydrocarbon group was assigned to this C11 aromatic hydrocarbon. Details on the chronic inhalation exposure limit for the aromatic C9-C16 hydrocarbon group are provided in the toxicity profile for Petroleum Hydrocarbons.

41.2 Oral Exposure Limits

41.2.1 Chronic Oral

Table B.41-3 Chronic Oral Exposure Limits for Pyrene

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	RfD	-	CR	**RfD**	-
Exposure Limit Value (mg/kg bw/day)	-	0.03	-	0.5	**0.03**	-
Critical Organ or Effect	-	Kidney	-	Cancer potency relative to B[a]P	**Kidney**	-
Species	-	Mice	-	Rat	**Mice**	-
Study	-	US EPA 1989	-	Kroese *et al.* 1999	**US EPA 1989**	-
Source	ATSDR 2005	Health Canada 2010	OEHHA 2013	RIVM, 2001	**US EPA 1993**	WHO 2000

- not available

Bold – Exposure Limit selected for HHRA.

The US EPA (1993) derived an RfD of 0.03 mg/kg body weight/day for pyrene based on a NOAEL of 75 mg/kg body weight/day for kidney effects in mice following subchronic gavage exposure (US EPA 1989). The US EPA RfD for pyrene was adopted by Health Canada (2010).

The RIVM (2001) recommend a CR of 0.5 mg/kg body weight/day for pyrene based on relative carcinogenic potency to benzo[a]pyrene of 0.001 and an excess lifetime cancer risk of 1 in 10,000.

The US EPA (1993) and Health Canada (2010) RfD of 0.3 mg/kg body weight/day was selected to evaluate risks associated with chronic oral exposure to pyrene. Pyrene was included in the chemical group for kidney effects following chronic oral exposures. Pyrene was also included as a component of the aromatic C9-C16 hydrocarbon group and included in the assessment of chronic oral exposure to these hydrocarbons.

The assessment of cancer risks associated with exposure to polycyclic aromatic hydrocarbons (PAHs) is described in detail in the toxicity profile for benzo[a]pyrene. Health Canada (2012) does not

recommend a potency equivalence factor (PEF) relative to benzo[a]pyrene for pyrene and therefore this PAH was not included in that assessment. The exposure limit developed by the US EPA (1993) for non-carcinogenic effects associated with chronic oral exposure to pyrene is lower and therefore more conservative than the RIVM (2001) exposure limit for potential carcinogenic effects of pyrene.

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42.0 SELENIUM

42.1 Inhalation Exposure Limits

42.1.1 Acute Inhalation

Table B.42-1 Acute Inhalation Exposure Limits for Selenium

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 Hour Guideline	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	10	-	-	2	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	-	OMOE 2012	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The OMOE (2012) derived a 24-hour guideline of 10 µg/m³ for selenium. Although the guideline is health based, supporting documentation was not available. As a result, it was not used in the acute effects assessment.

The TCEQ (2014) reports an interim short term ESL for selenium and compounds of 2 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible acute inhalation exposure limits, selenium was not assessed on an acute basis.

42.1.2 Chronic Inhalation

Table B.42-2 Chronic Inhalation Exposure Limits for Selenium

AGENCY	AEP	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	**REL**	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	**20**	-	0.2	-	-
Critical Organ or Effect	-	-	-	**Clinical Selenosis**	-	-	-	-
Species	-	-	-	**Human**	-	-	-	-
Study	-	-	-	**Yang *et al* 1989**	-	-	-	-
Source	-	-	-	**OEHHA 2001**	-	TCEQ 2014	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Selenium sulfide is classified as being reasonably anticipated to be a human carcinogen (Group R) by the NTP (2014). However, no unit risk factors were available for selenium exposure by inhalation. For this reason, selenium was treated as a non-carcinogen by chronic inhalation for this risk assessment.

The OEHHA (2001) uses a chronic inhalation REL of 20 µg/m³ for selenium and selenium compounds (other than hydrogen selenide) based on the US EPA's oral RfD of 0.005 mg/kg bw/d for clinical selenosis (US EPA 1991). The principal study for the US EPA RfD was a Chinese epidemiological study of 400 individuals (Yang *et al*. 1989). The OEHHA (2001) derived the reference level through route-to-route extrapolation of the oral REL using an inhalation extrapolation factor of 3,500 µg/m³ per mg/kg-day (*i.e.*, assuming a body weight of 70 kg, an inhalation rate of 20 m³/day). Although there was some uncertainty with the route-to-route extrapolation, the REL of 20 µg/m³ based on neurological effects and liver dysfunction was used as the chronic inhalation limit for selenium since selenosis is a relevant toxicological effect for both the oral and inhalation routes.

The TCEQ (2014) reports an interim long term ESL for selenium and compounds of 0.2 µg/m^3. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

42.2 Oral Exposure Limits

42.2.1 Chronic Oral

Table B.42-3 Chronic Oral Exposure Limits for Selenium

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL	UL	REL	-	**RfD**	TDI
Exposure Limit Value (mg/kg bw/day)	0.005	0.0055 (0- 6 mths), 0.0062 (7 mths-4 yrs), 0.0063 (5-11 yrs), 0.0062 (12-19 yrs), 0.0057 (for 20+ yrs)	0.005	-	**0.005**	0.004
Critical Organ or Effect	Clinical Selenosis	Clinical Selenosis	Clinical Selenosis	-	**Clinical Selenosis**	Alanine aminotransferase
Species	Human	Human	Human	-	**Human**	Human
Study	Yang *et al.* 1989	Yang and Zhou (1994)	Yang *et al.* 1989	-	**Yang *et al.* 1989**	Longnecker 1991
Source	US EPA 1991	Health Canada 2010	US EPA 1991	-	**US EPA 1991**	WHO 2011

- not available

Bold – Exposure Limit selected for HHRA.

Selenium sulfide is classified as being reasonably anticipated to be a human carcinogen (Group R) by the NTP (2014). No slope factors were available for Selenium exposure by ingestion. For this reason, Selenium was treated as a non-carcinogen by ingestion for this risk assessment.

The US EPA (1991) reported a chronic oral exposure RfD of 0.005 mg/kg bw/d based on a NOAEL of 0.015 mg/kg bw/d for clinical selenosis observed in a human epidemiological study in rural China (Yang *et al.* 1989). In the study, selenium intakes were evaluated in association with food and water intake. Hair, fingernail, toenail and blood samples were obtained from subjects in the different areas. The lowest whole blood selenium concentration at which no effects were observed was 1.0 mg/L, which corresponded to a NOAEL of 0.015 mg/kg bw/d. An uncertainty factor of 3 was applied to the

NOAEL to account for sensitive individuals. A full factor of 10 was not deemed necessary since similar NOAELs were identified in two other moderately-sized populations exposed to selenium levels without apparent clinical signs of selenosis. The oral RfD of 0.005 mg/kg bw/d, based on chronic selenosis (neurological effects and changes in blood parameters symptomatic of liver dysfunction), was used in the chronic effects assessment for selenium.

The OEHHA (2012) reports a chronic oral REL of 0.005 mg/kg bw/d, based on the US EPA oral RfD.

The ATSDR (2003) also derived a chronic oral MRL of 0.005 mg/kg bw/d based on the study by Yang *et al.* (1989) using the same method as the US EPA.

Health Canada (2010) has derived life stage-specific ULs for selenium based on an analysis by the IOM (2000) of two different studies: Shearer and Hadjimarkos (1975), and Yang and Zhou (1994). The ULs are "the highest level of daily intake likely to pose no risk of adverse health effects for almost all individuals in the specified life stage group". Health Canada uses the NOAEL of 0.007 mg/kg bw/d for selenosis in infants and an uncertainty factor of 1 to derive ULs of 0.0055 mg/kg bw/d (0 to 6 months), 0.0062 mg/kg bw/d (7 months to 4 years), 0.0063 mg/kg bw/d (5 to 11 years), 0.0062 mg/kg bw/d (12 to 19 years) and 0.0057 mg/kg bw/d (for 20+ years). The limits derived by Health Canada (2010) were not used in the oral assessment since the US EPA has derived a more conservative value based on a more comprehensive analysis of exposure in a larger population.

The WHO (2003) has established a TDI of 0.004 mg/kg bw/d, based on the absence of clinical effects in an exposed population of 142 individuals over 2 years (Longnecker 1991). An association between selenium intake and alanine aminotransferase levels in serum was observed but considered to be clinically insignificant. A NOAEL of 0.004 mg/kg bw/d was derived based on the assumption that soluble selenium salts in drinking water may be more toxic than organic-bound selenium in food. Since the US EPA value has been adjusted for sensitive individuals and is better explained and therefore more supportable than the WHO value, the WHO value was not selected.

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43.0 SILICA (AND SILICATES) (SILICON DIOXIDE)

43.1 Inhalation Exposure Limits

43.1.1 Acute Inhalation

Table B.43-1 Acute Inhalation Exposure Limits for Silica

AGENCY	AEP	ATSDR	OEHHA	OMOE	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	24 hour	**ReV**	-	-
Exposure Limit Value (µg/m^3)	-	-	-	5	**47**	-	-
Critical Organ or Effect	-		-	-	**Respiratory Inflammation**		-
Species	-	-	-	-	**Rats**	-	-
Study	-	-	-	-	**Warheit *et al* 1991**	-	-
Source	-	-	-	OMOE 2012	**TCEQ 2016**	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The OMOE (2012) currently recommends an acute (24-hour) exposure limit of 5 µg/m^3 for respirable silica (cristabolite and quartz) that is health-based; however, no supporting documentation was provided.

The TCEQ (2009) identified a LOAEL of 10 mg/m^3 (10,000 µg/m^3) for respiratory inflammation in rats reported in the Warheit *et al.* (1991) study following 6-hour exposure to crystalline silica (quartz). The inflammation was marked by increased neutrophils and lactate dehydrogenase in the bronchoalveolar lavage fluid in the rats. The TCEQ extrapolated the LOAEL to a point of departure of 1-hour duration. Uncertainty factors were applied for extrapolation from animals to humans (3), to account for potential sensitive human subpopulations (10), extrapolation from a LOAEL to a NOAEL (3), and lack of acute studies in other species (3), resulting in an acute ReV of 47 µg/m^3.

The TCEQ ReV of 47 µg/m^3 was selected for the assessment of acute inhalation exposure to silica.

43.1.2 Chronic Inhalation

Table B.43-2 Chronic Inhalation Exposure Limits for Silica

AGENCY	AEP	ATSDR	OEHHA	OMOE	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	REL	-	**ReV**	-	-
Exposure Limit Value (µg/m³)	-	-	3	-	**2**	-	-
Critical Organ or Effect	-	-	Respiratory System	-	**Respiratory System (Silicosis)**	-	-
Species	-	-	Humans	-	**Humans**	-	-
Study	-	-	Hnizdo and Sluis-Cremer 1993	-	Hnizdo and Sluis-Cremer 1993	-	-
Source	-	-	OEHHA 1999	-	**TCEQ 2016**	-	-

- not available

Bold – Exposure Limit selected for HHRA.

OEHHA (1999) reports a chronic REL for silica (respirable crystalline) of 3 µg/m³ (based on 30% silica in mine dust). Although the REL is based on health effects, it was derived based on the of silicosis in miners and other workers. In the key study, Hnizdo and Sluis-Cremer (1993) studied the risk of silicosis in 2,235 South African gold miners. The miners had 24 work years on average between 1940 and 1970s, and were followed up until 1991 for radiological signs of silicosis. Based on the findings, a LOAEL (20 µg/m³ from 3 mg/m³ per year cumulative dust exposure [CDE]) based on 9 miners with silicosis and a NOAEL (7 µg/m³ from 2 mg/m³ per year CDE) were estimated, based on an average of 24 years of dust exposure for 8 h/day, 5 days/week. OEHHA applied uncertainty factors for subchronic exposure data (1), interspecies (1), intraspecies (3), and cumulative (3).

The TCEQ (2016) reports a chronic ReV for crystalline silica of 2.0 µg/m³, based on the same key study by Hnizdo and Sluis-Cremer (1993). The TCEQ identified a benchmark concentration low$_{01}$ (BMCL$_{01}$) value of 0.635 mg/m³-year, which is the 95% lower bound estimate of the concentration at which 1% of the population develops silicosis. This value was extrapolated to incorporate continuous lifetime exposure (70-year), resulting in a value of 6.04 µg/m³. Uncertainty factors were applied to account for

the variability within the human population (3), to account for the use of a $BMCL_{01}$ (1), and database uncertainty (1), resulting in a chronic ReV of 2.0 µg/m^3.

The chronic ReV reported by the TCEQ (2016) based on Hnizdo and Sluis-Cremer (1993) is expected to be protective of human health and conservative, as the modelling was conducted using the $BMCL_{01}$ (*i.e.*, a 1% benchmark response). Additionally, the TCEQ chronic ReV is slightly more conservative than the OEHHA chronic REL, due to the TCEQ extrapolating the silica dust exposures to a 70-year lifetime exposure.

43.2 Oral Exposure Limits

No chronic oral exposure limit was required for silica, as silica via the oral exposure route is relatively non-toxic. The European Food Safety Authority (EFSA 2009) concluded that the use of silicon dioxide in food supplements (up to 1,500 mg SiO_2/day) is of no safety concern. Silica was not considered as a COPC through Multimedia Exposure (oral route).

Further, available human and laboratory animal studies do not identify adverse effects of oral exposure to crystalline or amorphous silica. Available data is not sufficient for deriving oral exposure limits for any exposure duration, as the available animal studies either did not identify any adverse effects or are not sufficient enough to determine any toxicological significance of observed effects (ATSDR 2017). Furthermore, based on crystalline silica's physico-chemical properties (*i.e.*, insolubility) and as oral effects have not been observed in workers, there is no evidence to suggest that adverse effects would occur *via* oral exposure (Health Canada and Environment Canada 2013).

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44.0 SULPHUR DIOXIDE

44.1 Inhalation Exposure Limits

44.1.1 Acute Inhalation

Table B.44-1 Acute Inhalation Exposure Limits for Sulphur Dioxide

AGENCY	AEP	ATSDR	CCME[1]	Health Canada	OEHHA	TCEQ	US EPA	WHO
Exposure Limit Type	1-hour 24-hour AAQO	1-hour MRL	1-hour CAAQS	-	1-hour REL	-	1-hour NAAQS	10-min 24-hour
Exposure Limit Value ($\mu g/m^3$)	**450** 125	26	170	-	660	-	200	**500** **20**
Critical Organ or Effect	Respiratory system	Respiratory system	-	-	Respiratory system	-	Respiratory system	Respiratory system
Species	Human	Human	-	-	Human	-	Human	Human
Study	Various	Sheppard *et al.* 1981	-	-	Roger *et al.*, 1985; Linn *et al.* 1987	-	Various	Various
Source	AEP 2019	ATSDR 2013; 1998	CCME 2014	-	OEHHA 2008; 2013	-	US EPA 2012; 2010	WHO 2005

- not available

Bold – Exposure Limit selected for HHRA.

1 CCME CAAQS were included in the HHRA in response to IR HC-2 (Addendum 6, CEAA #70, April 30 2018).

Alberta recommends 1-hour and 24-hour ambient air quality objectives of 450 and 125 μg/m^3, respectively, for sulphur dioxide (AEP 2019). The 1-hour guideline was intended to protect against pulmonary effects associated with acute sulphur dioxide exposure while the 24-hour objective was adopted from the European Union for the protection of human health (AENV 2011).

The ATSDR (2013) recommend a MRL of 26 μg/m^3 for acute exposure to sulphur dioxide. This MRL was derived from a study examining acute sulphur dioxide exposure and bronchoconstriction in mild asthmatics during exercise (Sheppard *et al.* 1981). The LOAEL identified for pulmonary effects in this study was supported by other controlled exposure studies in asthmatics (ATSDR 1998).

The OEHHA (2013) recommends a 1-hour REL of 660 μg/m^3. This exposure limit was based on NOAELs reported in studies of respiratory effects in healthy, asthmatic and atopic individuals following controlled exposure to sulphur dioxide with or without exercise (Roger *et al.*, 1985; Linn *et al.* 1987).

The US EPA (2012) has implemented a 1-hour NAAQS of 200 μg/m^3 for sulphur dioxide to protect against respiratory effects. This standard considers the 3-year average of the 99th percentile of 1-hour daily maximum sulphur dioxide concentrations. The basis for this exposure limit was the protection of sensitive individuals (including asthmatic children) from adverse respiratory effects during periods of exertion. This standard also considered epidemiological studies reporting causal associations between 1-hour daily maximum sulphur dioxide concentrations and respiratory morbidity (increased hospital admissions). The 1-hour NAAQS was expected to substantially limit asthmatics short-term exposure (5-10 minutes) to sulphur dioxide concentrations above 500 μg/m^3 (US EPA 2010).

Breathing difficulties in response to sulphur dioxide can occur within the first few minutes of exposure and may provoke asthma attacks, particularly during exercise; therefore, the WHO (2005) has recommended a 10-minute time-weighted average guideline of 500 μg/m^3 for acute exposures to sulphur dioxide. The WHO (2005) also recommends a 24-hour guideline of 20 μg/m^3 for sulphur dioxide, based on epidemiological studies that found an association between mortality, morbidity or lung function changes in relation to 24-hour average sulphur dioxide concentrations in ambient air. The WHO recognizes this exposure limit for sulphur dioxide may be difficult for some countries to attain and has recommended two interim 24-hour target levels of 125 μg/m^3 and 50 μg/m^3 as a stepped approach for countries as they develop successive and sustained abatement measures to move towards eventual compliance with the 20 μg/m^3 guideline (WHO 2005).

The AEP (2019) 1-hour objective of 450 μg/m^3 and the WHO (2005) 10-min and 24-hour guidelines of 500 μg/m^3 and 20 μg/m^3 were selected for use in the assessment of acute inhalation exposure to sulphur dioxide. Sulphur dioxide was included in the chemical group for respiratory irritation following acute inhalation exposures.

44.1.2 Chronic Inhalation

Table B.44-2 Chronic Inhalation Exposure Limits for Sulphur Dioxide

AGENCY	AEP	ATSDR	CCME[1]	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	Annual average	-	Annual CAAQS	-	-	-	-	-	**AQG**
Exposure Limit Value (µg/m³)	20	-	10	-	-	-	-	-	**20**
Critical Organ or Effect	Ecosystem protection	-	Ecological Based	-	-	-	-	-	**-**
Species	-	-	-	-	-	-	-	-	**-**
Study	-	-	-	-	-	-	-	-	**-**
Source	AEP 2019	-	CCME 2014	-	-	-	-	-	**-**

- not available

Bold – Exposure Limit selected for HHRA.

1 CCME CAAQS were included in the HHRA in response to IR HC-2 (Addendum 6, CEAA #70, April 30 2018).

The AEP (2019) has established an annual average guideline of 20 µg/m³ for sulphur dioxide. This exposure limit was developed for ecosystem protection (AENV 2011).

The WHO (2005) 24-hour air quality guideline of 20 µg/m³ was assumed to be protective of inhalation risks associated with chronic exposures in the absence of other guidelines.

44.2 Oral Exposure Limits

No chronic oral exposure limit was required for sulphur dioxide as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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45.0 THALLIUM

45.1 Inhalation Exposure Limits

45.1.1 Acute Inhalation

Table B.45-1 Acute Inhalation Exposure Limits for Thallium

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	-	1	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	-	-	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports an interim short term ESL for thallium and compounds of 1 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible acute inhalation exposure limits, thallium was not assessed on an acute basis.

45.1.2 Chronic Inhalation

Table B.45-2 Chronic Inhalation Exposure Limits for Thallium

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	0.1	-	-
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study	-	-	-	-	-	-	-	-
Source	-	-	-	-	-	TCEQ 2014	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports an interim long term ESL for thallium and compounds of 0.1 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible chronic inhalation exposure limits, thallium was not assessed on an acute basis.

45.2 Oral Exposure Limits

45.2.1 Chronic Oral

Table B.45-3 Chronic Oral Exposure Limits for Thallium

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	-	-	-	pRfD	-
Exposure Limit Value (mg/kg bw/day)	-	-	-	-	0.00002 (thallium sulphate), **0.00001 (soluble thallium),** 0.00002 (thallium acetate, thallium carbonate, thallium chloride and thallium nitrate)	-
Critical Organ or Effect	-	-	-	-	Hair follicle atrophy	-
Species	-	-	-	-	Rat	-
Study	-	-	-	-	Midwest Research Institute 1988	-
Source	-	-	-	-	US EPA 2012	-

- not available

Bold – Exposure Limit selected for HHRA.

The US EPA (2012) has derived provisional RfDs for thallium and compounds. The RfDs are based on a 90 day study in which rats were administered an aqueous solution of thallium sulphate (Midwest Research Institute 1988). the high dose (0.25 mg/kg bw/d of thallium sulphate or 0.2 mg/kg bw/d of soluble thallium) was characterized as a LOAEL for hair follicle atrophy. The NOAEL could not be determined with certainty. Given the low incidence of hair follicle atrophy in female rats and the absence of hair follicle atrophy in male rats, the mid-dose (0.05 mg/kg bw/d of thallium sulphate or 0.04 mg/kg bw/d of soluble thallium) was assumed to be a NOAEL for skin histopathology and used as the point of departure for the RfDs. The chronic RfDs for thallium sulphate and soluble thallium were derived by applying a cumulative uncertainty factor of 3,000 to their NOAELs (10 for interspecies variability, 10 for intraspecies variability, 10 for database limitations and 3 for extrapolation from subchronic to chronic exposure), resulting in a pRfD of 0.00002 mg/kg bw/d for thallium sulphate and 0.00001 mg/kg bw/d for soluble thallium. Based on molecular weight adjustments and stoichiometric calculations, chronic pRfDs were also derived for thallium acetate, thallium carbonate, thallium chloride and thallium nitrate, all of which were 0.00002 mg/kg bw/d.

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46.0 TOLUENE

46.1 Inhalation Exposure Limits

46.1.1 Acute Inhalation

Table B.46-1 Acute Inhalation Exposure Limits for Toluene

AGENCY	AEP	ATSDR	OEHHA	TCEQ
Exposure Limit Type	1-hour 24-hour	Acute ≤ 14 days MRL	1-hour REL	**1-hour** **ReV**
Exposure Limit Value ($\mu g/m^3$)	1,880 400	3,800	37,000	**15,000**
Critical Organ or Effect	Neurological	Neurological Eye and nose irritation	Neurological Eye and nose irritation	**Neurological** **Eye and nose irritation**
Species	Human	Human	Human	**Human**
Study	1-hr from TCEQ; 24-hr from US EPA	Anderson *et al.* 1983	Anderson *et al.* 1983	**Andersen *et al.* 1983**
Source	ESRD 2013	ATSDR 2013; 2000	OEHHA 2013; 2008	**TCEQ 2008**

- not available

Bold – Exposure Limit selected for HHRA.

The ESRD (2013) recommend a 1-hour AAQO of 1,800 $\mu g/m^3$ and a 24-hour AAQO of 400 $\mu g/m^3$ for toluene. The basis for the 1-hour AAQO was the 2003 TCEQ 1-hour ReV which was developed from the ACGIH threshold limit value of 50 ppm (190 mg/m^3) (AENV 2004). The TCEQ ReV for toluene has since been revised as described below. The basis for the 24-hour AAQO was the 1992 US EPA RfC for toluene which was developed from a LOAEL of 88 ppm (332 mg/m^3) reported by Foo *et al* (1990) for neurological effects in workers exposed to toluene (AENV 2004). The US EPA RfC for ethylbenzene has also since been revised as described in the chronic inhalation section below.

The ATSDR (2000), OEHHA (2008) and TCEQ (2008) have derived acute exposure limits for toluene based on an acute human exposure study reporting mild, reversible neurological effects (headache, dizziness) and irritation in the eyes and nose following controlled exposure to toluene for 6 hours a day over 4 consecutive days (Anderson *et al.* 1983).

An MRL of 3,800 µg/m³ (1 ppm) is recommended by the ATSDR (2013) for acute exposures to toluene. The ATSDR (2000) identified a NOAEL of 40 ppm for neurological effects from the Anderson *et al.* (1983) study. This NOAEL was adjusted for continuous exposure and an uncertainty factor of 10 applied to account for variability in human response.

THE OEHHA (2008) identified the same NOAEL of 40 ppm from the Anderson *et al.* (1983) study. The NOAEL was adjusted for 1-hour exposure and an uncertainty factor of 10 applied for human variability to arrive at a 1-hour REL of 37,000 µg/m³ (9.8 ppm) (OEHHA 2008).

The TCEQ (2008) adjusted the NOAEL of 40 ppm from the Anderson *et al.* (1983) study by an uncertainty factor of 10 for human variability to recommend a 1-hour ReV of 15,000 µg/m³ (4 ppm). No adjustment was made for exposure duration as the neurological effects associated with toluene exposure were considered to be associated with exposure concentration rather than exposure duration (TCEQ 2008).

The lowest 1-hour exposure limit of 15,000 µg/m³ (TCEQ) was selected for the assessment of acute exposure to toluene. Toluene was included in the chemical group for neurological effects as well as eye and nose irritation following acute inhalation exposures.

46.1.2 Chronic Inhalation

Table B.46-2 Chronic Inhalation Exposure Limits for Toluene

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	MRL	TC	REL	TCA	ReV	**RfC**	AQG
Exposure Limit Value (µg/m³)	300	3,750	300	400	4,100	**5,000**	260
Critical Organ or Effect	Neurological	Neurological	Neurological	Neurological	Neurological	**Neurological**	Neurological
Species	Human	Human	Rat	Human	Human	**Human**	Human
Study	Zavalic *et al.*, 1998a; 1998b	Anderson *et al.* 1983	Hillefors-Berglund *et al.* 1995	Foo *et al.* 1990	Zavalic *et al.* 1998a	**Multiple**	Foo *et al.*, 1990
Source	ATSDR 2013; 2000	Health Canada 2010; 1992	OEHHA 2013; 2000	RIVM 2001	TCEQ 2008	**US EPA 2005**	WHO 2000

- not available
Bold – Exposure Limit selected for HHRA.

The ATSDR (2000) and TCEQ (2008) both derived acute exposure limits for toluene based on a human study reporting colour vision impairment in workers occupationally exposed to toluene for 8 hours/day, 5 days/week (Zavalic *et al.* 1998a; 1988b).

A MRL of 300 µg/m^3 (0.08 ppm) is recommended by the ATSDR (2013) for chronic exposures to toluene. The ATSDR (2000) identified a LOAEL of 35 ppm (geometric mean of toluene exposure concentrations) for colour vision impairment in workers (Zavalic *et al.* 1998al 1998b). This LOAEL was adjusted for continuous exposure and an uncertainty factor of 100 applied to account for use of a LOAEL and variability in human response (ATSDR 2000).

The TCEQ (2008) identified a LOAEL of 32 ppm (median toluene exposure concentration) for colour vision impairment reported in the Zavalic *et al.* (1998a) study. An uncertainty factor of 10 was applied to this LOAEL to account for variability in human response, resulting in a chronic ReV of 4,100 µg/m^3 (11.4 ppm). Again, no adjustment was made by the TCEQ (2008) for exposure duration as the neurological effects associated with toluene were considered to be associated with exposure concentration rather than exposure duration.

Health Canada (2010) recommends a TC of 3,800 µg/m^3 for toluene. This TC was developed from the acute exposure study by Anderson *et al.* (1983) which reported a NOAEL of 150 mg/m^3 for neurological effects in volunteers exposed to up to 375 mg/m^3 toluene for 6 hours/day over 4 days. The NOAEL was adjusted for continuous exposure (from 8 hours/day, 5 days/week) and divided by an uncertainty factor of 10 to account for variability in human response (Health Canada 1992).

The OEHHA (2000) identified a NOAEL of 40 ppm for neurological effects in rats following subchronic exposure to toluene (6 hours/day, 5 days/week for 4 weeks) (Hillefors-Berglund *et al.* 1995). An uncertainty factor of 100 was applied to this NOAEL to account for use of a subchronic study and variability in human response. An uncertainty factor for extrapolation from animal to human response was not applied based on evidence of human effects at levels that were broadly consistent with animal data (OEHHA 2000).

The RIVM (2001) adopted the 1992 US EPA RfC of 400 µg/m^3 for toluene which was developed from a LOAEL of 88 ppm (332 mg/m^3) for neurological effects in workers exposed to toluene (Foo *et al.* 1990).

The US EPA (2005) currently recommends a RfC of 5,000 µg/m^3 for toluene. The EPA evaluated a large database of occupational studies for neurological effects following subchronic and chronic exposure to toluene, including studies by Zavalic *et al.* (1998a) and (Foo *et al.* 1990). Several occupational studies reported NOAELs in the range of 25-50 ppm toluene. The US EPA (2005) derived an arithmetic mean NOAEL of 34 ppm from 4 equally weighted occupational studies. The NOAEL was adjusted for continuous exposure (from 8 hours/day, 5 days/week) and divided by an

uncertainty factor of 10 to account for variability in human response to determine a chronic RfC of 5,000 µg/m^3 (US EPA 2005).

The WHO (2000) established an air quality guideline of 260 µg/m^3 for toluene. This guideline was based on the lowest available air concentration of 88 ppm (332 mg/m^3) associated with neurobehavioral effects following chronic occupational exposure to toluene (Foo *et al.* 1990; 1993). The LOAEL was adjusted for continuous exposure and divided by an uncertainty factor of 300 for use of a LOAEL (10), variability in human response (10) and the potential for human CNS developmental effects as observed in animal studies (WHO 2000).

The US EPA RfC of 5,000 µg/m^3 was selected for the evaluation of chronic exposure to toluene as this RfC was recently developed and took into account the results from a range of human exposure studies, including those identified by the ATSDR and TCEQ (Zavalic *et al.* 1998a) and RIVM and WHO (Foo *et al.* 1990). Toluene was included in the chemical group for neurological effects following chronic inhalation exposures.

46.2 Oral Exposure Limits

No chronic oral exposure limit was required for toluene as this chemical was not identified for inclusion in the multiple pathway exposure assessment.

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47.0 URANIUM

47.1 Inhalation Exposure Limits

47.1.1 Acute Inhalation

Table B.47-1 Acute Inhalation Exposure Limits for Uranium

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	-	-	-	ESL	-
Exposure Limit Value (µg/m³)	-	-	-	-	0.5 (soluble) 2 (insoluble)	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	-	-	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The TCEQ (2014) reports interim short term ESLs for uranium, soluble compounds (0.5 µg/m³) and uranium, insoluble compounds (2 µg/m³). Although the ESLs are based on health effects, they were derived based on exposure to PM_{10}. No supporting data was available for these limits; therefore, they were not selected.

Due to the lack of defensible acute inhalation exposure limits, uranium was not assessed on an acute basis.

47.1.2 Chronic Inhalation

Table B.47-2 Chronic Inhalation Exposure Limits for Uranium

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	**MRL**	-	-	-	ESL	-	-
Exposure Limit Value (µg/m³)	-	**0.04 (soluble)** **0.8 (insoluble)**	-	-	-	0.1	-	-
Critical Organ or Effect	-	**-**	-	-	-	-	-	-
Species	-	**-**	-	-	-	-	-	-
Study	-	**Stokinger *et al.* 1953** **Leach *et al* 1970, 1973**	-	-	-	-	-	-
Source	-	**ATSDR 2012**	-	-	-	TCEQ 2014	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Uranium (as U) is classified as being a confirmed human carcinogen (Group A1) by the ACGIH (2007). However, no unit risk factors were available for uranium exposure by inhalation. For this reason, uranium was treated as a non-carcinogen by chronic inhalation for this risk assessment.

The ATSDR (2012) has derived chronic duration MRLs of 0.8 µg/m³ and 0.04 µg/m³ for the insoluble and soluble forms of uranium, respectively. The chronic inhalation exposure MRL for soluble uranium compounds is based on a $BMCL_{10}$ of 0.019 µg/m³ for renal effects in dogs exposed to uranium tetrachloride 33 hours/week for 1 year (Stokinger *et al*. 1953). The $BMCL_{10}$ was adjusted to 0.0037 µg/m³ for chronic duration. A cumulative uncertainty factor of 100 was applied to the adjusted BMCL for interspecies (10) and intraspecies (10) variability. The chronic inhalation exposure MRL for insoluble uranium compounds is based on a LOAEL of 5.1 µg/m³ for lung fibrosis in monkeys exposed to uranium dioxide 5.4 hours/day, 5 days/week for 5 years (Leach *et al.* 1970, 1973). A cumulative uncertainty factor of 1,000 was applied for the use of a LOAEL (10); and for interspecies (10) and intraspecies (10) variability. The ATSDR MRL of 0.04 µg/m³, based on kidney effects, was used in the chronic inhalation assessment for uranium.

The TCEQ (2014) reports interim long term ESLs for uranium, soluble compounds (0.05 µg/m^3) and uranium, insoluble compounds (0.2 µg/m^3). Although the ESLs are based on health effects, they were derived based on exposure to PM_{10}. No supporting data was available for these limits; therefore, they were not selected.

47.2 Oral Exposure Limits

47.2.1 Chronic Oral

Table B.47-3 Chronic Oral Exposure Limits for Uranium

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	-	**TDI**	-	-	RfD	-
Exposure Limit Value (mg/kg bw/day)	-	**0.0006**	-	-	0.003	-
Critical Organ or Effect	-	**Kidney**	-	-	Weight Loss, Kidney	-
Species	-	**Rats**	-	-	Rabbits, Rats, Dogs	-
Study	-	**Gilman *et al.* 1998**	-	-	Maynard and Hodge 1949	-
Source	-	**Health Canada 2010**	-	-	US EPA 1989	-

- not available

Bold – Exposure Limit selected for HHRA.

Uranium (as U) is classified as being a confirmed human carcinogen (Group A1) by the ACGIH (2007). No slope factors were available for uranium exposure by ingestion. For this reason, uranium was treated as a non-carcinogen by ingestion for this risk assessment.

Health Canada (2010) provides an oral TDI of 0.0006 mg/kg bw/d based on a LOAEL of 0.06 mg/kg-d. The TDI is based on a subchronic drinking water study using rats exposed to uranyl nitrate hexahydrate (Gilman *et al.* 1998). A cumulative uncertainty factor of 100 was applied to the LOAEL for interspecies (10) and intraspecies (10) variability to derive the TDI of 0.06 mg/kg-d based on kidney effects. An additional uncertainty factor to account for the use of a LOAEL instead of a

NOAEL was not used due to the minimal degree of severity of the kidney lesions reported in the study. An adjustment was not made for chronic exposure since the estimated half-life of uranium in the kidneys is only 15 days (Health Canada 2001).

The US EPA (1989) uses an oral RfD of 0.003 mg/kg bw/d for initial body weight loss and moderate nephrotoxicity. The RfD is based on a LOAEL of 2.8 mg/kg bw/d from a study where rabbits, rats and dogs were administered uranium compounds in their diets for up to 2 years (Maynard and Hodge 1949). A cumulative uncertainty factor of 1,000 was applied to the LOAEL for interspecies variability (10), intraspecies variability (10) and the use of a LOAEL (10). The US EPA classified confidence in the RfD as medium, noting that the critical study was well designed, but used a relatively small number of experimental animals. The resultant RfD of 0.003 mg/kg bw/d was not used in the chronic oral assessment of uranium as the Health Canada TDI is more conservative.

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48.0 VANADIUM

48.1 Inhalation Exposure Limits

48.1.1 Acute Inhalation

Table B.48-1 Acute Inhalation Exposure Limits for Vanadium

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 hour Standard	MRL	**1 hour REL**	1 hour ESL	24 hour Guideline
Exposure Limit Value (µg/m³)	-	2	0.8	**30**	0.5	1
Critical Organ or Effect	-	-	Respiratory	**Respiratory**	-	-
Species	-	-	Rodents	**Human**	-	-
Study	-	-	NTP 2002	**Zenz and Berg 1967**	-	-
Source	-	OMOE 2012	ATSDR 2012	**OEHHA 2008**	-	-

- not available

Bold – Exposure Limit selected for HHRA.

The OMOE (2012) has a 24-hour standard of 2 µg/m³. Although the standard is based on health effects, supporting documentation is not available and, therefore, it was not used in the acute assessment.

The ATSDR (2012) derived an acute MRL of 0.8 µg/m³ based on an acute study in rodents exposed to vanadium pentoxide particulate aerosols for 6 hours per day, 5 days per week for a duration of 16 days (NTP 2002). A LOAEL of 0.56 mg/m³ for lung inflammation was identified was selected as the point of departure for the MRL. The LOAEL was adjusted for continuous exposure (6/24 hours × 5/7 days) to a $LOAEL_{ADJ}$ of 0.1 mg/m³. This $LOAEL_{ADJ}$ was then converted to a human equivalent concentration $LOAEL_{HEC}$ of 0.073 mg/m³. A cumulative uncertainty factor of 90 was applied for the use of a minimal LOAEL (3), interspecies differences (3) and intraspecies variability (10). Since the OEHHA's reported a human based value for the same toxicological endpoint of respiratory irritation, the ATSDR value was not selected for use in the acute assessment.

The OEHHA (2008) uses an acute (1-hour) REL of 30 µg/m³ for vanadium pentoxide. The REL is based on a study in which nine adult male volunteers were exposed to vanadium pentoxide for an eight hour period (Zenz and Berg 1967). A LOAEL of 0.25 mg/m³ for vanadium pentoxide was identified for five of the human volunteers. A NOAEL/LOAEL of 0.1 mg/m³ was identified in two of the volunteers. The critical effect was based on subjective reports of increased respiratory mucus production that was cleared by coughing. The lowest LOAEL of 0.1 mg/m³ was adjusted from an 8-hour exposure to a 1-hour exposure to 0.3 mg/m³. An uncertainty factor of 10 was applied to the adjusted LOAEL to account for intraspecies variability. Although a LOAEL was used instead of a NOAEL, an uncertainty factor was not applied to account for the associated uncertainty, due to the minor nature of the observed effects. This acute REL of 30 µg/m³ based on respiratory irritation was used in the acute assessment as a 1-hour exposure limit.

The TCEQ (2014) reports an interim short term (1 hour) ESL for vanadium and compounds (as vanadium pentoxide) of 0.5 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

The WHO (2000) has derived a 24-hour guideline of 1 µg/m³; however, this value is based on a LOAEL of 20 µg/m³ for chronic respiratory symptoms in occupational long-term studies. Since the adverse nature of the observed effects on the upper respiratory tract were minimal at 20 µg/m³ and a susceptible subpopulation had not been identified, a protection factor of 20 was applied to derive guideline of 1 µg/m³ with an averaging time of 24 hours. The WHO also identified an acute LOAEL of 60 µg/m³ based on acute occupational exposures; however, this LOAEL was not considered for the acute guideline and supporting information was limited. Since the WHO guideline of 1 µg/m³ was based on chronic occupational studies and supporting information was lacking, it was not used in the acute assessment.

48.1.2 Chronic Inhalation

Table B.48-2 Chronic Inhalation Exposure Limits for Vanadium

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	**MRL**	-	-	Provisional TCA	ESL	-	-
Exposure Limit Value (µg/m³)	-	**0.1**	-	-	1	0.05	-	-

Table B.48-2 Chronic Inhalation Exposure Limits for Vanadium

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Critical Organ or Effect	-	**Respiratory**	-	-	Respiratory	-	-	-
Species	-	**Rodents**	-	-	Rodents	-	-	-
Study	-	**NTP 2002**	-	-	NTP 2002	-	-	-
Source	-	**ATSDR 2012**	-	-	RIVM 2009	TCEQ 2014	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Vanadium pentoxide is classified as possibly carcinogenic to humans (Group 2B) by IARC (2006) and as a confirmed animal carcinogen with unknown relevance to humans (Group A3) by ACGIH (2007). However, no unit risk factors were available for vanadium exposure by inhalation. For this reason, vanadium was treated as a non-carcinogen by chronic inhalation for this risk assessment.

The ATSDR (2012) derived a chronic MRL of 0.1 µg/m³ based on a rodent study (NTP 2002). Male and female F344 rats were exposed to vanadium pentoxide for 6 hours per day, 5 days per week for up to 104 weeks. Statistically significant increases in respiratory lesions were observed in all exposed animals. Benchmark dose modelling was completed on the incidence of various types of respiratory lesions, and $BMCL_{10}$ values (for vanadium) were calculated for alveolar epithelial hyperplasia, bronchiolar epithelia hyperplasia, laryngeal chronic inflammation, degeneration of epiglottis epithelium and hyperplasia of nasal goblet cells. All of these BMCLs were adjusted for continuous exposure (6/24 hours × 5/7 days) and were converted to human equivalent concentrations (HEC). The most conservative $BMCL_{10}$(HEC) was determined to be 0.003 mg/m³ for degeneration of the epithelium of the epiglottis. A cumulative uncertainty factor of 30 was applied to account for interspecies differences for the use of a HEC (3) and intrahuman variability (10). The ATSDR MRL of 0.1 µg/m³ based on respiratory effects was used in the chronic inhalation assessment.

The RIVM (2009) provides a provisional TCA of 1 µg/m³ for vanadium based on a chronic inhalation study involving rats and mice exposed to vanadium pentoxide (NTP 2002). LOAELs of 0.5 mg/m³ for rats and 1 mg/m³ for mice were identified. A cumulative uncertainty factor of 1,000 was applied to account for extrapolation of a LOAEL to NOAEL (10), interspecies variation (10), and intraspecies variation (10). The resulting TCA values (for vanadium pentoxide) were 0.5 for rats and 1 µg/m³ for mice. Since these values were similar to the WHO's 24-hour guideline of 1 µg/m³, the provisional

TCA of 1 µg/m³ was adopted for vanadium. Since the RIVM provide a provisional TCA value based on a LOAEL and since the ATSDR provide a more conservative value based on benchmark dose modelling, the RIVM exposure limit was not selected for use in the chronic inhalation assessment.

The TCEQ (2014) reports an interim long term ESL for vanadium and compounds (as vanadium pentoxide) of 0.05 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

48.2 Oral Exposure Limits

48.2.1 Chronic Oral

Table B.48-3 Chronic Oral Exposure Limits for Vanadium

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	Intermediate Duration MRL	-	-	**Provisional TDI**	RfD	-
Exposure Limit Value (mg/kg bw/day)	0.01	-	-	**0.002**	0.009	-
Critical Organ or Effect	Hematological and Blood Pressure	-	-	**Developmental**	Decreased Cysteine in Hair	-
Species	Human	-	-	**Rats**	Rats	-
Study	Fawcett *et al.* 1997	-	-	**Domingo *et al.* 1986**	Stokinger *et al.* 1953	-
Source	ATSDR 2012	-	-	**RIVM 2009**	US EPA 1996	-

- not available

Bold – Exposure Limit selected for HHRA.

Vanadium pentoxide is classified as possibly carcinogenic to humans (Group 2B) by IARC (2006) and as a confirmed animal carcinogen with unknown relevance to humans (Group A3) by ACGIH (2007). No slope factors were available for Vanadium exposure by ingestion. For this reason, Vanadium was treated as a non-carcinogen by ingestion for this risk assessment.

The ATSDR (2012) reported an intermediate-duration MRL of 0.01 mg/kg bw/d for vanadium based on a NOAEL of 0.12 mg/kg bw/d for hematological and blood pressure effects in humans exposed to vanadyl sulphate for 12 weeks (Fawcett *et al.* 1997). An uncertainty factor of 10 was applied to the

NOAEL to derive the MRL of 0.01 mg/kg bw/d. The ATSDR did not report a chronic-duration oral MRL.

The RIVM (2009) provides a provisional TDI of 0.002 mg/kg bw/d based on a LOAEL of 2.1 mg/kg bw/d for vanadium in a reproduction study using rats (Domingo *et al*. 1986). A cumulative uncertainty factor of 1,000 was applied to the LOAEL to account for interspecies differences (10), subchronic to chronic exposure (10), and intraspecies differences (10). The resulting TDI of 0.002 mg/kg bw/d for developmental effects was used in the assessment. Since the RIVM provide a provisional TCA value based on a LOAEL

The US EPA (1996) uses an RfD of 0.009 mg/kg bw/d for vanadium pentoxide based on a study where rats were exposed to vanadium pentoxide through their diet for 2.5 years (Stokinger *et al.* 1953). A NOAEL of 17.85 ppm was identified for vanadium pentoxide, with the only significant change being decreased cysteine in the hair of the animals. The NOAEL was adjusted to 0.89 mg/kg bw/d for humans. A cumulative uncertainty factor of 100 was applied to account for interspecies variability (10) and intraspecies variability (10). The US EPA RfD was not chosen for the assessment since the RIVM provides a more conservative TDI for vanadium rather than for the vanadium pentoxide fraction provided by the US EPA.

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49.0 XYLENES

49.1 Inhalation Exposure Limits

49.1.1 Acute Inhalation

Table B.49-1 Acute Inhalation Exposure Limits for Xylenes

AGENCY	AEP	ATSDR	OEHHA	TCEQ
Exposure Limit Type	1-hour 24-hour	Acute MRL	1-hour REL	**1-hour ReV**
Exposure Limit Value ($\mu g/m^3$)	2,300 700	8,000	22,000	**7,400**
Critical Organ or Effect	1 hr- adopted from Ontario 24-hr adopted from California	Respiratory, neurological	Eye irritation respiratory irritation	**Respiratory, neurological**
Species	Human (24-hour)	Human	Human	**Human**
Study	Uchida *et al.* 1993 (24-hr)	Ernstgard *et al.* 2002	Hastings *et al.* 1984	**Ernstgard *et al.* 2002**
Source	ESRD 2013	ATSDR 2013; 2007	OEHHA 2013; 2008	**TCEQ 2009**

- not available

Bold – Exposure Limit selected for HHRA.

The ESRD (2013) recommend 1-hour and 24-hour exposure limits of 2,300 $\mu g/m^3$ and 700 $\mu g/m^3$, respectively for acute exposure to all three isomers of xylenes (ortho-, meta- and para-xylene). The 1-hr guideline represents an odour threshold for m-xylene identified by the Ontario Ministry of Environment (OMOE, 2001). The 24-hour guideline was adopted from the OEHHA (2000) and represents a reference exposure level for neurological effects in workers following chronic exposure (average of 7 years) to xylene isomers (Uchida *et al.* 1993). This study was not considered appropriate for assessment of acute exposures but was considered below in the discussion of chronic inhalation exposure limits.

The ATSDR (2013) recommend an acute MRL of 8,000 $\mu g/m^3$ (2 ppm) for xylenes. This MRL was derived from a LOAEL of 50 ppm (200 mg/m^3) for slight respiratory effects and subjective neurological symptoms in healthy female volunteers following controlled acute (2 hour) exposure to m-xylene vapours (Ernstgard *et al.* 2002). An uncertainty factor of 30 was applied to the LOAEL to

account for human variability (10) and use of a minimal LOAEL (3), resulting in a MRL of 2 ppm (8 mg/m^3) (ATSDR 2007).

The TCEQ (2009) developed a 1-hour ReV of 7,400 µg/m^3 (1.7 ppm) for xylene isomers. The 1-hour ReV was derived using the same study (Ernstgard *et al.* 2002), LOAEL (50 ppm) and uncertainty factor (30) recommended by the ATSDR (2007) with no rounding of the final value.

The OEHHA (2013) recommend a 1-hour REL of 22,000 µg/m^3 (5 ppm) for xylene isomers. The REL was developed from a study reporting a NOAEL of 100 ppm (430 mg/m^3) for eye and respiratory irritation in healthy volunteers exposed for 30 minutes to mixed xylenes (Hastings *et al.* 1984). The NOAEL was adjusted for 1-hour exposure (50 ppm) and an uncertainty factor of 10 was applied to account for human variability.

The lowest recommended, health-based 1-hour guideline of 7,400 µg/m^3 (TCEQ 2009) was selected for the assessment of acute inhalation exposures to all xylene isomers. Xylenes were included in the chemical groups for neurological effects, eye irritation and respiratory irritation following acute inhalation exposures.

49.1.2 Chronic Inhalation

Table B.49-2 Chronic Inhalation Exposure Limits for Xylenes

AGENCY	ATSDR	HEALTH CANADA	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	**Chronic MRL**	TC (provisional)	REL	TCA	ReV	RfC	-
Exposure Limit Value (µg/m^3)	**200**	180	700	870	610	100	-
Critical Organ or Effect	**Respiratory and eye irritation, neurological**	Fetotoxicity	Respiratory and eye irritation, neurological	Developmental neurotoxicity	Respiratory and eye irritation, neurological	Neurological	-
Species	**Human**	Rat	Human	Rat	Human	Rat	-
Study	**Uchida *et al.* 1993**	Ungvary and Tatrai 1985	Uchida *et al* 1993	Hass and Jakobsen 1993	Uchida *et al.* 1993	Korsak *et al.* 1994	-
Source	**ATSDR 2013; 2007**	Health Canada 2010; 1993	OEHHA 2013; 2000	RIVM 2001	TCEQ 2009	US EPA 2003	WHO 2000

- not available
Bold – Exposure Limit selected for HHRA.

The ATSDR (2013) recommend a chronic MRL of 200 µg/m^3 for xylene isomers. This MRL was based on symptoms of neurotoxicity and respiratory and eye irritation reported by workers exposed to mixed xylenes in Chinese factories producing boots or plastic coated wire or involved in printing work (Uchida *et al*. 1993). The ATSDR (2007) identified a LOAEL of 14 ppm (56 mg/m^3) based on a time-weighted average geometric mean of exposure concentrations over a 7 year period. This LOAEL was adjusted by an uncertainty factor of 300 to account for human variability (10), use of a LOAEL (10) and lack of supporting studies on the neurotoxicity of xylenes following chronic inhalation exposures (3).

The TCEQ (2009) developed a chronic ReV of 610 µg/m^3 for xylene isomers. The TCEQ selected the same study (Uchida *et al*. 1993) and LOAEL (14 ppm) for respiratory and neurological effects identified by the ATSDR (2007). An uncertainty factor of 100 was applied to the LOAEL to account for human variability (10), use of a LOAEL (3) and an incomplete database regarding chronic neurotoxicity studies (3).

The OEHHA (2013) recommend a chronic REL of 700 µg/m^3 for xylene isomers. This exposure limit was also derived from the LOAEL of 14 ppm reported by Uchida *et al*. (1993). The OEHHA (2000) adjusted the LOAEL (14.2 ppm) to account for continuous exposure (7 days/week) and differences in occupational inhalation rates, resulting in an adjusted LOAEL of 5.1 ppm. An uncertainty factor of 30 was applied to the adjusted LOAEL to account for human variability (10) and use of a LOAEL (3).

The RIVM (2001) recommend a TCA of 870 µg/m^3 for xylene isomers. This guideline is based on a LOAEL of 870 mg/m^3 for developmental neurotoxicity in rats (Hass and Jakobsen. 1993). An uncertainty factor of 1,000 was applied to the LOAEL to account for extrapolation from animals to humans (10), variability in human response (10) and use of a LOAEL (10).

Health Canada (2010) recommends a TC (provisional) of 180 µg/m^3 for xylene isomers. The TC was based on a study by Ungvary and Tatrai (1985) which reported maternal toxicity (unspecified) and fetotoxicity (skeletal retardation) in rats exposed to 250 mg/m^3 xylenes on gestation days 7 to 15 (Health Canada 1993). This LOAEL was adjusted for human exposure using inhalation to body weight dose scaling and an uncertainty factor of 1,000 applied to account for extrapolation from animal response (10), variability in human response (10) and use of a LOAEL (10).

The US EPA (2003) developed a RfC of 100 µg/m^3 for xylene isomers. The RfC is based on a NOAEL of 50 ppm for impaired motor coordination in rats exposed to m-xylene for 3 months (Korsak *et al.* 1994). The US EPA (2003) calculated a NOAEL (HEC) of 39 mg/m^3 to which an uncertainty factor of 300 was applied to account for human variability (10), interspecies differences (3), extrapolation from subchronic to chronic exposure duration study (3) and uncertainties in the database (3).

The chronic human exposure study conducted by Uchida *et al*. (1993) was identified by three agencies for the development of chronic inhalation exposure limits for xylenes. The lowest exposure limit of 200 μg/m^3 (ATSDR 2007) was selected for the assessment of chronic inhalation exposure to xylene isomers. Xylenes were included in the chemical groups for neurological effects, eye irritation and nasal irritation following chronic inhalation exposures.

49.2 Oral Exposure Limits

No chronic oral exposure limit was required for ortho-, meta- or para-xylenes as these chemicals were not identified for inclusion in the multiple pathway exposure assessment.

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50.0 ZINC

50.1 Inhalation Exposure Limits

50.1.1 Acute Inhalation

Table B.50-1 Acute Inhalation Exposure Limits for Zinc

AGENCY	AEP	OMOE	ATSDR	OEHHA	TCEQ	WHO
Exposure Limit Type	-	24 Hour AAQC	-	-	1 Hour ESL	-
Exposure Limit Value (µg/m³)	-	120	-	-	20	-
Critical Organ or Effect	-	-	-	-	-	-
Species	-	-	-	-	-	-
Study	-	-	-	-	-	-
Source	-	OMOE 2012	-	-	TCEQ 2014	-

- not available

Bold – Exposure Limit selected for HHRA.

The OMOE (2012) provides a particulate-based 24-hour AAQC of 120 µg/m³ for zinc. The scientific basis of this limit is not provided and, therefore, it was not used.

The TCEQ (2014) reports an interim short term (1 hour) ESL for zinc and compounds of 20 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible acute inhalation exposure limits, zinc was not assessed on an acute basis.

50.1.2 Chronic Inhalation

Table B.50-2 Chronic Inhalation Exposure Limits for Zinc

AGENCY	AEP	ATSDR	Health Canada	OEHHA	RIVM	TCEQ	US EPA	WHO
Exposure Limit Type	-	-	-	-	-	2	-	-
Exposure Limit Value (µg/m³)	-	-	-	-	-	-	-	-
Critical Organ or Effect	-	-	-	-	-	-	-	-
Species	-	-	-	-	-	-	-	-
Study	-	-	-	-	-	-	-	-
Source	-	-	-	-	-	**TCEQ 2014**	-	-

- not available

Bold – Exposure Limit selected for HHRA.

Zinc chromate (VI) is classified as a human carcinogen (Group 1) by IARC, as a known human carcinogen (Group K) by NTP and a confirmed human carcinogen (Group A1) by ACGIH (OSU 2010). Zinc chromate (VI) hydroxide is classified as a human carcinogen (Group 1) by IARC (OSU 2010). Zinc chromates as chromium (zinc potassium chromate and zinc yellow) are classified as confirmed human carcinogens (Group A1) by ACGIH (OSU 2010). The chromium (VI) ion present in these compounds is a well-known human lung carcinogen (OSU 2010). However, no unit risk factors were available for zinc exposure by inhalation. For this reason, zinc was treated as a non-carcinogen by chronic inhalation for this risk assessment.

The TCEQ (2014) reports an interim long term ESL for zinc and compounds of 2 µg/m³. Although the ESL is based on health effects, it was derived based on exposure to PM_{10}. No supporting data was available for this limit; therefore, it was not selected.

Due to the lack of defensible chronic inhalation exposure limits, zinc was not assessed on a chronic basis.

50.2 Oral Exposure Limits

50.2.1 Chronic Oral

Table B.50-3 Chronic Oral Exposure Limits for Zinc

AGENCY	ATSDR	Health Canada	OEHHA	RIVM	US EPA	WHO
Exposure Limit Type	MRL	UL	-	TDI	**RfD**	TDI
Exposure Limit Value (mg/kg bw/day)	0.3	Infants and Children: 0.5 Adults: 0.6	-	0.5	**0.3**	1
Critical Organ or Effect	ESOD Activity	Increased Growth of Infant Length, Weight and Head Circumference; Reduced iron and Copper Status	-	ESOD Activity	**ESOD Activity**	-
Species	Human	Human	-	Human	**Human**	-
Study	Yadrick *et al.* 1989	Yadrick *et al.* 1989, Walravens and Hambridge (1976)	-	ATSDR 2005	**Multiple**	-
Source	ATSDR 2005	Health Canada 2010	-	RIVM 2001	**US EPA 2005**	WHO 2003

- not available

Bold – Exposure Limit selected for HHRA.

Zinc chromate (VI) is classified as a human carcinogen (Group 1) by IARC, as a known human carcinogen (Group K) by NTP and a confirmed human carcinogen (Group A1) by ACGIH (OSU 2010). Zinc chromate (VI) hydroxide is classified as a human carcinogen (Group 1) by IARC (OSU 2010). Zinc chromates as chromium (zinc potassium chromate and zinc yellow) are classified as confirmed human carcinogens (Group A1) by ACGIH (OSU 2010). The chromium (VI) ion present in these compounds is a well-known human carcinogen (OSU 2010). No slope factors were available for zinc exposure by ingestion. For this reason, zinc was treated as a non-carcinogen by ingestion for this risk assessment.

Zinc is an essential trace element that is crucial to survival and health maintenance, as well as growth, development, and maturation of developing organisms of all animal species (US EPA 2005). Thus,

insufficient as well as excessive oral intake can cause toxicity and disease. The zinc content of a typical mixed diet of North American adults is approximately 10 to 15 mg/day (IOM, 2001). The recommended dietary allowances (RDAs) for zinc for the year 2000 (IOM, 2001) are 11 mg/day for adult males and 8 mg/day for adult females (not pregnant or lactating).

The US EPA (2005) presents an oral exposure limit of 0.3 mg/kg bw/d based on decreases in erythrocyte copper zinc-superoxidase dismutase (ESOD) activity (*i.e.*, a change in copper status) based on a human study. A LOAEL of 0.91 mg/kg bw/d was derived as an average from effect levels reported in four separate studies with similar methodologies (Yadrick *et al.* 1989, Fischer *et al*. 1984, Davis *et al.* 2000, Milne *et al*. 2001). A total uncertainty factor of 3 was applied to the LOAEL for intraspecies variability. An uncertainty factor greater than 3 was not applied for intraspecies variability as this would result in an exposure limit lower than the daily requirement for sensitive humans. An uncertainty factor was not deemed necessary from the use of the minimal LOAEL. The oral RfD of 0.3 mg/kg bw/d was used in the chronic multiple pathway assessment of zinc.

The ATSDR (2005) also recommends a chronic oral MRL of 0.3 mg/kg bw/d, which was adopted from the intermediate oral MRL. The intermediate MRL is based on decreases in ESOD activity, a sensitive indicator of body copper status, as well as on changes in serum ferritin in women given supplements containing zinc gluconate for 10 weeks (Yadrick *et al*. 1989). An uncertainty factor of 3 was applied to account for human variability. No uncertainty factors were applied by the ATSDR to account for a subchronic duration. As a result, this MRL was not selected for use in the assessment.

Health Canada (2010) presents upper limits (ULs) for zinc on a life stage-specific basis. The UL for adults over 19 years of age is 0.6 mg/kg bw/d based on reduced iron and copper status; and the UL for infants and children is 0.5 mg/kg bw/d based on increased growth of infant length, weight and head circumference. The adult UL is based on a LOAEL of 60 mg/d identified by the IOM (2001) for reduced iron and copper status based on a significant reduction in ESOD activity (Yadrick *et al.* 1989). The IOM applied an uncertainty factor of 1.5 for intrahuman variability and use of a LOAEL instead of a NOAEL. The result is a UL of 40 mg/d for adults. For infants, toddlers, children and teens, Health Canada based their UL on a NOAEL of 5.8 mg/d identified by IOM (2001) from a study by Walravens and Hambridge (1976) in which infants were fed formula containing 1.8 mg/L (control) or 5.8 mg/L of zinc for 6 months. No adverse effects were reported. The NOAEL was adjusted to a daily intake of 4.5 mg/d, assuming an estimated average daily intake of human milk of 0.78 L/d. Health Canada's ULs for toddlers, children and teens were calculated on the basis of relative body weight.

The RIVM (2001) provides a TDI value of 0.5 mg/kg bw/d based on a LOAEL of 1 mg/kg bw/d for humans reported previously by ATSDR (2005) for ESOD activity. A margin of safety of 2 was used to convert a LOAEL to a NOAEL. The TDI recommended by RIVM was not used for the chronic oral

assessment of zinc because the ATSDR has since updated its oral exposure limit for zinc and exposure durations and concentrations were not presented.

The WHO (2003) provides a provisional maximum TDI of 1 mg/kg bw/d that was derived by the WHO JECFA Committee. The WHO concludes that, in the light of recent studies on humans, the derivation of a health-based guideline value for drinking water is not required. The toxicological basis of the TDI value is not clearly provided by the WHO (2003). As a result, it was not used in the assessment.

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APPENDIX C: ACUTE INHALATION RESULTS

Acute Inhalation Results

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TABLE C.1 Predicted Hazard Quotients from Inhalation of Criteria Air Contaminants

COPC	SO2									NO2						CO						PM2.5			PM10		
Averaging Time	10 min			1 hour (Alberta)			1 hour (CCME CAAQSs)			1 hour (US EPA TRV)			1 hour (CCME CAAQSs)			1 hour			8 hour			24 hour			24 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	1.4E-01	2.7E-02	1.5E-01	9.2E-02	1.3E-02	9.2E-02	2.4E-01	3.3E-02	2.4E-01	1.5E+00	6.5E-01	1.5E+00	3.5E+00	1.5E+00	3.5E+00	3.8E-01	1.3E-01	3.9E-01	4.2E-01	2.3E-01	4.2E-01	1.9E+00	4.8E-01	1.9E+00	5.9E+00	4.2E-01	6.3E+00
FL-MPOI	1.8E-02	1.2E-03	1.8E-02	1.1E-02	5.5E-04	1.1E-02	2.8E-02	1.5E-03	2.8E-02	5.5E-01	3.6E-01	5.7E-01	1.3E+00	8.5E-01	1.4E+00	4.8E-02	9.1E-03	4.8E-02	1.8E-01	1.5E-02	1.8E-01	4.3E-01	3.5E-02	4.3E-01	1.7E+00	4.8E-01	2.1E+00
R1	1.8E-03	9.7E-03	9.7E-03	8.2E-04	4.5E-03	4.5E-03	2.2E-03	1.2E-02	1.2E-02	3.0E-01	4.7E-01	4.7E-01	7.1E-01	1.1E+00	1.1E+00	2.2E-03	4.9E-02	4.9E-02	4.4E-03	9.7E-02	9.7E-02	2.2E-02	1.8E-01	2.0E-01	4.7E-02	7.6E-01	7.7E-01
R2	1.5E-03	8.9E-05	1.5E-03	8.8E-04	3.8E-05	8.9E-04	2.3E-03	1.0E-04	2.4E-03	1.9E-01	1.8E-01	3.2E-01	4.6E-01	4.3E-01	7.5E-01	4.1E-03	8.0E-04	4.2E-03	8.2E-03	1.5E-03	8.5E-03	2.7E-02	1.5E-03	2.9E-02	5.9E-02	4.2E-01	4.8E-01
R3	6.7E-04	3.6E-03	3.7E-03	4.2E-04	1.7E-03	1.8E-03	1.1E-03	4.4E-03	4.7E-03	1.4E-01	4.8E-01	4.9E-01	3.2E-01	1.2E+00	1.2E+00	1.6E-03	3.1E-02	3.1E-02	6.3E-03	6.2E-02	6.2E-02	1.4E-02	1.1E-01	1.1E-01	4.9E-02	6.1E-01	6.2E-01
R4	7.8E-04	3.8E-05	7.8E-04	4.1E-04	1.9E-05	4.1E-04	1.1E-03	4.9E-05	1.1E-03	6.7E-02	1.8E-01	2.4E-01	1.6E-01	4.2E-01	5.7E-01	1.9E-03	3.8E-04	2.0E-03	3.9E-03	7.1E-04	4.0E-03	8.5E-03	6.8E-04	9.1E-03	2.3E-02	4.2E-01	4.4E-01
R5	1.2E-03	5.3E-05	1.2E-03	7.1E-04	2.4E-05	7.1E-04	1.9E-03	6.4E-05	1.9E-03	1.0E-01	1.8E-01	2.7E-01	2.5E-01	4.2E-01	6.5E-01	3.2E-03	4.4E-04	3.3E-03	6.6E-03	9.9E-04	7.0E-03	1.2E-02	9.4E-04	1.3E-02	3.8E-02	4.2E-01	4.6E-01
R6	7.4E-04	8.3E-03	8.3E-03	4.0E-04	3.7E-03	3.8E-03	1.1E-03	9.9E-03	1.0E-02	1.7E-01	5.5E-01	5.5E-01	4.2E-01	1.3E+00	1.3E+00	1.3E-03	6.2E-02	6.2E-02	4.2E-03	1.2E-01	1.2E-01	1.4E-02	3.4E-01	3.4E-01	4.2E-02	1.1E+00	1.1E+00
R7	5.5E-04	5.0E-03	5.1E-03	3.0E-04	2.4E-03	2.4E-03	8.0E-04	6.4E-03	6.4E-03	1.5E-01	4.7E-01	4.7E-01	3.5E-01	1.1E+00	1.1E+00	1.4E-03	3.5E-02	3.5E-02	4.0E-03	7.7E-02	7.7E-02	1.4E-02	1.6E-01	1.6E-01	3.4E-02	7.4E-01	7.4E-01
R8	4.2E-03	1.8E-02	1.8E-02	2.0E-03	8.4E-03	8.7E-03	5.3E-03	2.2E-02	2.3E-02	4.3E-01	6.3E-01	6.4E-01	1.0E+00	1.5E+00	1.5E+00	4.9E-03	1.1E-01	1.1E-01	6.9E-03	2.1E-01	2.1E-01	5.3E-02	4.1E-01	4.4E-01	6.6E-02	1.3E+00	1.3E+00
R9	3.5E-03	5.4E-04	3.6E-03	1.7E-03	2.6E-04	1.8E-03	4.6E-03	7.0E-04	4.8E-03	4.6E-01	2.4E-01	4.8E-01	1.1E+00	5.8E-01	1.1E+00	4.0E-03	3.9E-03	5.7E-03	8.9E-03	7.1E-03	1.2E-02	8.1E-02	1.4E-02	8.9E-02	2.5E-01	4.4E-01	6.7E-01
R10	9.9E-03	1.8E-04	9.9E-03	6.1E-03	9.1E-05	6.1E-03	1.6E-02	2.4E-04	1.6E-02	4.4E-01	1.9E-01	4.7E-01	1.0E+00	4.6E-01	1.1E+00	2.5E-02	1.4E-03	2.5E-02	5.2E-02	3.0E-03	5.3E-02	2.5E-01	4.5E-03	2.5E-01	6.8E-01	4.3E-01	1.1E+00
R11	1.0E-02	1.2E-04	1.0E-02	5.8E-03	5.1E-05	5.9E-03	1.5E-02	1.3E-04	1.5E-02	4.5E-01	1.8E-01	4.9E-01	1.1E+00	4.4E-01	1.2E+00	2.6E-02	9.8E-04	2.6E-02	3.9E-02	2.3E-03	4.0E-02	1.2E-01	2.5E-03	1.3E-01	3.1E-01	4.2E-01	7.4E-01
R12	2.2E-03	3.1E-04	2.2E-03	1.3E-03	1.4E-04	1.4E-03	3.6E-03	3.7E-04	3.6E-03	2.9E-01	2.1E-01	3.8E-01	7.0E-01	5.0E-01	9.0E-01	4.2E-03	2.3E-03	5.2E-03	2.1E-02	4.9E-03	2.2E-02	4.2E-02	7.8E-03	4.8E-02	1.2E-01	4.3E-01	5.4E-01
R13	4.8E-03	2.2E-04	4.8E-03	2.8E-03	1.1E-04	2.8E-03	7.5E-03	2.9E-04	7.5E-03	3.2E-01	2.0E-01	3.9E-01	7.7E-01	4.8E-01	9.3E-01	1.1E-02	1.7E-03	1.1E-02	2.6E-02	3.7E-03	2.7E-02	6.1E-02	5.9E-03	6.5E-02	1.7E-01	4.3E-01	5.9E-01
R14	1.0E-03	2.4E-02	2.4E-02	4.6E-04	1.1E-02	1.1E-02	1.2E-03	3.0E-02	3.0E-02	2.8E-01	5.0E-01	5.0E-01	6.7E-01	1.2E+00	1.2E+00	1.3E-03	1.1E-01	1.1E-01	4.4E-03	2.1E-01	2.1E-01	1.6E-02	4.2E-01	4.2E-01	3.6E-02	1.2E+00	1.2E+00

TABLE C.2 Predicted Hazard Quotients from Inhalation of Metals

COPC	Aluminum			Antimony			Arsenic			Cadmium			Chromium		
Averaging Time	1 hour			1 hour			1 hour			1 hour			1 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	1.6E-03	4.4E-04	1.6E-03	3.4E-05	8.1E-06	3.4E-05	4.3E-01	1.2E-01	4.4E-01	1.6E-03	4.8E-04	1.7E-03	7.8E-04	2.2E-04	8.0E-04
FL-MPOI	1.0E-04	3.3E-05	1.0E-04	1.3E-05	7.0E-07	1.3E-05	3.1E-02	9.0E-03	3.1E-02	2.3E-04	3.9E-05	2.3E-04	8.3E-05	1.8E-05	8.3E-05
R1	1.2E-04	1.5E-04	2.0E-04	1.1E-06	3.1E-06	3.1E-06	3.3E-02	4.0E-02	5.3E-02	1.3E-04	1.7E-04	2.0E-04	6.1E-05	7.8E-05	9.7E-05
R2	1.4E-05	3.1E-06	1.6E-05	9.9E-07	5.7E-08	1.0E-06	4.0E-03	8.5E-04	4.5E-03	2.2E-05	3.3E-06	2.4E-05	8.8E-06	1.6E-06	9.8E-06
R3	2.0E-05	1.1E-04	1.1E-04	8.3E-07	2.0E-06	2.0E-06	5.3E-03	2.9E-02	2.9E-02	2.0E-05	1.1E-04	1.1E-04	9.7E-06	5.2E-05	5.2E-05
R4	4.8E-06	1.4E-06	6.2E-06	3.1E-07	2.7E-08	3.1E-07	1.4E-03	3.9E-04	1.7E-03	7.1E-06	1.5E-06	8.5E-06	2.9E-06	7.1E-07	3.6E-06
R5	6.8E-06	2.1E-06	7.8E-06	4.4E-07	3.9E-08	4.5E-07	1.9E-03	5.7E-04	2.2E-03	1.0E-05	2.2E-06	1.1E-05	4.3E-06	1.0E-06	4.8E-06
R6	2.5E-05	1.9E-04	1.9E-04	9.1E-07	4.5E-06	4.5E-06	6.9E-03	5.3E-02	5.3E-02	2.6E-05	2.3E-04	2.3E-04	1.3E-05	1.0E-04	1.0E-04
R7	1.8E-05	1.2E-04	1.2E-04	6.4E-07	2.7E-06	2.8E-06	4.9E-03	3.3E-02	3.3E-02	1.9E-05	1.4E-04	1.4E-04	8.9E-06	6.1E-05	6.1E-05
R8	1.9E-04	3.8E-04	4.3E-04	9.8E-07	6.8E-06	6.8E-06	5.2E-02	1.0E-01	1.2E-01	2.0E-04	4.4E-04	4.5E-04	9.5E-05	2.0E-04	2.1E-04
R9	5.4E-05	1.8E-05	5.9E-05	3.0E-06	3.9E-07	3.1E-06	1.5E-02	5.1E-03	1.6E-02	6.5E-05	2.2E-05	6.9E-05	2.9E-05	1.0E-05	3.1E-05
R10	4.6E-05	6.1E-06	4.7E-05	5.4E-06	1.3E-07	5.4E-06	1.4E-02	1.6E-03	1.4E-02	9.8E-05	6.9E-06	9.9E-05	3.7E-05	3.1E-06	3.7E-05
R11	5.3E-05	3.8E-06	5.6E-05	3.7E-06	7.7E-08	3.7E-06	1.5E-02	1.0E-03	1.6E-02	8.5E-05	4.2E-06	8.9E-05	3.5E-05	1.9E-06	3.6E-05
R12	2.8E-05	9.7E-06	3.0E-05	1.5E-06	2.1E-07	1.5E-06	7.8E-03	2.7E-03	8.6E-03	4.2E-05	1.2E-05	4.5E-05	1.7E-05	5.3E-06	1.9E-05
R13	2.0E-05	7.1E-06	2.1E-05	2.0E-06	1.6E-07	2.0E-06	5.9E-03	1.9E-03	6.2E-03	3.9E-05	8.5E-06	4.0E-05	1.5E-05	3.8E-06	1.5E-05
R14	5.4E-05	3.2E-04	3.2E-04	9.2E-07	7.0E-06	7.0E-06	1.5E-02	8.7E-02	8.7E-02	5.6E-05	3.7E-04	3.7E-04	2.7E-05	1.6E-04	1.6E-04

TABLE C.2 Predicted Hazard Quotients from Inhalation of Metals

COPC	Copper			Mercury			Nickel			Selenium			Vanadium		
Averaging Time	1 hour			1 hour			1 hour			1 hour			1 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.4E-04	7.2E-05	2.5E-04	4.1E-05	9.2E-06	4.1E-05	2.2E-02	4.9E-03	2.2E-02	1.1E-05	2.4E-06	1.1E-05	1.1E-03	3.1E-04	1.1E-03
FL-MPOI	3.3E-05	5.8E-06	3.3E-05	1.6E-05	8.0E-07	1.6E-05	8.3E-03	4.2E-04	8.3E-03	4.1E-06	2.1E-07	4.1E-06	1.2E-04	2.5E-05	1.2E-04
R1	1.9E-05	2.6E-05	3.1E-05	1.3E-06	3.5E-06	3.5E-06	6.9E-04	1.9E-03	1.9E-03	3.4E-07	9.1E-07	9.1E-07	8.5E-05	1.1E-04	1.4E-04
R2	3.2E-06	4.9E-07	3.5E-06	1.2E-06	6.4E-08	1.2E-06	6.3E-04	3.4E-05	6.5E-04	3.1E-07	1.7E-08	3.2E-07	1.3E-05	2.2E-06	1.4E-05
R3	3.0E-06	1.7E-05	1.7E-05	1.0E-06	2.2E-06	2.3E-06	5.3E-04	1.2E-03	1.2E-03	2.6E-07	5.8E-07	6.0E-07	1.3E-05	7.3E-05	7.3E-05
R4	1.0E-06	2.2E-07	1.3E-06	3.7E-07	3.0E-08	3.8E-07	2.0E-04	1.6E-05	2.0E-04	9.7E-08	7.8E-09	9.8E-08	4.2E-06	9.9E-07	5.2E-06
R5	1.5E-06	3.3E-07	1.7E-06	5.3E-07	4.3E-08	5.4E-07	2.8E-04	2.3E-05	2.9E-04	1.4E-07	1.1E-08	1.4E-07	6.1E-06	1.5E-06	6.8E-06
R6	4.0E-06	3.4E-05	3.4E-05	1.1E-06	5.1E-06	5.1E-06	5.8E-04	2.7E-03	2.7E-03	2.8E-07	1.3E-06	1.3E-06	1.8E-05	1.4E-04	1.4E-04
R7	2.8E-06	2.0E-05	2.0E-05	7.6E-07	3.1E-06	3.2E-06	4.0E-04	1.6E-03	1.7E-03	2.0E-07	8.1E-07	8.4E-07	1.2E-05	8.7E-05	8.7E-05
R8	3.0E-05	6.5E-05	6.7E-05	1.2E-06	7.5E-06	7.5E-06	6.3E-04	4.0E-03	4.0E-03	3.1E-07	2.0E-06	2.0E-06	1.3E-04	2.8E-04	3.0E-04
R9	9.6E-06	3.3E-06	1.0E-05	3.6E-06	4.3E-07	3.7E-06	1.9E-03	2.3E-04	1.9E-03	9.3E-07	1.1E-07	9.6E-07	4.1E-05	1.4E-05	4.4E-05
R10	1.4E-05	1.0E-06	1.4E-05	6.5E-06	1.4E-07	6.5E-06	3.5E-03	7.5E-05	3.5E-03	1.7E-06	3.7E-08	1.7E-06	5.3E-05	4.3E-06	5.4E-05
R11	1.2E-05	6.2E-07	1.3E-05	4.4E-06	8.7E-08	4.5E-06	2.3E-03	4.6E-05	2.4E-03	1.2E-06	2.3E-08	1.2E-06	5.0E-05	2.6E-06	5.2E-05
R12	6.1E-06	1.7E-06	6.5E-06	1.8E-06	2.4E-07	1.9E-06	9.8E-04	1.3E-04	9.9E-04	4.8E-07	6.2E-08	4.9E-07	2.5E-05	7.4E-06	2.7E-05
R13	5.7E-06	1.3E-06	5.8E-06	2.4E-06	1.7E-07	2.4E-06	1.3E-03	9.3E-05	1.3E-03	6.3E-07	4.6E-08	6.4E-07	2.2E-05	5.4E-06	2.2E-05
R14	8.4E-06	5.5E-05	5.5E-05	1.1E-06	8.0E-06	8.0E-06	5.9E-04	4.2E-03	4.2E-03	2.9E-07	2.1E-06	2.1E-06	3.7E-05	2.3E-04	2.3E-04

TABLE C.3 Predicted Hazard Quotients from Inhalation of Volatile Organic Compounds

COPC	Benzene			Toluene			Xylenes			Acetaldehyde		
Averaging Time	1 hour			1 hour			1 hour			1 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	4.1E-02	1.1E-02	4.2E-02	2.9E-05	8.2E-06	3.1E-05	4.1E-05	1.1E-05	4.3E-05	8.4E-05	2.4E-05	8.8E-05
FL-MPOI	2.7E-03	8.5E-04	2.7E-03	1.9E-06	6.1E-07	2.0E-06	2.7E-06	8.5E-07	2.7E-06	5.5E-06	1.8E-06	5.6E-06
R1	3.2E-03	3.9E-03	5.1E-03	2.3E-06	2.8E-06	3.7E-06	3.2E-06	3.9E-06	5.1E-06	6.6E-06	8.0E-06	1.1E-05
R2	3.6E-04	8.1E-05	4.1E-04	2.6E-07	5.9E-08	3.0E-07	3.6E-07	8.2E-08	4.1E-07	7.4E-07	1.7E-07	8.5E-07
R3	5.1E-04	2.7E-03	2.7E-03	3.7E-07	2.0E-06	2.0E-06	5.1E-07	2.7E-06	2.8E-06	1.1E-06	5.6E-06	5.7E-06
R4	1.2E-04	3.7E-05	1.6E-04	8.9E-08	2.7E-08	1.2E-07	1.2E-07	3.7E-08	1.6E-07	2.6E-07	7.7E-08	3.3E-07
R5	1.8E-04	5.5E-05	2.0E-04	1.3E-07	4.0E-08	1.5E-07	1.8E-07	5.5E-08	2.0E-07	3.6E-07	1.1E-07	4.2E-07
R6	6.6E-04	5.0E-03	5.0E-03	4.8E-07	3.6E-06	3.6E-06	6.7E-07	5.1E-06	5.1E-06	1.4E-06	1.0E-05	1.0E-05
R7	4.6E-04	3.1E-03	3.1E-03	3.3E-07	2.3E-06	2.3E-06	4.7E-07	3.2E-06	3.2E-06	9.6E-07	6.5E-06	6.5E-06
R8	5.0E-03	1.0E-02	1.1E-02	3.6E-06	7.2E-06	8.1E-06	5.0E-06	1.0E-05	1.1E-05	1.0E-05	2.1E-05	2.3E-05
R9	1.4E-03	4.8E-04	1.5E-03	1.0E-06	3.5E-07	1.1E-06	1.4E-06	4.8E-07	1.5E-06	2.9E-06	9.9E-07	3.2E-06
R10	1.2E-03	1.6E-04	1.2E-03	8.7E-07	1.1E-07	8.8E-07	1.2E-06	1.6E-07	1.2E-06	2.5E-06	3.3E-07	2.5E-06
R11	1.4E-03	9.7E-05	1.5E-03	1.0E-06	7.1E-08	1.1E-06	1.4E-06	9.8E-08	1.5E-06	2.9E-06	2.0E-07	3.0E-06
R12	7.1E-04	2.5E-04	7.9E-04	5.2E-07	1.8E-07	5.7E-07	7.2E-07	2.5E-07	7.9E-07	1.5E-06	5.2E-07	1.6E-06
R13	5.2E-04	1.8E-04	5.4E-04	3.7E-07	1.3E-07	3.9E-07	5.2E-07	1.8E-07	5.4E-07	1.1E-06	3.8E-07	1.1E-06
R14	1.4E-03	8.3E-03	8.3E-03	1.0E-06	6.0E-06	6.0E-06	1.4E-06	8.3E-06	8.3E-06	2.9E-06	1.7E-05	1.7E-05

TABLE C.3 Predicted Hazard Quotients from Inhalation of Volatile Organic Compounds

COPC	Acrolein			Formaldehyde			Acenaphthene			Acenaphthylene			Anthracene		
Averaging Time	1 hour			1 hour			1 hour			1 hour			1 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	5.0E-03	1.4E-03	5.1E-03	2.5E-03	6.9E-04	2.6E-03	1.3E-05	3.6E-06	1.3E-05	2.5E-05	7.1E-06	2.6E-05	3.4E-06	9.5E-07	3.5E-06
FL-MPOI	3.2E-04	1.0E-04	3.3E-04	1.6E-04	5.2E-05	1.7E-04	8.4E-07	2.7E-07	8.6E-07	1.7E-06	5.3E-07	1.7E-06	2.2E-07	7.1E-08	2.3E-07
R1	3.9E-04	4.7E-04	6.2E-04	1.9E-04	2.4E-04	3.1E-04	1.0E-06	1.2E-06	1.6E-06	2.0E-06	2.4E-06	3.2E-06	2.7E-07	3.2E-07	4.2E-07
R2	4.4E-05	9.9E-06	5.0E-05	2.2E-05	5.0E-06	2.5E-05	1.1E-07	2.6E-08	1.3E-07	2.2E-07	5.1E-08	2.6E-07	3.0E-08	6.8E-09	3.4E-08
R3	6.2E-05	3.3E-04	3.3E-04	3.1E-05	1.7E-04	1.7E-04	1.6E-07	8.6E-07	8.7E-07	3.2E-07	1.7E-06	1.7E-06	4.2E-08	2.3E-07	2.3E-07
R4	1.5E-05	4.5E-06	1.9E-05	7.5E-06	2.3E-06	9.7E-06	3.9E-08	1.2E-08	5.1E-08	7.7E-08	2.3E-08	1.0E-07	1.0E-08	3.1E-09	1.3E-08
R5	2.1E-05	6.7E-06	2.5E-05	1.1E-05	3.3E-06	1.2E-05	5.6E-08	1.7E-08	6.4E-08	1.1E-07	3.4E-08	1.3E-07	1.5E-08	4.6E-09	1.7E-08
R6	8.0E-05	6.1E-04	6.1E-04	4.0E-05	3.1E-04	3.1E-04	2.1E-07	1.6E-06	1.6E-06	4.1E-07	3.1E-06	3.1E-06	5.5E-08	4.2E-07	4.2E-07
R7	5.6E-05	3.8E-04	3.8E-04	2.8E-05	1.9E-04	1.9E-04	1.5E-07	9.9E-07	9.9E-07	2.9E-07	2.0E-06	2.0E-06	3.9E-08	2.6E-07	2.6E-07
R8	6.1E-04	1.2E-03	1.4E-03	3.0E-04	6.1E-04	6.8E-04	1.6E-06	3.2E-06	3.5E-06	3.1E-06	6.2E-06	7.0E-06	4.1E-07	8.3E-07	9.3E-07
R9	1.7E-04	5.8E-05	1.9E-04	8.5E-05	2.9E-05	9.3E-05	4.4E-07	1.5E-07	4.9E-07	8.7E-07	3.0E-07	9.6E-07	1.2E-07	4.0E-08	1.3E-07
R10	1.5E-04	1.9E-05	1.5E-04	7.3E-05	9.6E-06	7.4E-05	3.8E-07	5.0E-08	3.9E-07	7.5E-07	9.8E-08	7.6E-07	1.0E-07	1.3E-08	1.0E-07
R11	1.7E-04	1.2E-05	1.8E-04	8.4E-05	5.9E-06	8.9E-05	4.4E-07	3.1E-08	4.6E-07	8.6E-07	6.1E-08	9.1E-07	1.1E-07	8.1E-09	1.2E-07
R12	8.7E-05	3.1E-05	9.6E-05	4.3E-05	1.5E-05	4.8E-05	2.3E-07	7.9E-08	2.5E-07	4.5E-07	1.6E-07	4.9E-07	5.9E-08	2.1E-08	6.6E-08
R13	6.3E-05	2.2E-05	6.6E-05	3.1E-05	1.1E-05	3.3E-05	1.6E-07	5.8E-08	1.7E-07	3.2E-07	1.1E-07	3.4E-07	4.3E-08	1.5E-08	4.5E-08
R14	1.7E-04	1.0E-03	1.0E-03	8.6E-05	5.0E-04	5.0E-04	4.5E-07	2.6E-06	2.6E-06	8.8E-07	5.2E-06	5.2E-06	1.2E-07	6.9E-07	6.9E-07

TABLE C.3 Predicted Hazard Quotients from Inhalation of Volatile Organic Compounds

COPC	Fluoranthene			Fluorene			Naphthalene			Phenanthrene			Pyrene		
Averaging Time	1 hour			1 hour			24 hour			1 hour			1 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	1.1E-05	3.1E-06	1.2E-05	3.5E-05	9.8E-06	3.7E-05	7.3E-04	9.0E-04	1.1E-03	1.1E-04	3.1E-05	1.2E-04	1.0E-05	2.9E-06	1.1E-05
FL-MPOI	7.3E-07	2.3E-07	7.4E-07	2.3E-06	7.3E-07	2.4E-06	2.2E-04	5.9E-05	2.2E-04	7.4E-06	2.3E-06	7.5E-06	6.7E-07	2.1E-07	6.8E-07
R1	8.7E-07	1.1E-06	1.4E-06	2.8E-06	3.4E-06	4.4E-06	8.2E-05	4.1E-04	4.7E-04	8.8E-06	1.1E-05	1.4E-05	8.0E-07	9.7E-07	1.3E-06
R2	9.8E-08	2.2E-08	1.1E-07	3.1E-07	7.0E-08	3.6E-07	8.9E-06	4.6E-06	1.2E-05	9.9E-07	2.2E-07	1.1E-06	9.0E-08	2.0E-08	1.0E-07
R3	1.4E-07	7.4E-07	7.5E-07	4.4E-07	2.4E-06	2.4E-06	1.1E-05	2.8E-04	2.9E-04	1.4E-06	7.5E-06	7.6E-06	1.3E-07	6.9E-07	6.9E-07
R4	3.4E-08	1.0E-08	4.4E-08	1.1E-07	3.2E-08	1.4E-07	3.2E-06	2.1E-06	4.8E-06	3.4E-07	1.0E-07	4.4E-07	3.1E-08	9.3E-09	4.0E-08
R5	4.8E-08	1.5E-08	5.5E-08	1.5E-07	4.7E-08	1.8E-07	4.9E-06	3.3E-06	8.2E-06	4.9E-07	1.5E-07	5.6E-07	4.4E-08	1.4E-08	5.1E-08
R6	1.8E-07	1.4E-06	1.4E-06	5.7E-07	4.4E-06	4.4E-06	1.6E-05	5.6E-04	5.7E-04	1.8E-06	1.4E-05	1.4E-05	1.7E-07	1.3E-06	1.3E-06
R7	1.3E-07	8.5E-07	8.6E-07	4.0E-07	2.7E-06	2.7E-06	1.7E-05	3.7E-04	3.9E-04	1.3E-06	8.6E-06	8.7E-06	1.2E-07	7.9E-07	7.9E-07
R8	1.4E-06	2.7E-06	3.0E-06	4.3E-06	8.6E-06	9.7E-06	1.9E-04	7.6E-04	9.2E-04	1.4E-05	2.8E-05	3.1E-05	1.3E-06	2.5E-06	2.8E-06
R9	3.8E-07	1.3E-07	4.2E-07	1.2E-06	4.2E-07	1.3E-06	6.2E-05	2.2E-05	7.2E-05	3.9E-06	1.3E-06	4.2E-06	3.5E-07	1.2E-07	3.9E-07
R10	3.3E-07	4.3E-08	3.3E-07	1.0E-06	1.4E-07	1.1E-06	8.0E-05	9.0E-06	8.7E-05	3.3E-06	4.4E-07	3.4E-06	3.0E-07	4.0E-08	3.1E-07
R11	3.8E-07	2.7E-08	4.0E-07	1.2E-06	8.5E-08	1.3E-06	3.7E-05	6.5E-06	4.2E-05	3.8E-06	2.7E-07	4.0E-06	3.5E-07	2.5E-08	3.7E-07
R12	1.9E-07	6.8E-08	2.2E-07	6.2E-07	2.2E-07	6.8E-07	3.0E-05	1.5E-05	4.2E-05	2.0E-06	6.9E-07	2.2E-06	1.8E-07	6.3E-08	2.0E-07
R13	1.4E-07	5.0E-08	1.5E-07	4.5E-07	1.6E-07	4.7E-07	2.8E-05	1.2E-05	3.6E-05	1.4E-06	5.1E-07	1.5E-06	1.3E-07	4.6E-08	1.4E-07
R14	3.8E-07	2.3E-06	2.3E-06	1.2E-06	7.2E-06	7.2E-06	3.8E-05	7.9E-04	8.3E-04	3.9E-06	2.3E-05	2.3E-05	3.5E-07	2.1E-06	2.1E-06

TABLE C.4 Predicted Hazard Quotients from Inhalation of Constituents of Fugitive Dust

COPC	Diesel Particulate Matter			Coal Dust			Silica (PM2.5)								
Averaging Time	2 hour			24 hour			24 hour								
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project (Low)	Project (High)	Project (Mean)	Baseline (Low)	Baseline (High)	Baseline (Mean)	Application (Low)	Application (High)	Application (Mean)
RSA-MPOI	3.1E+00	2.2E+00	3.4E+00	3.5E-01	-	-	2.7E-02	7.3E-02	5.0E-02	6.9E-03	6.9E-03	6.9E-03	3.4E-02	8.0E-02	5.7E-02
FL-MPOI	1.4E+00	2.8E-01	1.4E+00	9.9E-02	-	-	6.0E-03	1.6E-02	1.1E-02	5.1E-04	5.1E-04	5.1E-04	6.6E-03	1.7E-02	1.2E-02
R1	2.7E-01	1.2E+00	1.2E+00	2.8E-03	-	-	3.1E-04	8.5E-04	5.8E-04	2.7E-03	2.7E-03	2.7E-03	3.0E-03	3.5E-03	3.3E-03
R2	2.0E-01	3.0E-02	2.0E-01	3.5E-03	-	-	3.9E-04	1.1E-03	7.2E-04	2.2E-05	2.2E-05	2.2E-05	4.1E-04	1.1E-03	7.4E-04
R3	1.4E-01	1.1E+00	1.1E+00	2.9E-03	-	-	2.0E-04	5.5E-04	3.8E-04	1.5E-03	1.5E-03	1.5E-03	1.7E-03	2.1E-03	1.9E-03
R4	1.4E-01	2.3E-02	1.6E-01	1.4E-03	-	-	1.2E-04	3.3E-04	2.2E-04	9.8E-06	9.8E-06	9.8E-06	1.3E-04	3.4E-04	2.3E-04
R5	1.1E-01	2.4E-02	1.3E-01	2.3E-03	-	-	1.8E-04	4.7E-04	3.3E-04	1.4E-05	1.4E-05	1.4E-05	1.9E-04	4.9E-04	3.4E-04
R6	1.4E-01	1.3E+00	1.3E+00	2.5E-03	-	-	2.0E-04	5.4E-04	3.7E-04	4.9E-03	4.9E-03	4.9E-03	5.1E-03	5.4E-03	5.3E-03
R7	8.6E-02	9.0E-01	9.1E-01	2.0E-03	-	-	2.0E-04	5.4E-04	3.7E-04	2.3E-03	2.3E-03	2.3E-03	2.5E-03	2.8E-03	2.7E-03
R8	4.1E-01	1.7E+00	2.0E+00	3.9E-03	-	-	7.6E-04	2.0E-03	1.4E-03	6.0E-03	6.0E-03	6.0E-03	6.7E-03	8.0E-03	7.4E-03
R9	7.6E-01	1.3E-01	7.8E-01	1.5E-02	-	-	1.2E-03	3.1E-03	2.1E-03	2.0E-04	2.0E-04	2.0E-04	1.4E-03	3.3E-03	2.3E-03
R10	4.6E-01	5.1E-02	5.0E-01	4.0E-02	-	-	3.5E-03	9.5E-03	6.5E-03	6.5E-05	6.5E-05	6.5E-05	3.6E-03	9.5E-03	6.6E-03
R11	5.8E-01	3.4E-02	5.9E-01	1.8E-02	-	-	1.8E-03	4.8E-03	3.3E-03	3.6E-05	3.6E-05	3.6E-05	1.8E-03	4.8E-03	3.3E-03
R12	2.1E-01	8.3E-02	2.3E-01	7.1E-03	-	-	6.0E-04	1.6E-03	1.1E-03	1.1E-04	1.1E-04	1.1E-04	7.1E-04	1.7E-03	1.2E-03
R13	2.4E-01	6.5E-02	2.6E-01	1.0E-02	-	-	8.6E-04	2.3E-03	1.6E-03	8.5E-05	8.5E-05	8.5E-05	9.5E-04	2.4E-03	1.7E-03
R14	1.5E-01	1.8E+00	1.8E+00	2.1E-03	-	-	2.3E-04	6.3E-04	4.3E-04	6.0E-03	6.0E-03	6.0E-03	6.3E-03	6.7E-03	6.5E-03

TABLE C.4 Predicted Hazard Quotients from Inhalation of Constituents of Fugitive Dust

COPC	Silica (PM10)								
Averaging Time	24 hour								
Receptor Location	Project (Low)	Project (High)	Project (Mean)	Baseline (Low)	Baseline (High)	Baseline (Mean)	Application (Low)	Application (High)	Application (Mean)
RSA-MPOI	3.1E-01	5.7E-01	4.4E-01	2.5E-04	2.5E-04	2.5E-04	3.1E-01	5.7E-01	4.4E-01
FL-MPOI	8.9E-02	1.6E-01	1.3E-01	3.5E-03	3.5E-03	3.5E-03	9.3E-02	1.7E-01	1.3E-01
R1	2.5E-03	4.6E-03	3.5E-03	1.9E-02	1.9E-02	1.9E-02	2.1E-02	2.3E-02	2.2E-02
R2	3.1E-03	5.7E-03	4.4E-03	1.7E-04	1.7E-04	1.7E-04	3.3E-03	5.9E-03	4.6E-03
R3	2.6E-03	4.8E-03	3.7E-03	1.0E-02	1.0E-02	1.0E-02	1.3E-02	1.5E-02	1.4E-02
R4	1.2E-03	2.3E-03	1.7E-03	9.4E-05	9.4E-05	9.4E-05	1.3E-03	2.4E-03	1.8E-03
R5	2.0E-03	3.8E-03	2.9E-03	1.1E-04	1.1E-04	1.1E-04	2.2E-03	3.9E-03	3.0E-03
R6	2.2E-03	4.1E-03	3.2E-03	3.8E-02	3.8E-02	3.8E-02	4.1E-02	4.2E-02	4.2E-02
R7	1.8E-03	3.3E-03	2.5E-03	1.8E-02	1.8E-02	1.8E-02	2.0E-02	2.1E-02	2.0E-02
R8	3.5E-03	6.5E-03	5.0E-03	4.8E-02	4.8E-02	4.8E-02	5.2E-02	5.5E-02	5.3E-02
R9	1.3E-02	2.4E-02	1.9E-02	1.3E-03	1.3E-03	1.3E-03	1.4E-02	2.6E-02	2.0E-02
R10	3.6E-02	6.7E-02	5.2E-02	4.0E-04	4.0E-04	4.0E-04	3.7E-02	6.7E-02	5.2E-02
R11	1.7E-02	3.1E-02	2.4E-02	2.5E-04	2.5E-04	2.5E-04	1.7E-02	3.1E-02	2.4E-02
R12	6.4E-03	1.2E-02	9.1E-03	7.5E-04	7.5E-04	7.5E-04	7.2E-03	1.3E-02	9.8E-03
R13	9.0E-03	1.7E-02	1.3E-02	5.3E-04	5.3E-04	5.3E-04	9.6E-03	1.7E-02	1.3E-02
R14	1.9E-03	3.6E-03	2.8E-03	4.5E-02	4.5E-02	4.5E-02	4.7E-02	4.9E-02	4.8E-02

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	1	1	3.87E-01	4.20E-03	3.55E-01	8.96E-02	4.43E-01	4.35E+00	2.34E+00	6.76E+00	1.34E-01	7.94E+00	1.14E+00	9.11E-01	1.28E+00	5.75E+00	7.47E-01
2002	1	2	1.38E-01	0.00E+00	9.00E-02	0.00E+00	0.00E+00	1.06E+00	5.10E-01	2.38E+00	1.31E-03	1.71E+00	2.07E-02	6.52E-01	2.81E-01	1.65E+00	2.42E-01
2002	1	3	4.03E-02	0.00E+00	9.19E-04	0.00E+00	0.00E+00	3.60E-01	3.57E-01	1.06E+00	1.64E-16	2.64E+00	4.45E-03	5.43E-01	1.94E-01	5.84E-01	7.00E-02
2002	1	4	1.37E-01	0.00E+00	5.86E-03	0.00E+00	0.00E+00	5.72E-01	4.96E-01	1.75E+00	9.54E-03	3.47E+00	1.68E-03	6.03E-01	2.77E-01	9.42E-01	2.34E-01
2002	1	5	1.41E-01	0.00E+00	1.16E-02	0.00E+00	0.00E+00	5.76E-01	7.41E-01	2.05E+00	1.07E-15	5.70E+00	2.16E-03	8.66E-01	2.62E-01	1.35E+00	2.12E-01
2002	1	6	4.56E-02	0.00E+00	1.39E-02	0.00E+00	9.65E-04	4.31E-01	3.56E-01	1.02E+00	1.04E-06	9.69E-01	1.27E-01	4.26E-01	2.85E-01	6.63E-01	1.14E-01
2002	1	7	5.21E-01	3.41E-05	6.59E-02	3.94E-06	6.88E-04	2.86E+00	2.87E-01	2.87E+00	6.10E-02	9.93E-01	2.78E-01	9.24E-03	3.05E-01	1.18E+00	8.43E-01
2002	1	8	3.17E-01	7.39E-06	5.64E-02	4.93E-08	2.86E-04	2.00E+00	5.61E-01	3.04E+00	4.25E-02	2.03E+00	6.43E-02	5.46E-01	3.53E-01	1.56E+00	5.50E-01
2002	1	9	3.81E-01	0.00E+00	1.23E-01	0.00E+00	0.00E+00	8.75E-01	3.90E-01	2.65E+00	1.58E-04	6.58E+00	4.19E-07	4.36E-01	1.21E+00	1.41E+00	5.36E-01
2002	1	10	6.11E-02	0.00E+00	5.82E-04	0.00E+00	0.00E+00	3.37E-01	3.18E-01	8.12E-01	3.27E-15	1.80E+00	6.32E-03	4.83E-01	1.82E-01	5.91E-01	9.70E-02
2002	1	11	4.95E-01	8.81E-02	1.80E-01	1.95E-01	5.69E-01	1.62E+00	1.49E+00	3.64E+00	1.24E-01	7.95E+00	2.48E+00	2.82E+00	3.25E+00	2.08E+00	7.17E-01
2002	1	12	4.64E-02	0.00E+00	6.71E-03	0.00E+00	1.28E-03	5.47E-01	2.01E-01	6.51E-01	7.04E-04	1.03E+00	6.80E-02	1.75E-01	1.93E-01	5.13E-01	1.35E-01
2002	1	13	4.41E-01	9.96E-05	2.39E-01	4.77E-06	2.38E-05	2.07E+00	9.22E-01	4.62E+00	9.98E-02	3.08E+00	7.62E-04	9.96E-01	1.07E+00	3.35E+00	6.84E-01
2002	1	14	2.50E+00	1.20E-01	2.76E+00	1.18E-02	6.92E-02	5.17E+00	2.49E+00	6.59E+00	1.01E+01	4.69E+00	1.33E+00	9.47E-01	1.33E+00	6.79E+00	3.54E+00
2002	1	15	1.11E+00	6.40E-04	5.19E-01	1.30E-04	2.53E-04	4.48E+00	2.18E+00	9.22E+00	3.30E-01	9.14E+00	2.48E-03	3.83E+00	3.83E+00	6.07E+00	1.98E+00
2002	1	16	3.50E-01	1.32E-04	1.08E-01	1.15E-05	5.77E-05	1.79E+00	1.67E+00	4.48E+00	3.82E-02	9.82E+00	9.76E-04	1.54E+00	1.08E+00	3.15E+00	4.55E-01
2002	1	17	7.56E-01	4.22E-04	1.12E-01	3.75E-04	1.23E-03	3.02E+00	2.30E+00	6.31E+00	3.21E-02	1.12E+01	4.66E-02	2.60E+00	1.34E+00	5.29E+00	1.18E+00
2002	1	18	1.98E-01	2.89E-04	9.99E-02	2.82E-05	1.27E-04	2.78E+00	1.12E+00	4.60E+00	3.49E-02	4.83E+00	4.00E-03	6.93E-01	8.19E-01	2.85E+00	2.50E-01
2002	1	19	5.35E-02	0.00E+00	7.81E-04	0.00E+00	0.00E+00	3.89E-01	3.58E-01	1.03E+00	1.47E-16	2.19E+00	5.40E-03	4.65E-01	2.07E-01	6.29E-01	7.40E-02
2002	1	20	5.98E-02	0.00E+00	1.10E-02	0.00E+00	2.37E-10	5.38E-01	3.12E-01	1.20E+00	3.88E-03	1.54E+00	3.70E-02	3.50E-01	2.11E-01	6.18E-01	9.00E-02
2002	1	21	1.47E-01	0.00E+00	7.25E-02	0.00E+00	0.00E+00	1.15E+00	5.82E-01	3.15E+00	1.24E-03	2.36E+00	1.71E-02	6.50E-01	2.13E-01	1.37E+00	2.77E-01
2002	1	22	2.62E-02	0.00E+00	1.24E-01	0.00E+00	0.00E+00	1.74E+00	6.77E-01	3.60E+00	8.62E-03	2.16E+00	3.29E-02	6.46E-01	3.16E-01	2.20E+00	8.19E-02
2002	1	23	9.11E-02	0.00E+00	1.69E-02	0.00E+00	0.00E+00	7.72E-01	3.96E-01	1.81E+00	1.40E-03	2.64E+00	1.18E-02	4.54E-01	1.78E-01	8.64E-01	1.10E-01
2002	1	24	2.33E-01	0.00E+00	2.26E-02	0.00E+00	4.77E-05	9.25E-01	1.56E-01	6.16E-01	2.73E-02	6.94E-01	9.96E-02	1.04E-01	1.92E-01	6.38E-01	4.77E-01
2002	1	25	5.26E-01	8.21E-01	2.10E-01	7.38E-02	4.66E-02	1.56E+00	5.58E-01	2.42E+00	3.34E-01	1.86E+00	6.75E-01	1.57E-01	3.32E-01	1.73E+00	7.27E-01
2002	1	26	1.13E+00	7.01E-03	2.17E-01	1.50E-02	1.80E-01	1.49E+00	9.52E-01	3.27E+00	9.31E-02	1.92E+00	2.64E+00	5.03E-02	2.18E-01	2.73E+00	1.67E+00
2002	1	27	2.00E+00	9.08E-01	7.06E-01	3.66E-01	4.97E-01	4.82E+00	2.06E+00	5.90E+00	1.37E+00	2.99E+00	6.11E+00	3.59E-01	4.73E-01	5.09E+00	2.67E+00
2002	1	28	4.07E-01	1.91E-02	2.39E-01	7.74E-03	1.56E-02	4.38E+00	1.63E+00	7.58E+00	2.23E-01	6.67E+00	6.94E-02	1.40E+00	1.05E+00	5.10E+00	5.52E-01
2002	1	29	2.83E-01	1.61E-05	8.63E-02	9.37E-07	4.41E-06	2.86E+00	8.65E-01	4.89E+00	4.66E-02	5.38E+00	3.51E-03	8.03E-01	5.42E-01	3.21E+00	3.92E-01
2002	1	30	2.54E-01	2.02E-06	2.03E-02	0.00E+00	7.41E-08	1.83E+00	6.62E-01	3.61E+00	1.55E-02	2.45E+00	2.18E-03	9.43E-01	2.08E-01	1.75E+00	3.68E-01
2002	1	31	3.70E-01	0.00E+00	7.37E-02	0.00E+00	1.72E-06	1.71E+00	3.66E-01	1.79E+00	3.16E-02	2.01E+00	9.79E-02	3.12E-01	3.77E-01	1.10E+00	6.22E-01
2002	2	1	1.41E-01	0.00E+00	1.28E-02	0.00E+00	4.47E-12	7.91E-01	4.74E-01	2.16E+00	1.87E-07	3.30E+00	2.14E-02	5.32E-01	2.76E-01	1.04E+00	2.59E-01
2002	2	2	5.87E-02	0.00E+00	5.92E-03	0.00E+00	0.00E+00	5.43E-01	3.47E-01	1.38E+00	7.05E-06	1.61E+00	1.59E-02	5.12E-01	1.93E-01	6.24E-01	1.09E-01
2002	2	3	4.68E-02	0.00E+00	5.61E-03	0.00E+00	8.03E-12	4.03E-01	2.85E-01	8.70E-01	2.89E-16	1.62E+00	3.90E-02	3.99E-01	1.76E-01	5.55E-01	8.12E-02
2002	2	4	7.58E-02	0.00E+00	1.89E-02	0.00E+00	0.00E+00	9.57E-01	4.32E-01	1.95E+00	6.09E-04	3.61E+00	3.57E-03	4.38E-01	3.19E-01	1.00E+00	1.14E-01
2002	2	5	2.41E-01	9.71E-08	2.56E-02	1.86E-07	5.99E-03	5.72E-01	3.38E-01	1.50E+00	2.52E-02	1.22E+00	3.27E-01	2.08E-01	2.23E-01	7.95E-01	3.82E-01
2002	2	6	4.09E-01	3.22E-05	6.32E-02	3.43E-02	2.77E-01	1.55E+00	4.15E-01	1.44E+00	4.10E-02	1.87E+00	1.35E+00	3.52E-01	1.69E-01	1.04E+00	6.70E-01
2002	2	7	1.08E+00	1.37E-01	4.28E-01	2.30E-02	3.33E-02	2.14E+00	4.44E-01	2.36E+00	5.11E-01	1.30E+00	6.86E-01	5.15E-02	3.37E-01	1.56E+00	1.39E+00
2002	2	8	3.17E+00	5.13E-01	1.46E+00	1.87E-01	2.57E-01	4.30E+00	1.49E+00	5.13E+00	2.15E+00	2.95E+00	4.08E+00	1.31E+00	1.65E+00	3.99E+00	4.05E+00
2002	2	9	2.58E-01	3.44E-04	1.01E-01	1.41E-04	1.76E-04	2.36E+00	8.18E-01	4.00E+00	4.25E-02	5.05E+00	8.64E-03	1.18E+00	1.86E-01	2.32E+00	3.44E-01
2002	2	10	7.25E-02	0.00E+00	2.59E-02	0.00E+00	1.43E-03	6.23E-01	2.28E-01	8.28E-01	1.15E-03	1.20E+00	1.05E-01	2.60E-01	2.21E-01	5.83E-01	1.04E-01
2002	2	11	1.27E-01	0.00E+00	2.39E-02	0.00E+00	0.00E+00	8.30E-01	2.25E-01	1.81E+00	5.23E-04	3.40E+00	6.13E-04	4.40E-01	7.30E-01	9.37E-01	2.91E-01
2002	2	12	5.40E-01	2.83E-07	2.82E-01	0.00E+00	3.18E-08	1.99E+00	5.32E-01	2.97E+00	6.13E-03	4.88E+00	1.24E-03	3.71E-01	8.12E-01	2.26E+00	7.20E-01
2002	2	13	1.07E-01	0.00E+00	3.64E-02	0.00E+00	0.00E+00	9.03E-01	2.82E-01	1.67E+00	7.65E-05	2.45E+00	1.15E-02	4.52E-01	3.41E-01	9.98E-01	2.78E-01
2002	2	14	2.79E-01	2.56E-06	3.94E-02	0.00E+00	6.65E-08	1.58E+00	4.30E-01	3.07E+00	1.45E-02	3.38E+00	2.48E-04	5.42E-01	5.61E-01	1.82E+00	3.28E-01
2002	2	15	1.41E-01	0.00E+00	3.03E-02	0.00E+00	0.00E+00	1.27E+00	6.56E-01	3.02E+00	2.35E-02	4.04E+00	4.36E-03	6.94E-01	2.70E-01	1.47E+00	2.63E-01
2002	2	16	1.81E-01	1.16E-04	1.39E-01	7.59E-06	6.72E-05	2.54E+00	8.94E-01	4.02E+00	3.95E-02	3.58E+00	3.83E-02	6.71E-01	2.67E-01	2.52E+00	2.37E-01
2002	2	17	4.35E-01	2.72E-05	3.21E-01	2.63E-07	8.63E-06	2.21E+00	1.12E+00	3.58E+00	5.38E-02	4.35E+00	1.85E-02	1.00E+00	3.14E-01	3.06E+00	9.07E-01
2002	2	18	3.05E-01	3.02E-04	1.57E-01	1.50E-05	9.07E-05	1.88E+00	9.61E-01	4.19E+00	2.22E-02	2.57E+00	2.19E-02	8.04E-01	3.91E-01	2.71E+00	5.09E-01
2002	2	19	1.47E-01	4.41E-06	8.16E-02	5.11E-05	3.96E-02	1.00E+00	6.08E-01	2.65E+00	3.73E-02	1.78E+00	4.38E-01	3.53E-01	4.67E-01	1.28E+00	3.24E-01
2002	2	20	1.14E-01	0.00E+00	9.80E-03	0.00E+00	0.00E+00	7.28E-01	6.08E-01	2.12E+00	1.07E-04	3.97E+00	3.48E-02	6.56E-01	3.36E-01	1.12E+00	2.11E-01
2002	2	21	1.79E-01	4.76E-06	8.55E-03	9.53E-02	9.58E-02	9.58E-01	4.25E-01	9.49E-01	1.41E-02	2.97E+00	8.19E-01	5.04E-01	3.18E-01	8.11E-01	3.30E-01
2002	2	22	5.20E-01	1.46E-05	3.18E-01	5.73E-09	2.93E-06	1.62E+00	1.89E-01	8.07E-01	9.66E-01	1.25E+00	4.60E-02	1.21E-01	4.51E-01	1.44E+00	8.33E-01
2002	2	23	9.15E-01	0.00E+00	5.00E-01	0.00E+00	0.00E+00	9.54E-01	3.72E-03	7.45E-01	2.20E+00	7.98E-04	0.00E+00	0.00E+00	9.09E-25	1.82E+00	1.11E+00
2002	2	24	3.40E+00	3.46E-04	2.33E+00	6.63E-05	1.47E-04	4.07E+00	3.08E-01	3.53E+00	2.73E+00	5.91E-03	1.18E-03	1.06E-02	5.57E-03	4.30E+00	3.91E+00
2002	2	25	1.30E+00	1.17E-03	9.58E-01	2.07E-04	5.14E-04	4.28E+00	1.61E+00	7.86E+00	1.18E+00	5.38E+00	2.45E-02	9.76E-01	1.41E+00	6.67E+00	1.85E+00
2002	2	26	4.43E-02	0.00E+00	6.52E-04	0.00E+00	0.00E+00	4.71E-01	2.46E-01	1.32E+00	2.91E-12	2.72E+00	2.13E-03	6.74E-01	6.28E-01	6.71E-01	7.58E-02
2002	2	27	7.02E-02	0.00E+00	1.29E-02	0.00E+00	0.00E+00	9.67E-01	6.03E-01	2.58E+00	1.32E-03	4.56E+00	4.25E-03	9.93E-01	1.06E+00	1.37E+00	1.48E-01
2002	2	28	2.34E+00	2.68E-01	1.17E+00	3.45E-02	4.28E-02	4.08E+00	6.85E-01	4.07E+00	4.49E-01	1.09E+00	1.15E+00	3.65E-01	3.60E-01	3.31E+00	2.77E+00
2002	3	1	2.24E+00	2.76E-01	1.17E+00	7.32E-02	1.73E-01	4.36E+00	3.58E-01	3.97E+00	1.84E+00	1.56E+00	7.63E-01	4.67E-01	5.81E-01	2.96E+00	2.56E+00
2002	3	2	3.86E-01	1.00E-05	7.85E-02	0.00E+00	0.00E+00	2.89E+00	7.37E-01	5.17E+00	1.77E-02	4.69E+00	5.62E-05	1.77E+00	1.98E+00	2.29E+00	6.50E-01
2002	3	3	5.25E-02	0.00E+00	3.88E-04	0.00E+00	0.00E+00	3.88E-01	2.77E-01	1.09E+00	4.83E-14	2.43E+00	3.54E-04	3.63E-01	2.75E-01	5.54E-01	8.56E-02
2002	3	4	1.78E-01	1.65E-01	2.51E-02	2.30E-02	9.61E-02	3.96E-01	3.10E-01	8.59E-01	7.92E-02	7.18E-01	1.01E+00	1.77E-01	8.63E-02	7.11E-01	2.46E-01
2002	3	5	6.71E-01	7.29E-03	5.17E-01	3.26E-03	2.42E-03	8.62E-01	2.46E-03	1.12E+00	1.85E+00	9.48E-04	2.13E-03	2.81E-04	4.93E-04	1.79E+00	8.00E-01
2002	3	6	1.08E+00	0.00E+00	5.06E-01	0.00E+00	0.00E+00	1.08E+00	3.77E-03	6.31E-01	3.33E+00	1.22E-04	0.00E+00	0.00E+00	3.17E-29	2.03E+00	1.32E+00
2002	3	7	2.12E+00	1.60E-02	1.03E+00	1.44E-03	5.39E-04	2.21E+00	9.08E-02	2.03E+00	5.20E+00	1.21E-03	4.44E-03	8.56E-04	5.93E-04	2.87E+00	2.71E+00
2002	3	8	3.07E+00	3.01E-01	1.60E+00	1.82E-01	3.79E-01	4.47E+00	4.54E-01	4.39E+00	2.65E+00	2.16E+00	1.03E+00	3.75E-01	2.54E-01	4.43E+00	3.92E+00
2002	3	9	2.85E+00	2.61E-01	1.07E+00	4.86E-02	7.99E-02	3.84E+00	1.15E+00	6.47E+00	3.16E-01	3.90E+00	9.22E-01	5.58E-01	1.44E-01	5.61E+00	3.79E+00
2002	3	10	5.22E-01	8.57E-02	9.12E-02	5.39E-02	1.67E-01	2.94E+00	4.22E-01	2.63E+00	1.00E-01	1.09E+00	1.59E+00	1.13E-01	2.92E-01	1.27E+00	8.25E-01
2002	3	11	8.31E-02	0.00E+00	7.27E-03	0.00E+00	1.94E-06	6.98E-01	1.21E-01	3.32E-01	4.70E-03	6.01E-01	7.01E-02	9.16E-02	1.85E-01	3.60E-01	1.66E-01
2002	3	12	9.16E-02	0.00E+00	1.68E-02	0.00E+00	1.53E-09	7.80E-01	1.73E-01	8.61E-01	2.99E-03	6.95E-01	5.68E-02	6.39E-02	2.36E-01	5.29E-01	1.56E-01
2002	3	13	4.49E-01	1.80E-05	9.65E-02	1.06E-06	4.73E-04	1.71E+00	4.79E-01	3.17E+00	4.05E-02	1.95E+00	1.39E-01	2.50E-01	3.79E-01	1.67E+00	7.20E-01
2002	3	14	3.33E-01	2.61E-05	1.16E-01	1.17E-06	1.82E-05	2.46E+00	1.02E+00	3.57E+00	3.65E-02	6.00E+00	6.44E-03	9.19E-01	3.22E-01	2.68E+00	4.49E-01
2002	3	15	6.91E-01	5.15E-01	8.82E-02	6.91E-02	1.51E-01	1.60E+00	3.29E-01	2.74E+00	6.07E-02	1.05E+00	1.28E+00	3.25E-02	2.27E-01	1.55E+00	9.39E-01
2002	3	16	1.43E+00	4.09E-03	7.00E-01	3.77E-07	0.00E+00	1.64E+00	2.92E-02	1.03E+00	2.13E+00	7.48E-04	2.86E-05	6.80E-06	8.35E-06	1.82E+00	1.50E+00
2002	3	17	1.57E+00	2.50E-03	7.36E-01	6.53E-05	1.89E-05	1.92E+00	6.93E-02	2.05E+00	1.76E+00	1.52E-04	1.87E-04	7.21E-05	6.01E-05	2.07E+00	1.87E+00
2002	3	18	1.72E+00	4.22E-01	6.37E-01	1.42E-01	1.39E-01	1.67E+00	1.43E-01	1.67E+00	6.26E+00	3.81E-01	4.28E-01	6.71E-03	1.37E-02	2.62E+00	2.29E+00
2002	3	19	8.48E-01	0.00E+00	6.06E-01	0.00E+00	0.00E+00	1.08E+00	2.42E-03	8.73E-01	2.39E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E+00	1.00E+00
2002	3	20	2.88E+00	1.09E-04	1.68E+00	2.97E-07	5.61E-06	3.02E+00	2.09E-02	1.73E+00	8.10E-01	2.07E-03	3.71E-04	2.90E-03	1.97E-03	2.43E+00	3.21E+00
2002	3	21	3.56E+00	1.14E-01	1.85E+00	4.07E-02	1.29E-01	4.39E+00	1.23E+00	6.26E+00	2.53E+00	4.65E+00	7.94E-01	1.05E+00	1.15E+00	5.67E+00	4.41E+00
2002	3	22	2.53E+00	1.09E-02	1.78E+00	1.78E-03	4.72E-03	4.78E+00	1.81E+00	7.34E+00	3.09E+00	8.44E+00	3.97E-02	1.77E+00	2.10E+00	5.55E+00	3.06E+00
2002	3	23	3.88E+00	4.70E-03	2.19E+00	4.45E-04	9.65E-04	3.05E+00	5.33E-01	4.30E+00	3.04E+00	1.55E-02	8.28E-03	2.87E-02	2.04E-02	4.89E+00	4.73E+00

Year	Month	Day	Baseline														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	1	1	3.64E-01	4.16E-03	3.55E-01	3.32E-03	6.33E-03	4.34E+00	2.27E+00	4.91E+00	1.25E-01	3.81E-02	1.69E-02	6.91E-02	5.11E-02	5.57E+00	6.32E-01
2002	1	2	1.05E-01	0.00E+00	9.00E-02	0.00E+00	0.00E+00	1.06E+00	4.90E-01	1.71E+00	1.31E-03	0.00E+00	0.00E+00	3.11E-03	5.32E-04	1.63E+00	1.83E-01
2002	1	3	4.03E-02	0.00E+00	9.19E-04	0.00E+00	0.00E+00	3.60E-01	3.18E-01	5.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.84E-01	7.00E-02
2002	1	4	1.37E-01	0.00E+00	5.86E-03	0.00E+00	0.00E+00	5.72E-01	4.31E-01	1.13E+00	9.54E-03	1.83E-04	0.00E+00	2.90E-03	1.72E-03	9.35E-01	2.34E-01
2002	1	5	1.41E-01	0.00E+00	1.16E-02	0.00E+00	0.00E+00	5.76E-01	6.47E-01	1.25E+00	0.00E+00	0.00E+00	0.00E+00	3.42E-06	0.00E+00	1.32E+00	2.12E-01
2002	1	6	4.56E-02	0.00E+00	1.39E-02	0.00E+00	0.00E+00	4.31E-01	3.55E-01	6.92E-01	1.04E-06	4.82E-07	0.00E+00	1.42E-03	4.94E-04	6.63E-01	1.14E-01
2002	1	7	5.21E-01	3.41E-05	6.59E-02	3.94E-06	4.37E-05	2.86E+00	2.86E-01	2.03E+00	6.10E-02	9.91E-03	7.72E-04	8.59E-03	1.25E-02	1.13E+00	8.43E-01
2002	1	8	3.16E-01	7.39E-06	5.64E-02	4.93E-08	1.60E-05	2.00E+00	5.25E-01	2.04E+00	4.22E-02	4.84E-03	5.66E-04	1.31E-02	1.10E-02	1.55E+00	5.44E-01
2002	1	9	3.52E-01	0.00E+00	1.23E-01	0.00E+00	0.00E+00	8.71E-01	3.34E-01	2.22E+00	1.48E-04	1.04E-08	0.00E+00	1.67E-04	1.89E-05	1.32E+00	4.59E-01
2002	1	10	6.11E-02	0.00E+00	5.82E-04	0.00E+00	0.00E+00	3.37E-01	2.83E-01	5.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.90E-01	9.70E-02
2002	1	11	4.08E-01	1.46E-03	1.69E-01	2.00E-03	4.13E-03	1.60E+00	1.04E+00	2.45E+00	2.21E-02	1.08E-02	5.57E-03	2.57E-02	1.74E-02	1.90E+00	5.72E-01
2002	1	12	4.64E-02	0.00E+00	6.71E-03	0.00E+00	4.29E-07	5.47E-01	1.82E-01	3.98E-01	7.04E-04	3.50E-04	8.62E-06	1.90E-03	1.42E-03	5.13E-01	1.35E-01
2002	1	13	4.14E-01	9.43E-05	2.38E-01	3.36E-06	1.88E-05	2.07E+00	8.56E-01	3.69E+00	2.34E-02	1.94E-03	4.77E-04	6.42E-03	3.54E-03	3.32E+00	5.88E-01
2002	1	14	2.30E+00	4.32E-03	1.68E+00	9.95E-04	2.42E-03	4.50E+00	2.41E+00	5.78E+00	1.31E-01	4.11E-02	1.51E-02	9.39E-02	6.45E-02	6.64E+00	3.18E+00
2002	1	15	9.92E-01	6.37E-04	5.13E-01	1.30E-04	2.53E-04	4.44E+00	1.92E+00	7.76E+00	8.49E-02	9.22E-03	2.37E-03	3.61E-02	1.86E-02	5.91E+00	1.68E+00
2002	1	16	3.38E-01	1.32E-04	1.06E-01	1.15E-05	5.77E-05	1.78E+00	1.52E+00	3.12E+00	3.69E-02	5.63E-03	9.08E-04	2.63E-02	1.46E-02	3.12E+00	4.45E-01
2002	1	17	7.55E-01	7.58E-05	1.12E-01	2.43E-05	1.43E-04	3.02E+00	2.07E+00	4.63E+00	3.07E-02	5.63E-03	8.80E-04	2.43E-02	1.28E-02	5.23E+00	1.18E+00
2002	1	18	1.96E-01	2.89E-04	9.99E-02	2.82E-05	1.27E-04	2.78E+00	1.04E+00	3.61E+00	3.49E-02	6.19E-03	1.65E-03	2.06E-02	1.13E-02	2.80E+00	2.40E-01
2002	1	19	5.35E-02	0.00E+00	7.81E-04	0.00E+00	0.00E+00	3.89E-01	3.17E-01	5.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-01	7.40E-02
2002	1	20	5.98E-02	0.00E+00	1.10E-02	0.00E+00	0.00E+00	5.38E-01	2.93E-01	7.66E-01	3.88E-03	2.97E-06	0.00E+00	2.49E-03	9.33E-04	6.18E-01	9.00E-02
2002	1	21	9.68E-02	0.00E+00	7.25E-02	0.00E+00	0.00E+00	1.15E+00	5.48E-01	2.06E+00	1.22E-03	8.51E-06	2.07E-08	1.63E-03	1.72E-04	1.36E+00	1.99E-01
2002	1	22	2.44E-02	0.00E+00	1.24E-01	0.00E+00	0.00E+00	1.74E+00	6.46E-01	2.62E+00	8.62E-03	8.00E-04	4.91E-05	9.56E-03	3.57E-03	2.18E+00	7.48E-02
2002	1	23	9.11E-02	0.00E+00	1.69E-02	0.00E+00	0.00E+00	7.72E-01	3.57E-01	1.22E+00	1.40E-03	7.94E-06	0.00E+00	7.23E-04	1.56E-04	8.53E-01	1.10E-01
2002	1	24	2.33E-01	0.00E+00	2.26E-02	0.00E+00	4.14E-08	9.25E-01	1.54E-01	5.37E-01	2.73E-02	5.60E-03	6.48E-05	4.35E-03	7.52E-03	6.38E-01	4.77E-01
2002	1	25	4.99E-01	1.48E-02	1.90E-01	7.26E-03	8.23E-03	1.54E+00	5.29E-01	2.20E+00	6.46E-02	2.56E-02	2.01E-02	2.81E-02	2.66E-02	1.70E+00	6.96E-01
2002	1	26	1.11E+00	6.47E-04	2.16E-01	1.01E-03	7.96E-03	1.49E+00	9.37E-01	3.01E+00	6.78E-02	3.20E-02	1.86E-02	2.18E-02	2.86E-02	2.70E+00	1.64E+00
2002	1	27	1.83E+00	2.22E-02	6.91E-01	1.56E-02	2.28E-02	4.74E+00	2.00E+00	5.00E+00	1.51E-01	5.29E-02	4.08E-02	6.05E-02	5.19E-02	5.00E+00	2.41E+00
2002	1	28	3.78E-01	8.89E-04	2.35E-01	3.91E-04	6.91E-04	4.37E+00	1.43E+00	5.87E+00	6.16E-02	1.02E-02	2.97E-03	3.47E-02	1.96E-02	4.99E+00	5.06E-01
2002	1	29	2.75E-01	1.61E-05	8.52E-02	9.37E-07	4.41E-06	2.85E+00	7.82E-01	3.45E+00	4.54E-02	2.07E-03	1.66E-04	1.45E-02	8.03E-03	3.18E+00	3.65E-01
2002	1	30	2.54E-01	2.02E-06	2.03E-02	0.00E+00	7.41E-08	1.83E+00	5.79E-01	2.20E+00	1.55E-02	6.13E-04	3.97E-05	1.00E-02	2.95E-03	1.73E+00	3.68E-01
2002	1	31	3.37E-01	0.00E+00	7.37E-02	0.00E+00	9.49E-08	1.71E+00	3.43E-01	1.43E+00	3.16E-02	2.53E-03	2.17E-05	8.95E-03	7.37E-03	1.10E+00	5.15E-01
2002	2	1	1.41E-01	0.00E+00	1.28E-02	0.00E+00	0.00E+00	7.91E-01	4.26E-01	1.25E+00	1.87E-07	0.00E+00	0.00E+00	1.68E-03	4.43E-05	1.04E+00	2.59E-01
2002	2	2	5.87E-02	0.00E+00	5.92E-03	0.00E+00	0.00E+00	5.43E-01	3.29E-01	7.07E-01	7.05E-06	0.00E+00	0.00E+00	1.78E-03	3.93E-05	6.24E-01	1.09E-01
2002	2	3	4.68E-02	0.00E+00	5.61E-03	0.00E+00	0.00E+00	4.03E-01	2.66E-01	5.99E-01	0.00E+00	0.00E+00	0.00E+00	1.26E-03	1.22E-05	5.55E-01	8.12E-02
2002	2	4	7.58E-02	0.00E+00	1.89E-02	0.00E+00	0.00E+00	9.57E-01	3.71E-01	1.40E+00	6.09E-04	4.95E-05	1.69E-06	8.94E-04	1.99E-04	9.60E-01	1.14E-01
2002	2	5	2.41E-01	9.71E-08	2.55E-02	1.86E-07	1.90E-04	5.71E-01	3.28E-01	1.25E+00	2.33E-02	5.78E-03	1.11E-03	2.97E-03	4.94E-03	7.84E-01	3.79E-01
2002	2	6	3.56E-01	3.22E-05	6.30E-02	6.62E-04	2.74E-03	1.55E+00	4.06E-01	1.08E+00	3.92E-02	9.86E-03	3.54E-03	1.26E-02	8.27E-03	1.04E+00	5.51E-01
2002	2	7	9.33E-01	1.91E-03	4.19E-01	3.14E-04	4.92E-04	2.13E+00	4.43E-01	2.11E+00	5.27E-02	8.72E-03	2.65E-03	1.60E-02	1.20E-02	1.55E+00	1.19E+00
2002	2	8	2.38E+00	2.01E-02	1.29E+00	6.17E-03	6.66E-03	4.04E+00	1.09E+00	4.04E+00	9.92E-02	2.24E-02	1.68E-02	3.17E-02	2.48E-02	3.48E+00	2.90E+00
2002	2	9	2.58E-01	3.44E-04	1.01E-01	1.41E-04	1.76E-04	2.36E+00	7.18E-01	2.68E+00	4.25E-02	2.19E-03	3.06E-04	2.00E-02	8.25E-03	2.29E+00	3.44E-01
2002	2	10	7.25E-02	0.00E+00	2.59E-02	0.00E+00	9.56E-06	6.23E-01	2.12E-01	6.81E-01	1.15E-03	3.55E-04	6.56E-05	4.01E-03	2.60E-03	5.35E-01	1.04E-01
2002	2	11	1.21E-01	0.00E+00	2.39E-02	0.00E+00	0.00E+00	8.30E-01	2.08E-01	1.37E+00	5.23E-04	0.00E+00	0.00E+00	3.66E-05	7.28E-07	9.31E-01	2.80E-01
2002	2	12	4.85E-01	0.00E+00	2.65E-01	0.00E+00	0.00E+00	1.91E+00	5.00E-01	2.35E+00	5.01E-03	9.96E-06	0.00E+00	2.69E-03	6.02E-04	2.24E+00	5.99E-01
2002	2	13	1.03E-01	0.00E+00	3.64E-02	0.00E+00	0.00E+00	9.03E-01	2.61E-01	1.19E+00	6.87E-05	0.00E+00	0.00E+00	1.50E-03	2.02E-04	9.84E-01	2.72E-01
2002	2	14	2.79E-01	2.56E-06	3.94E-02	0.00E+00	6.65E-08	1.58E+00	3.62E-01	2.47E+00	1.45E-02	1.42E-03	2.06E-04	1.06E-02	4.32E-03	1.80E+00	3.28E-01
2002	2	15	1.41E-01	0.00E+00	3.03E-02	0.00E+00	0.00E+00	1.27E+00	5.87E-01	1.99E+00	2.35E-02	3.62E-04	0.00E+00	1.54E-02	5.88E-03	1.43E+00	2.63E-01
2002	2	16	1.75E-01	1.16E-04	1.39E-01	7.59E-06	6.72E-05	2.54E+00	8.19E-01	2.84E+00	3.95E-02	5.07E-03	8.06E-04	1.76E-02	1.08E-02	2.47E+00	2.17E-01
2002	2	17	3.61E-01	2.72E-05	3.18E-01	2.63E-07	8.63E-06	2.20E+00	1.07E+00	2.66E+00	4.78E-02	5.65E-03	7.42E-04	1.79E-02	1.23E-02	3.02E+00	7.26E-01
2002	2	18	2.87E-01	3.02E-04	1.57E-01	1.50E-05	9.07E-05	1.88E+00	9.21E-01	2.66E+00	2.22E-02	4.25E-03	1.26E-03	8.86E-03	6.55E-03	2.69E+00	4.37E-01
2002	2	19	1.23E-01	4.41E-06	8.16E-02	3.92E-05	2.89E-04	1.00E+00	5.87E-01	1.80E+00	3.72E-02	5.54E-03	6.07E-04	1.89E-02	1.38E-02	1.28E+00	2.70E-01
2002	2	20	1.14E-01	0.00E+00	9.80E-03	0.00E+00	0.00E+00	7.28E-01	5.49E-01	1.15E+00	1.07E-04	2.63E-06	0.00E+00	2.50E-03	3.96E-04	1.11E+00	2.11E-01
2002	2	21	1.79E-01	4.76E-06	8.55E-03	2.65E-04	5.79E-04	9.58E-01	3.92E-01	6.64E-01	1.41E-02	2.48E-03	1.96E-04	4.87E-03	6.41E-03	8.10E-01	3.30E-01
2002	2	22	5.03E-01	4.45E-06	2.78E-01	5.73E-09	2.93E-06	1.55E+00	1.72E-01	7.78E-01	2.39E-02	4.30E-03	3.91E-04	1.20E-02	1.24E-02	1.42E+00	8.09E-01
2002	2	23	9.15E-01	0.00E+00	4.66E-01	0.00E+00	0.00E+00	9.19E-01	3.72E-03	7.45E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.82E+00	1.11E+00
2002	2	24	2.66E+00	3.46E-04	1.53E+00	6.63E-05	1.47E-04	3.57E+00	2.93E-01	3.25E+00	2.44E-02	3.18E-03	1.16E-03	9.49E-03	5.18E-03	4.23E+00	2.81E+00
2002	2	25	6.96E-01	1.15E-03	6.92E-01	2.07E-04	5.14E-04	3.67E+00	1.39E+00	6.77E+00	5.48E-02	8.99E-03	3.05E-03	2.86E-02	1.57E-02	6.16E+00	1.13E+00
2002	2	26	4.43E-02	0.00E+00	6.52E-04	0.00E+00	0.00E+00	4.71E-01	2.20E-01	5.57E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.71E-01	7.58E-02
2002	2	27	7.02E-02	0.00E+00	1.29E-02	0.00E+00	0.00E+00	9.67E-01	5.36E-01	1.82E+00	1.32E-03	0.00E+00	0.00E+00	1.00E-03	5.46E-05	1.37E+00	1.48E-01
2002	2	28	1.86E+00	3.02E-03	1.03E+00	1.48E-03	2.20E-03	3.86E+00	6.46E-01	3.38E+00	5.28E-02	1.40E-02	6.89E-03	1.97E-02	1.65E-02	3.27E+00	1.98E+00
2002	3	1	1.90E+00	7.43E-03	7.28E-01	2.01E-03	4.00E-03	3.78E+00	3.13E-01	3.52E+00	6.11E-02	1.89E-02	1.17E-02	2.78E-02	2.21E-02	2.87E+00	2.07E+00
2002	3	2	3.50E-01	1.00E-05	7.85E-02	0.00E+00	0.00E+00	2.89E+00	4.77E-01	3.94E+00	1.06E-02	3.61E-04	5.08E-05	6.98E-03	1.30E-03	2.18E+00	5.89E-01
2002	3	3	5.25E-02	0.00E+00	3.88E-04	0.00E+00	0.00E+00	3.88E-01	2.40E-01	5.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.53E-01	8.56E-02
2002	3	4	1.78E-01	5.47E-03	2.50E-02	1.84E-03	5.85E-03	3.94E-01	3.04E-01	6.45E-01	9.75E-03	4.06E-03	9.56E-03	5.58E-03	3.77E-03	7.11E-01	2.46E-01
2002	3	5	6.70E-01	1.01E-03	4.23E-01	8.16E-04	5.60E-04	7.84E-01	2.43E-03	1.12E+00	3.15E-04	2.78E-04	4.88E-04	1.09E-04	1.59E-04	1.79E+00	7.91E-01
2002	3	6	1.08E+00	0.00E+00	4.53E-01	0.00E+00	0.00E+00	1.02E+00	3.77E-03	6.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E+00	1.32E+00
2002	3	7	2.02E+00	7.64E-03	9.88E-01	1.41E-03	5.35E-04	2.12E+00	9.08E-02	2.02E+00	1.03E-02	1.17E-03	2.06E-03	8.56E-04	5.89E-04	2.87E+00	2.54E+00
2002	3	8	2.58E+00	5.71E-03	1.50E+00	5.99E-03	9.36E-03	4.39E+00	4.22E-01	4.04E+00	8.38E-02	2.29E-02	1.21E-02	3.46E-02	3.25E-02	4.38E+00	2.98E+00
2002	3	9	2.74E+00	6.86E-03	1.02E+00	2.77E-03	3.27E-03	3.65E+00	1.10E+00	6.07E+00	7.55E-02	1.36E-02	7.33E-03	2.85E-02	1.93E-02	5.56E+00	3.55E+00
2002	3	10	5.08E-01	3.45E-03	9.10E-02	2.45E-03	4.04E-03	2.94E+00	4.20E-01	2.00E+00	9.76E-02	2.09E-02	8.52E-03	3.49E-02	2.91E-02	1.23E+00	8.02E-01
2002	3	11	8.31E-02	0.00E+00	7.27E-03	0.00E+00	0.00E+00	6.98E-01	1.21E-01	3.23E-01	4.70E-03	7.08E-04	3.18E-06	4.82E-03	3.60E-03	3.60E-01	1.66E-01
2002	3	12	9.16E-02	0.00E+00	1.68E-02	0.00E+00	0.00E+00	7.80E-01	1.72E-01	6.14E-01	2.99E-03	1.58E-05	0.00E+00	5.71E-03	2.18E-03	5.25E-01	1.56E-01
2002	3	13	4.37E-01	1.80E-05	9.62E-02	1.06E-06	4.48E-04	1.71E+00	4.68E-01	2.25E+00	3.83E-02	8.81E-03	1.81E-03	1.66E-02	1.24E-02	1.66E+00	6.84E-01
2002	3	14	3.33E-01	2.61E-05	1.16E-01	1.17E-06	1.82E-05	2.46E+00	9.29E-01	2.27E+00	3.53E-02	3.55E-03	4.19E-04	2.00E-02	1.03E-02	2.66E+00	4.48E-01
2002	3	15	6.84E-01	9.38E-03	8.76E-02	4.93E-03	7.18E-03	1.59E+00	3.28E-01	2.18E+00	4.99E-02	1.68E-02	1.18E-02	2.71E-02	2.13E-02	1.54E+00	9.05E-01
2002	3	16	1.41E+00	4.44E-04	6.33E-01	3.77E-07	0.00E+00	1.52E+00	2.92E-02	1.03E+00	2.03E-03	2.81E-05	2.86E-05	6.80E-06	8.35E-06	1.82E+00	1.45E+00
2002	3	17	1.56E+00	1.49E-03	6.79E-01	6.46E-05	1.89E-05	1.80E+00	6.93E-02	2.05E+00	4.92E-03	1.52E-04	1.87E-04	7.21E-05	6.01E-05	2.07E+00	1.83E+00
2002	3	18	1.72E+00	8.62E-03	6.23E-01	9.97E-03	1.18E-02	1.59E+00	1.43E-01	1.67E+00	1.91E-02	1.14E-02	1.28E-02	6.65E-03	7.64E-03	2.62E+00	2.29E+00
2002	3	19	8.48E-01	0.00E+00	5.25E-01	0.00E+00	0.00E+00	9.71E-01	2.42E-03	8.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E+00	1.00E+00
2002	3	20	2.28E+00	1.09E-04	1.41E+00	2.97E-07	5.61E-06	2.83E+00	2.08E-02	1.71E+00	1.59E-02	1.35E-03	3.71E-04	2.90E-03	1.97E-03	2.42E+00	2.26E+00
2002	3	21	2.93E+00	4.01E-03	1.73E+00	1.28E-03	2.60E-03	4.28E+00	1.13E+00	5.63E+00	5.00E-02	1.58E-02	8.10E-03	3.74E-02	2.36E-02	5.57E+00	3.33E+00
2002	3	22	2.25E+00	3.24E-03	1.63E+00	6.95E-04	1.68E-03	4.60E+00	1.48E+00	6.18E+00	9.68E-02	2.06E-02	8.92E-03	4.60E-02	3.06E-02	5.30E+00	2.65E+00
2002	3	23	3.45E+00	3.32E-03	2.04E+00	4.44E-04	9.61E-04	2.95E+00	5.31E-01	4.22E+00	7.81E-02	1.43E-02	6.30E-03	2.77E-02	1.96E-02	4.85E+00	4.01E+00

Year	Month	Day	Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	1	1	2.27E-02	4.51E-05	4.03E-06	8.63E-02	4.36E-01	4.00E-05	7.57E-02	1.85E+00	8.85E-03	7.90E+00	1.13E+00	8.42E-01	1.23E+00	1.82E-01	1.15E-01
2002	1	2	3.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-04	2.04E-02	6.64E-01	4.75E-17	1.71E+00	2.07E-02	6.49E-01	2.80E-01	1.88E-02	5.95E-02
2002	1	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E-02	4.91E-01	1.64E-16	2.64E+00	4.45E-03	5.43E-01	1.94E-01	0.00E+00	0.00E+00
2002	1	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.42E-02	6.17E-01	3.83E-17	3.47E+00	1.68E-03	6.00E-01	2.75E-01	7.14E-03	0.00E+00
2002	1	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.34E-02	7.99E-01	1.07E-15	5.70E+00	2.16E-03	8.66E-01	2.62E-01	3.14E-02	0.00E+00
2002	1	6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.65E-04	0.00E+00	1.53E-03	3.28E-01	3.19E-18	9.69E-01	1.27E-01	4.24E-01	2.84E-01	0.00E+00	0.00E+00
2002	1	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.45E-04	0.00E+00	4.59E-04	8.44E-01	0.00E+00	9.83E-01	2.77E-01	6.47E-04	2.92E-01	5.64E-02	0.00E+00
2002	1	8	1.38E-03	0.00E+00	0.00E+00	0.00E+00	2.70E-04	4.88E-05	3.58E-02	1.00E+00	2.44E-04	2.02E+00	6.37E-02	5.33E-01	3.42E-01	1.21E-02	5.84E-03
2002	1	9	2.91E-02	0.00E+00	2.23E-04	0.00E+00	0.00E+00	3.56E-03	5.65E-02	4.39E-01	1.00E-05	6.58E+00	4.19E-07	4.36E-01	1.21E+00	8.75E-02	7.70E-02
2002	1	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.48E-02	3.10E-01	3.27E-15	1.80E+00	6.32E-03	4.83E-01	1.82E-01	2.93E-04	0.00E+00
2002	1	11	8.79E-02	8.67E-02	1.09E-02	1.93E-01	5.65E-01	2.69E-02	4.49E-01	1.19E+00	1.02E-01	7.94E+00	2.48E+00	2.79E+00	3.23E+00	1.81E-01	1.45E-01
2002	1	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-03	0.00E+00	1.92E-02	2.53E-01	2.17E-17	1.03E+00	6.80E-02	1.73E-01	1.91E-01	0.00E+00	0.00E+00
2002	1	13	2.68E-02	5.25E-06	4.92E-04	1.41E-06	4.93E-06	1.77E-03	6.63E-02	9.32E-01	7.64E-02	3.07E+00	2.85E-04	9.90E-01	1.07E+00	3.15E-02	9.58E-02
2002	1	14	1.99E-01	1.16E-01	1.08E+00	1.08E-02	6.68E-02	6.71E-01	7.52E-02	8.07E-01	9.93E+00	4.65E+00	1.31E+00	8.53E-01	1.26E+00	1.42E-01	3.64E-01
2002	1	15	1.22E-01	3.49E-06	6.68E-03	9.76E-13	4.43E-10	3.45E-02	2.57E-01	1.45E+00	2.45E-01	9.13E+00	1.07E-04	3.79E+00	3.81E+00	1.59E-01	2.96E-01
2002	1	16	1.16E-02	0.00E+00	2.46E-03	0.00E+00	0.00E+00	1.36E-02	1.45E-01	1.36E+00	1.31E-03	9.82E+00	6.82E-05	1.51E+00	1.07E+00	2.20E-02	1.02E-02
2002	1	17	8.33E-04	3.46E-04	1.26E-04	3.51E-04	1.08E-03	1.68E-04	2.32E-01	1.67E+00	1.48E-03	1.12E+01	4.58E-02	2.57E+00	1.33E+00	5.12E-02	9.57E-04
2002	1	18	2.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-03	8.75E-02	9.92E-01	3.01E-05	4.82E+00	2.35E-03	6.72E-01	8.08E-01	4.99E-02	9.16E-03
2002	1	19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-02	4.92E-01	1.47E-16	2.19E+00	5.40E-03	4.65E-01	2.07E-01	0.00E+00	0.00E+00
2002	1	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-10	0.00E+00	1.96E-02	4.30E-01	8.79E-18	1.54E+00	3.70E-02	3.47E-01	2.10E-01	0.00E+00	0.00E+00
2002	1	21	5.05E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-05	3.48E-02	1.10E+00	1.42E-05	2.36E+00	1.71E-02	6.48E-01	2.13E-01	6.22E-03	7.73E-02
2002	1	22	1.73E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-02	9.87E-01	8.18E-19	2.16E+00	3.29E-02	6.37E-01	3.12E-01	2.01E-02	7.04E-03
2002	1	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E-02	5.94E-01	1.24E-17	2.64E+00	1.18E-02	4.53E-01	1.78E-01	1.14E-02	0.00E+00
2002	1	24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.77E-05	0.00E+00	1.71E-03	7.87E-02	5.02E-18	6.88E-01	9.96E-02	9.96E-02	1.85E-01	0.00E+00	0.00E+00
2002	1	25	2.67E-02	8.06E-01	2.02E-02	6.65E-02	3.83E-02	2.86E-02	2.92E-02	2.25E-01	2.69E-01	1.84E+00	6.54E-01	1.29E-01	3.06E-01	2.78E-02	3.16E-02
2002	1	26	1.33E-02	6.36E-03	1.24E-03	1.40E-02	1.72E-01	4.41E-03	1.46E-02	2.56E-01	2.53E-02	1.89E+00	2.62E+00	2.85E-02	1.89E-01	2.66E-02	2.73E-02
2002	1	27	1.66E-01	8.86E-01	1.53E-02	3.50E-01	4.74E-01	7.62E-02	6.21E-02	9.03E-01	1.22E+00	2.94E+00	6.07E+00	2.99E-01	4.21E-01	8.22E-02	2.54E-01
2002	1	28	2.90E-02	1.82E-02	4.77E-03	7.35E-03	1.49E-02	7.10E-03	2.02E-01	1.71E+00	1.61E-01	6.66E+00	6.65E-02	1.37E+00	1.03E+00	1.06E-01	4.59E-02
2002	1	29	8.13E-03	0.00E+00	1.02E-03	0.00E+00	0.00E+00	2.57E-03	8.29E-02	1.44E+00	1.12E-03	5.38E+00	3.34E-03	7.89E-01	5.34E-01	3.58E-02	2.69E-02
2002	1	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.32E-02	1.41E+00	7.21E-17	2.45E+00	2.14E-03	9.33E-01	2.05E-01	1.37E-02	0.00E+00
2002	1	31	3.29E-02	0.00E+00	0.00E+00	0.00E+00	1.63E-06	5.00E-04	2.24E-02	3.59E-01	1.99E-05	2.01E+00	9.79E-02	3.03E-01	3.70E-01	5.80E-03	1.07E-01
2002	2	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.47E-12	0.00E+00	4.79E-02	9.07E-01	1.98E-17	3.30E+00	2.14E-02	5.30E-01	2.75E-01	1.24E-03	0.00E+00
2002	2	2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-02	6.73E-01	1.89E-16	1.61E+00	1.59E-02	5.11E-01	1.93E-01	0.00E+00	0.00E+00
2002	2	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.03E-12	0.00E+00	1.88E-02	2.72E-01	2.89E-16	1.62E+00	3.90E-02	3.98E-01	1.76E-01	0.00E+00	0.00E+00
2002	2	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.05E-02	5.56E-01	5.14E-13	3.61E+00	3.56E-03	4.37E-01	3.18E-01	4.09E-02	0.00E+00
2002	2	5	8.02E-04	0.00E+00	8.83E-05	0.00E+00	5.80E-03	6.62E-04	1.05E-02	2.55E-01	1.88E-03	1.22E+00	3.26E-01	2.05E-01	2.18E-01	1.17E-02	2.52E-03
2002	2	6	5.25E-02	1.87E-08	1.29E-04	3.37E-02	2.75E-01	2.08E-03	8.08E-03	3.61E-01	1.79E-03	1.86E+00	1.35E+00	3.39E-01	1.61E-01	1.65E-04	1.19E-01
2002	2	7	1.51E-01	1.35E-01	9.14E-03	2.27E-02	3.28E-02	1.19E-02	3.68E-04	2.54E-01	4.58E-01	1.29E+00	6.83E-01	3.55E-02	3.25E-01	2.10E-03	1.94E-01
2002	2	8	7.91E-01	4.93E-01	1.77E-01	1.80E-01	2.50E-01	2.58E-01	4.01E-01	1.09E+00	2.05E+00	2.93E+00	4.07E+00	1.28E+00	1.63E+00	5.08E-01	1.15E+00
2002	2	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.94E-02	1.32E+00	3.49E-16	5.05E+00	8.33E-03	1.16E+00	1.78E-01	2.78E-02	0.00E+00
2002	2	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-03	0.00E+00	1.56E-02	1.47E-01	1.01E-16	1.20E+00	1.05E-01	2.56E-01	2.18E-01	4.81E-02	0.00E+00
2002	2	11	6.33E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-02	4.39E-01	6.69E-14	3.40E+00	6.13E-04	4.40E-01	7.30E-01	5.48E-03	1.10E-02
2002	2	12	5.54E-02	2.83E-07	1.65E-02	0.00E+00	3.18E-08	8.56E-02	3.24E-02	6.15E-01	1.12E-03	4.88E+00	1.24E-03	3.68E-01	8.12E-01	1.86E-02	1.21E-01
2002	2	13	4.41E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E-12	2.11E-02	4.77E-01	7.76E-06	2.45E+00	1.15E-02	4.51E-01	3.41E-01	1.32E-02	5.64E-03
2002	2	14	1.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.81E-02	5.97E-01	1.84E-07	3.38E+00	4.24E-05	5.32E-01	5.56E-01	1.08E-02	3.26E-05
2002	2	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.90E-02	1.03E+00	4.03E-17	4.04E+00	4.36E-03	6.79E-01	2.64E-01	3.52E-02	0.00E+00
2002	2	16	6.09E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.56E-02	1.17E+00	5.18E-18	3.57E+00	3.75E-02	6.53E-01	2.56E-01	5.65E-02	2.02E-02
2002	2	17	7.38E-02	0.00E+00	3.13E-03	0.00E+00	0.00E+00	1.28E-02	5.09E-02	9.25E-01	6.00E-03	4.35E+00	1.78E-02	9.84E-01	3.02E-01	4.13E-02	1.82E-01
2002	2	18	1.75E-02	0.00E+00	7.81E-05	0.00E+00	0.00E+00	2.72E-03	4.02E-02	1.52E+00	7.49E-17	2.57E+00	2.07E-02	7.95E-01	3.85E-01	2.63E-02	7.29E-02
2002	2	19	2.36E-02	0.00E+00	1.78E-05	1.19E-05	3.93E-02	1.26E-04	2.06E-02	8.54E-01	8.15E-05	1.78E+00	4.38E-01	3.34E-01	4.53E-01	3.66E-03	5.42E-02
2002	2	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E-02	9.72E-01	6.37E-18	3.97E+00	3.48E-02	6.54E-01	3.36E-01	4.58E-03	0.00E+00
2002	2	21	0.00E+00	0.00E+00	0.00E+00	9.50E-02	9.52E-02	0.00E+00	3.24E-02	2.85E-01	0.00E+00	2.96E+00	8.19E-01	4.99E-01	3.11E-01	9.17E-04	0.00E+00
2002	2	22	1.72E-02	1.02E-05	3.99E-02	0.00E+00	4.55E-12	6.99E-02	1.65E-02	2.92E-02	9.42E-01	1.25E+00	4.57E-02	1.09E-01	4.38E-01	1.69E-02	2.46E-02
2002	2	23	0.00E+00	0.00E+00	3.40E-02	0.00E+00	0.00E+00	3.54E-02	0.00E+00	0.00E+00	2.20E+00	7.98E-04	0.00E+00	0.00E+00	9.09E-25	0.00E+00	0.00E+00
2002	2	24	7.40E-01	5.01E-07	7.94E-01	0.00E+00	9.23E-14	4.99E-01	1.41E-02	2.72E-01	2.70E+00	2.73E-03	1.18E-05	1.13E-03	3.85E-04	7.17E-02	1.11E+00
2002	2	25	6.06E-01	1.67E-05	2.66E-01	0.00E+00	0.00E+00	6.05E-01	2.21E-01	1.09E+00	1.12E+00	5.37E+00	2.14E-02	9.48E-01	1.40E+00	5.08E-01	7.29E-01
2002	2	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-02	7.65E-01	2.91E-12	2.72E+00	2.13E-03	6.74E-01	6.28E-01	1.25E-15	0.00E+00
2002	2	27	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.73E-02	7.57E-01	2.83E-16	4.56E+00	4.25E-03	9.92E-01	1.06E+00	2.85E-04	0.00E+00
2002	2	28	4.86E-01	2.65E-01	1.36E-01	3.31E-02	4.06E-02	2.27E-01	3.95E-02	6.92E-01	3.97E-01	1.08E+00	1.14E+00	3.46E-01	3.43E-01	3.65E-02	7.88E-01
2002	3	1	3.41E-01	2.68E-01	4.45E-01	7.12E-02	1.69E-01	5.85E-01	4.53E-02	4.51E-01	1.77E+00	1.54E+00	7.51E-01	4.39E-01	5.59E-01	8.61E-02	4.85E-01
2002	3	2	3.57E-02	0.00E+00	2.92E-05	0.00E+00	0.00E+00	5.89E-04	2.60E-01	1.23E+00	7.13E-03	4.69E+00	5.41E-06	1.76E+00	1.98E+00	1.10E-01	6.05E-02
2002	3	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.70E-02	5.40E-01	4.83E-14	2.43E+00	3.54E-04	3.63E-01	2.75E-01	8.89E-04	0.00E+00
2002	3	4	7.43E-05	1.59E-01	7.85E-05	2.12E-02	9.02E-02	2.33E-03	5.37E-03	2.14E-01	6.94E-02	7.14E-01	9.97E-01	1.71E-01	8.26E-02	2.77E-04	8.32E-05
2002	3	5	1.28E-03	6.28E-03	9.31E-02	2.44E-03	1.86E-03	7.81E-02	2.29E-05	4.15E-05	1.85E+00	6.70E-04	1.64E-03	1.73E-04	3.35E-04	3.56E-05	9.00E-03
2002	3	6	0.00E+00	0.00E+00	5.34E-02	0.00E+00	0.00E+00	6.69E-02	0.00E+00	0.00E+00	3.33E+00	1.22E-04	0.00E+00	0.00E+00	3.17E-29	0.00E+00	0.00E+00
2002	3	7	9.74E-02	8.35E-03	4.21E-02	3.16E-05	3.19E-06	8.70E-02	0.00E+00	7.00E-03	5.19E+00	3.41E-05	2.38E-03	7.55E-10	4.69E-06	3.03E-03	1.71E-01
2002	3	8	4.87E-01	2.95E-01	1.00E-01	1.77E-01	3.69E-01	7.27E-02	3.13E-02	3.54E-01	2.57E+00	2.14E+00	1.01E+00	3.41E-01	2.21E-01	5.60E-02	9.46E-01
2002	3	9	1.15E-01	2.54E-01	5.68E-02	4.58E-02	7.67E-02	1.91E-01	4.42E-02	3.94E-01	2.40E-01	3.89E+00	9.15E-01	5.30E-01	1.25E-01	4.29E-02	2.37E-01
2002	3	10	1.42E-02	8.23E-02	1.84E-04	5.15E-02	1.63E-01	9.56E-04	2.12E-03	6.33E-01	2.74E-03	1.07E+00	1.58E+00	7.83E-02	2.63E-01	3.84E-02	2.28E-02
2002	3	11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-06	0.00E+00	3.71E-04	9.03E-03	1.03E-17	6.01E-01	7.01E-02	8.68E-02	1.82E-01	0.00E+00	0.00E+00
2002	3	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-09	0.00E+00	5.68E-04	2.47E-01	2.00E-21	6.95E-01	5.68E-02	5.81E-02	2.34E-01	3.73E-03	0.00E+00
2002	3	13	1.19E-02	0.00E+00	3.08E-04	0.00E+00	2.46E-05	3.46E-03	1.10E-02	9.18E-01	2.15E-03	1.94E+00	1.37E-01	2.33E-01	3.66E-01	1.27E-02	3.66E-02
2002	3	14	1.10E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.13E-06	8.71E-02	1.31E+00	1.21E-03	5.99E+00	6.02E-03	8.99E-01	3.12E-01	2.06E-02	5.19E-04
2002	3	15	6.88E-03	5.05E-01	5.53E-04	6.42E-02	1.43E-01	2.39E-03	4.64E-04	5.57E-01	1.08E-02	1.04E+00	1.26E+00	5.39E-03	2.06E-01	4.39E-03	3.38E-02
2002	3	16	2.60E-02	3.64E-03	6.65E-02	0.00E+00	0.00E+00	1.22E-01	0.00E+00	0.00E+00	2.13E+00	7.20E-04	1.81E-16	0.00E+00	3.00E-19	0.00E+00	5.12E-02
2002	3	17	9.49E-03	1.01E-03	5.71E-02	7.87E-07	0.00E+00	1.15E-01	0.00E+00	0.00E+00	1.75E+00	2.49E-34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.74E-02
2002	3	18	0.00E+00	4.13E-01	1.35E-02	1.32E-01	1.27E-01	7.26E-02	0.00E+00	0.00E+00	6.24E+00	3.69E-01	4.15E-01	5.52E-05	6.04E-03	0.00E+00	0.00E+00
2002	3	19	0.00E+00	0.00E+00	8.15E-02	0.00E+00	0.00E+00	1.05E-01	0.00E+00	0.00E+00	2.39E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2002	3	20	6.03E-01	0.00E+00	2.75E-01	0.00E+00	0.00E+00	1.91E-01	7.49E-05	1.84E-02	7.94E-01	7.17E-04	0.00E+00	6.07E-07	9.19E-08	1.22E-02	9.46E-01
2002	3	21	6.29E-01	1.10E-01	1.21E-01	3.94E-02	1.26E-01	1.13E-01	1.01E-01	6.37E-01	2.48E+00	4.64E+00	7.86E-01	1.01E+00	1.13E+00	9.22E-02	1.08E+00
2002	3	22	2.81E-01	7.62E-03	1.59E-01	1.09E-03	3.04E-03	1.77E-01	3.30E-01	1.16E+00	3.00E+00	8.42E+00	3.07E-02	1.72E+00	2.07E+00	2.58E-01	4.09E-01
2002	3	23	4.28E-01	1.39E-03	1.45E-01	6.32E-07	3.60E-06	9.69E-02	1.41E-03	8.57E-02	2.96E+00	1.17E-03	1.97E-03	1.02E-03	7.89E-04	3.72E-02	7.18E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	3	24	2.94E+00	1.92E+00	1.86E+00	7.36E-01	6.81E-01	4.89E+00	2.29E+00	8.19E+00	3.04E+00	7.70E+00	3.60E+00	1.41E+00	1.51E+00	7.24E+00	4.29E+00	2.60E+00	5.23E-02	1.74E+00	3.88E-02	4.29E-02	4.72E+00	2.15E+00	7.08E+00	1.94E-01	7.82E-02	6.31E-02	1.07E-01	8.63E-02	7.08E+00	3.52E+00	3.41E-01	1.87E+00	1.28E-01	6.98E-01	6.38E-01	1.78E-01	1.39E-01	1.11E+00	2.85E+00	7.62E+00	3.53E+00	1.30E+00	1.42E+00	1.57E-01	7.73E-01
2002	3	25	6.53E-01	1.01E-02	1.18E-01	5.33E-02	2.69E-01	2.56E+00	1.01E+00	4.80E+00	8.17E-02	7.75E+00	1.62E+00	1.01E+00	1.45E+00	3.56E+00	8.41E-01	6.48E-01	4.41E-03	1.18E-01	2.98E-03	8.62E-03	2.56E+00	8.88E-01	3.38E+00	6.12E-02	2.50E-02	1.68E-02	3.71E-02	2.99E-02	3.50E+00	8.32E-01	4.23E-03	5.72E-03	3.92E-05	5.04E-02	2.60E-01	8.86E-04	1.18E-01	1.42E+00	2.05E-02	7.72E+00	1.60E+00	9.71E-01	1.42E+00	5.58E-02	9.46E-03
2002	3	26	2.74E-02	9.94E-07	6.36E-02	0.00E+00	3.65E-06	1.08E+00	3.52E-01	1.61E+00	2.98E-02	1.73E+00	6.86E-02	3.34E-01	2.28E-01	1.33E+00	1.76E-01	2.25E-02	9.94E-07	6.24E-02	0.00E+00	1.02E-08	1.08E+00	3.40E-01	1.37E+00	2.87E-02	1.09E-03	2.78E-05	1.32E-02	4.87E-03	1.32E+00	1.63E-01	4.93E-03	0.00E+00	1.17E-03	0.00E+00	3.64E-06	2.43E-03	1.22E-02	2.40E-01	1.06E-03	1.73E+00	6.85E-02	3.21E-01	2.23E-01	1.37E-02	1.27E-02
2002	3	27	7.42E-02	0.00E+00	2.99E-03	0.00E+00	0.00E+00	6.09E-01	3.58E-01	1.74E+00	5.05E-17	1.92E+00	1.07E-02	3.82E-01	1.81E-01	7.12E-01	1.34E-01	7.42E-02	0.00E+00	2.99E-03	0.00E+00	0.00E+00	6.09E-01	3.30E-01	1.10E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-04	0.00E+00	7.12E-01	1.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E-02	6.33E-01	5.05E-17	1.92E+00	1.07E-02	3.82E-01	1.81E-01	0.00E+00	0.00E+00
2002	3	28	5.39E-02	0.00E+00	3.15E-02	0.00E+00	0.00E+00	8.01E-01	3.81E-01	2.47E+00	4.52E-03	2.32E+00	5.12E-03	2.97E-01	3.55E-01	1.50E+00	9.75E-02	5.33E-02	0.00E+00	3.15E-02	0.00E+00	0.00E+00	8.01E-01	3.39E-01	1.75E+00	4.52E-03	3.98E-05	4.81E-07	3.54E-04	1.22E-04	1.49E+00	9.25E-02	5.87E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-04	4.15E-02	7.19E-01	7.30E-07	2.32E+00	5.12E-03	2.97E-01	3.55E-01	2.79E-03	5.00E-03
2002	3	29	5.86E-01	1.73E-05	3.33E-01	1.74E-06	7.41E-06	1.88E+00	1.26E+00	2.65E+00	9.13E-02	5.93E+00	1.62E-02	3.97E-01	5.71E-01	2.55E+00	8.87E-01	5.53E-01	1.26E-05	3.28E-01	1.24E-06	5.55E-06	1.83E+00	1.25E+00	2.31E+00	2.22E-02	2.05E-03	1.36E-04	1.25E-02	5.48E-03	2.54E+00	8.23E-01	3.34E-02	4.70E-06	4.17E-03	5.06E-07	1.86E-06	4.46E-02	1.81E-02	3.40E-01	6.92E-02	5.93E+00	1.61E-02	3.85E-01	5.66E-01	1.72E-02	6.39E-02
2002	3	30	7.10E-01	3.24E-04	2.37E-01	3.65E-05	1.08E-04	1.41E+00	9.26E-01	2.54E+00	1.49E-01	7.41E+00	2.65E-02	5.84E-01	1.56E+00	2.50E+00	1.15E+00	6.76E-01	3.24E-04	2.36E-01	3.65E-05	1.08E-04	1.41E+00	9.01E-01	2.28E+00	7.20E-02	2.05E-02	2.10E-03	3.53E-02	3.21E-02	2.49E+00	1.07E+00	3.44E-02	0.00E+00	1.20E-03	0.00E+00	0.00E+00	6.42E-03	2.47E-02	2.57E-01	7.69E-02	7.39E+00	2.44E-02	5.48E-01	1.53E+00	6.54E-03	7.88E-02
2002	3	31	2.71E-01	2.67E-05	8.57E-02	1.20E-05	3.39E-05	8.08E-01	8.30E-01	1.17E+00	7.02E-01	1.18E+00	2.86E-02	3.67E-01	5.21E-01	1.01E+00	4.17E-01	2.64E-01	2.67E-05	8.56E-02	1.20E-05	3.36E-05	8.05E-01	8.20E-01	1.00E+00	9.37E-03	8.71E-04	1.41E-04	8.07E-03	2.51E-03	9.97E-01	4.06E-01	6.61E-03	0.00E+00	1.13E-04	0.00E+00	2.32E-07	3.05E-03	1.01E-02	1.72E-01	6.93E-01	1.18E+00	2.85E-02	3.59E-01	5.19E-01	1.49E-02	1.07E-02
2002	4	1	1.06E+00	9.78E-07	8.13E-01	0.00E+00	0.00E+00	1.47E+00	2.04E-01	2.13E+00	3.60E+00	4.84E-01	1.05E-05	1.78E-01	2.81E-01	2.51E+00	1.34E+00	1.01E+00	9.78E-07	5.15E-01	0.00E+00	0.00E+00	1.30E+00	1.81E-01	2.01E+00	3.02E-03	9.27E-05	1.05E-05	8.40E-04	2.24E-04	2.49E+00	1.20E+00	5.42E-02	0.00E+00	2.98E-01	0.00E+00	0.00E+00	1.71E-01	2.30E-02	1.20E-01	3.60E+00	4.83E-01	3.72E-08	1.77E-01	2.81E-01	1.76E-02	1.32E-01
2002	4	2	3.90E+00	5.35E-01	1.88E+00	2.02E-02	2.25E-02	4.38E+00	1.20E+00	5.65E+00	3.03E+00	7.57E-01	2.25E+00	9.36E-02	1.63E-01	5.78E+00	5.29E+00	3.49E+00	1.29E-02	1.76E+00	3.54E-03	3.82E-03	4.27E+00	1.19E+00	5.46E+00	1.11E-01	2.18E-02	1.23E-02	4.31E-02	2.91E-02	5.76E+00	4.51E+00	4.13E-01	5.22E-01	1.13E-01	1.67E-02	1.87E-02	1.05E-01	4.76E-03	1.93E-01	2.92E+00	7.35E-01	2.24E+00	5.05E-02	1.34E-01	2.36E-02	7.83E-01
2002	4	3	1.15E+00	1.09E-01	6.66E-01	4.79E-02	9.70E-02	4.40E+00	1.94E+00	5.95E+00	7.45E-01	7.82E+00	9.89E-01	1.17E+00	1.36E+00	4.21E+00	1.54E+00	1.08E+00	9.41E-03	6.47E-01	3.08E-03	4.65E-03	4.37E+00	1.82E+00	4.66E+00	1.48E-01	4.00E-02	1.76E-02	7.90E-02	5.61E-02	4.11E+00	1.38E+00	7.45E-02	9.98E-02	1.93E-02	4.48E-02	9.24E-02	2.98E-02	1.23E-01	1.29E+00	5.97E-01	7.78E+00	9.71E-01	1.09E+00	1.30E+00	9.97E-02	1.66E-01
2002	4	4	9.13E-01	6.84E-01	6.16E-01	4.01E-01	4.54E-01	2.85E+00	1.72E+00	4.16E+00	7.94E-01	6.60E+00	3.98E+00	7.12E-01	1.01E+00	3.34E+00	1.37E+00	8.46E-01	3.45E-02	5.85E-01	2.77E-02	3.51E-02	2.80E+00	1.68E+00	3.72E+00	1.70E-01	7.06E-02	5.30E-02	1.12E-01	8.70E-02	3.26E+00	1.22E+00	6.64E-02	6.50E-01	3.11E-02	3.73E-01	4.19E-01	4.65E-02	4.74E-02	4.32E-01	6.24E-01	6.53E+00	3.92E+00	6.00E-01	9.28E-01	8.51E-02	1.52E-01
2002	4	5	2.39E+00	1.33E+00	1.03E+00	3.72E-01	2.22E-01	2.23E+00	6.16E-01	3.50E+00	1.89E+00	1.41E+00	2.40E+00	3.51E-01	2.34E-01	3.93E+00	2.78E+00	2.30E+00	2.50E-02	9.90E-01	1.13E-02	1.03E-02	2.14E+00	5.94E-01	3.13E+00	5.17E-02	2.34E-02	2.10E-02	2.73E-02	2.41E-02	3.91E+00	2.61E+00	9.09E-02	1.31E+00	3.64E-02	3.60E-01	2.12E-01	9.19E-02	2.11E-02	3.69E-01	1.83E+00	1.39E+00	2.38E+00	3.24E-01	2.10E-01	2.43E-02	1.70E-01
2002	4	6	6.87E-02	1.89E-05	2.25E-02	2.36E-06	6.19E-04	5.58E-01	3.01E-01	1.21E+00	8.12E-04	2.17E+00	1.16E-01	4.39E-01	2.19E-01	6.38E-01	1.28E-01	5.30E-02	1.89E-05	2.24E-02	2.36E-06	2.75E-04	5.58E-01	2.85E-01	7.39E-01	7.45E-04	7.78E-04	1.42E-03	8.51E-04	4.83E-04	6.35E-01	1.01E-01	1.58E-02	0.00E+00	6.81E-05	0.00E+00	3.44E-04	2.30E-04	1.65E-02	4.75E-01	6.73E-05	2.17E+00	1.15E-01	4.39E-01	2.18E-01	3.55E-03	2.74E-02
2002	4	7	1.01E+00	4.33E-01	4.89E-01	1.18E-01	2.80E-01	1.13E+00	4.52E-01	2.08E+00	1.02E+00	2.29E+00	1.03E+00	3.12E-01	1.23E-01	2.00E+00	1.19E+00	9.01E-01	9.90E-03	4.79E-01	7.57E-03	1.65E-02	1.12E+00	4.30E-01	1.81E+00	4.06E-02	3.06E-02	2.72E-02	2.02E-02	2.59E-02	1.99E+00	1.02E+00	1.07E-01	4.23E-01	1.04E-02	1.10E-01	2.64E-01	1.02E-02	2.15E-02	2.75E-01	9.76E-01	2.26E+00	1.01E+00	2.92E-01	9.76E-02	4.77E-03	1.68E-01
2002	4	8	1.40E+00	3.74E-01	6.90E-01	5.02E-02	6.39E-02	2.78E+00	2.00E+00	5.46E+00	7.65E-01	5.52E+00	1.30E+00	1.20E+00	7.19E-01	3.75E+00	1.98E+00	1.35E+00	7.43E-03	6.78E-01	2.10E-03	3.91E-03	2.76E+00	1.91E+00	4.46E+00	1.00E-01	3.17E-02	1.58E-02	6.12E-02	4.31E-02	3.71E+00	1.88E+00	4.25E-02	3.67E-01	1.19E-02	4.81E-02	5.99E-02	2.61E-02	9.04E-02	1.01E+00	6.65E-01	5.49E+00	1.28E+00	1.14E+00	6.76E-01	3.84E-02	1.02E-01
2002	4	9	1.10E+00	3.78E-01	5.80E-01	4.14E-02	6.66E-02	2.03E+00	8.37E-01	3.23E+00	7.11E-01	5.28E-01	2.60E+00	1.25E-01	1.54E-01	3.33E+00	1.53E+00	1.05E+00	8.27E-03	5.55E-01	1.40E-03	3.45E-03	1.99E+00	8.32E-01	3.06E+00	1.35E-01	4.21E-02	1.97E-02	7.23E-02	5.56E-02	3.31E+00	1.43E+00	4.44E-02	3.70E-01	2.43E-02	4.00E-02	6.31E-02	3.61E-02	5.00E-03	1.66E-01	5.75E-01	4.86E-01	2.58E+00	5.29E-02	9.85E-02	2.01E-02	9.31E-02
2002	4	10	1.05E-01	2.15E-04	6.22E-02	2.33E-04	3.76E-04	1.01E+00	4.18E-01	1.91E+00	1.24E-02	1.53E+00	2.31E-02	5.42E-01	2.57E-01	1.14E+00	1.48E-01	1.05E-01	2.13E-04	6.22E-02	2.17E-04	3.42E-04	1.01E+00	3.91E-01	1.41E+00	1.23E-02	2.92E-03	9.88E-04	6.70E-03	4.56E-03	1.12E+00	1.47E-01	2.05E-04	1.86E-06	3.03E-06	1.61E-05	3.42E-05	2.23E-05	2.68E-02	5.01E-01	8.73E-05	1.53E+00	2.21E-02	5.35E-01	2.52E-01	2.25E-02	3.03E-04
2002	4	11	5.84E-02	0.00E+00	1.57E-02	0.00E+00	1.25E-05	5.54E-01	2.69E-01	1.42E+00	1.01E-16	1.09E+00	7.60E-02	2.63E-01	2.15E-01	6.47E-01	1.02E-01	5.84E-02	0.00E+00	1.57E-02	0.00E+00	0.00E+00	5.54E-01	2.63E-01	8.80E-01	0.00E+00	0.00E+00	0.00E+00	5.37E-04	4.99E-06	6.46E-01	1.02E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-05	0.00E+00	6.03E-03	5.44E-01	1.01E-16	1.09E+00	7.60E-02	2.63E-01	2.15E-01	1.14E-03	0.00E+00
2002	4	12	3.90E-02	0.00E+00	1.65E-02	0.00E+00	3.39E-05	5.03E-01	3.05E-01	1.19E+00	4.55E-18	1.11E+00	9.68E-02	2.91E-01	3.28E-01	6.28E-01	5.68E-02	3.90E-02	0.00E+00	1.65E-02	0.00E+00	0.00E+00	5.03E-01	3.01E-01	7.43E-01	0.00E+00	0.00E+00	0.00E+00	4.30E-04	5.78E-06	6.28E-01	5.68E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.39E-05	0.00E+00	3.91E-03	4.48E-01	4.55E-18	1.11E+00	9.68E-02	2.90E-01	3.28E-01	0.00E+00	0.00E+00
2002	4	13	1.00E-01	0.00E+00	3.44E-02	0.00E+00	2.80E-04	9.48E-01	2.02E-01	1.47E+00	2.73E-02	7.84E-01	1.14E-01	4.97E-02	3.20E-01	8.01E-01	3.36E-01	1.00E-01	0.00E+00	3.44E-02	0.00E+00	5.23E-09	9.48E-01	2.01E-01	9.14E-01	2.73E-02	2.45E-03	2.94E-05	6.20E-03	5.91E-03	7.94E-01	3.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.80E-04	0.00E+00	1.23E-03	5.57E-01	9.94E-29	7.82E-01	1.14E-01	4.35E-02	3.14E-01	7.32E-03	0.00E+00
2002	4	14	5.43E-01	5.81E-04	1.81E-01	5.45E-02	7.39E-02	1.66E+00	3.92E-01	2.28E+00	2.63E-02	9.65E-01	8.65E-01	1.32E-01	2.03E-01	1.33E+00	7.90E-01	5.19E-01	5.72E-04	1.79E-01	5.19E-04	9.52E-04	1.66E+00	3.87E-01	1.64E+00	2.54E-02	5.41E-03	2.38E-03	1.29E-02	8.48E-03	1.29E+00	7.39E-01	2.41E-02	9.09E-06	1.77E-03	5.40E-02	7.29E-02	6.20E-03	5.01E-03	6.45E-01	8.61E-04	9.59E-01	8.63E-01	1.19E-01	1.94E-01	3.72E-02	5.04E-02
2002	4	15	1.62E-01	0.00E+00	3.94E-02	0.00E+00	3.98E-06	7.64E-01	3.23E-01	1.23E+00	5.41E-03	1.15E+00	9.75E-02	2.16E-01	3.85E-01	7.64E-01	2.86E-01	1.59E-01	0.00E+00	3.94E-02	0.00E+00	7.48E-08	7.64E-01	3.08E-01	9.72E-01	5.08E-03	5.00E-04	3.16E-05	7.19E-03	2.01E-03	7.33E-01	2.82E-01	2.28E-03	0.00E+00	0.00E+00	0.00E+00	3.90E-06	0.00E+00	1.49E-02	2.56E-01	3.27E-04	1.15E+00	9.75E-02	2.08E-01	3.83E-01	3.02E-02	4.45E-03
2002	4	16	3.71E-01	1.12E-04	2.66E-01	1.27E-05	9.61E-03	2.84E+00	1.01E+00	5.09E+00	7.14E-02	3.10E+00	3.27E-01	4.62E-01	7.39E-01	2.94E+00	5.01E-01	3.59E-01	9.41E-05	2.65E-01	1.26E-05	1.21E-04	2.84E+00	9.66E-01	4.17E+00	6.95E-02	1.10E-02	1.77E-03	2.80E-02	2.07E-02	2.86E+00	4.65E-01	1.19E-02	1.77E-05	1.03E-03	1.03E-07	9.49E-03	2.46E-03	4.31E-02	9.21E-01	1.88E-03	3.09E+00	3.25E-01	4.34E-01	7.18E-01	7.65E-02	3.62E-02
2002	4	17	2.25E+00	3.98E-03	1.29E+00	3.54E-04	8.71E-04	4.18E+00	1.48E+00	5.45E+00	1.49E+00	4.47E+00	7.63E-03	7.14E-01	8.01E-01	4.58E+00	2.85E+00	1.76E+00	1.07E-03	1.11E+00	1.19E-04	4.08E-04	3.97E+00	1.32E+00	4.81E+00	6.16E-02	1.10E-02	3.76E-03	2.73E-02	1.71E-02	4.41E+00	2.18E+00	4.90E-01	2.91E-03	1.79E-01	2.35E-04	4.63E-04	2.02E-01	1.59E-01	6.39E-01	1.43E+00	4.45E+00	3.87E-03	6.87E-01	7.84E-01	1.68E-01	6.70E-01
2002	4	18	1.34E+00	1.23E-01	7.28E-01	4.77E-03	2.56E-03	1.47E+00	1.61E-01	2.47E+00	3.49E+00	2.70E-03	4.56E-03	2.47E-03	1.86E-03	3.10E+00	1.70E+00	1.31E+00	6.42E-03	6.55E-01	1.90E-03	1.54E-03	1.39E+00	1.61E-01	2.47E+00	2.40E-02	1.72E-03	2.17E-03	2.32E-03	1.59E-03	3.10E+00	1.66E+00	2.17E-02	1.17E-01	7.26E-02	2.87E-03	1.02E-03	8.07E-02	3.98E-05	1.37E-04	3.46E+00	9.78E-04	2.39E-03	1.50E-04	2.65E-04	8.12E-05	3.37E-02
2002	4	19	2.28E+00	6.46E-01	1.40E+00	2.42E-01	4.09E-01	4.00E+00	2.11E+00	6.28E+00	2.63E+00	6.65E+00	2.06E+00	1.21E+00	1.84E+00	5.96E+00	3.42E+00	2.03E+00	2.00E-02	1.29E+00	1.03E-02	1.53E-02	3.86E+00	1.98E+00	5.74E+00	1.22E-01	4.82E-02	3.02E-02	8.49E-02	6.30E-02	5.82E+00	2.95E+00	2.49E-01	6.26E-01	1.09E-01	2.31E-01	3.94E-01	1.36E-01	1.28E-01	5.42E-01	2.51E+00	6.60E+00	2.03E+00	1.13E+00	1.77E+00	1.42E-01	4.73E-01
2002	4	20	7.27E-01	4.91E-02	4.39E-01	4.37E-02	9.56E-02	4.95E+00	2.67E+00	8.34E+00	2.91E-01	1.53E+01	5.35E-01	3.08E+00	4.46E+00	6.37E+00	9.33E-01	6.59E-01	5.91E-03	4.19E-01	2.93E-03	4.97E-03	4.92E+00	2.50E+00	6.67E+00	1.35E-01	3.66E-02	1.52E-02	9.52E-02	5.98E-02	6.17E+00	7.73E-01	6.77E-02	4.32E-02	1.99E-02	4.08E-02	9.07E-02	2.26E-02	1.68E-01	1.67E+00	1.57E-01	1.52E+01	5.20E-01	2.98E+00	4.40E+00	1.96E-01	1.60E-01
2002	4	21	3.01E-01	1.17E-03	1.99E-01	2.33E-04	4.43E-04	2.23E+00	1.02E+00	3.27E+00	4.47E-02	3.91E+00	3.50E-02	6.70E-01	7.81E-01	2.36E+00	5.00E-01	2.67E-01	1.17E-03	1.99E-01	2.33E-04	4.43E-04	2.23E+00	9.60E-01	2.43E+00	4.46E-02	6.63E-03	2.36E-03	2.39E-02	1.48E-02	2.34E+00	4.24E-01	3.37E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E-04	5.77E-02	8.44E-01	1.60E-04	3.90E+00	3.26E-02	6.46E-01	7.66E-01	2.33E-02	7.70E-02
2002	4	22	5.01E-01	0.00E+00	7.28E-02	0.00E+00	1.03E-05	9.77E-01	5.71E-01	1.43E+00	2.96E-01	2.52E+00	5.67E-02	4.56E-01	3.08E-01	1.14E+00	7.04E-01	4.15E-01	0.00E+00	6.93E-02	0.00E+00	0.00E+00	9.48E-01	5.34E-01	1.17E+00	5.99E-03	4.30E-04	1.17E-05	2.19E-03	1.22E-03	1.11E+00	5.65E-01	8.66E-02	0.00E+00	3.44E-03	0.00E+00	1.03E-05	2.94E-02	3.70E-02	2.59E-01	2.90E-01	2.52E+00	5.67E-02	4.54E-01	3.07E-01	3.06E-02	1.39E-01
2002	4	23	8.34E-01	3.17E-04	3.23E-01	1.11E-05	3.31E-04	2.46E+00	9.63E-01	5.43E+00	8.68E-02	6.98E+00	7.21E-02	1.08E+00	1.91E+00	3.77E+00	1.15E+00	7.88E-01	3.09E-04	3.15E-01	1.11E-05	3.21E-04	2.42E+00	9.34E-01	5.04E+00	3.90E-02	6.99E-03	3.32E-03	1.01E-02	7.97E-03	3.72E+00	1.04E+00	4.62E-02	8.52E-06	8.21E-03	0.00E+00	1.05E-05	3.43E-02	2.88E-02	3.90E-01	4.78E-02	6.97E+00	6.87E-02	1.07E+00	1.90E+00	4.53E-02	1.13E-01
2002	4	24	1.44E+00	7.58E-04	8.72E-01	5.83E-05	2.04E-04	3.42E+00	1.52E+00	5.15E+00	1.45E+00	9.58E+00	8.30E-03	1.13E+00	2.18E+00	4.36E+00	1.65E+00	1.11E+00	4.03E-04	6.25E-01	5.83E-05	2.01E-04	3.18E+00	1.35E+00	4.20E+00	4.08E-02	7.58E-03	2.02E-03	2.57E-02	1.46E-02	4.13E+00	1.23E+00	3.26E-01	3.55E-04	2.47E-01	6.09E-08	2.26E-06	2.40E-01	1.75E-01	9.52E-01	1.41E+00	9.57E+00	6.28E-03	1.10E+00	2.16E+00	2.26E-01	4.17E-01
2002	4	25	3.69E+00	3.40E-02	1.96E+00	8.84E-04	9.99E-04	4.09E+00	3.11E-01	5.05E+00	3.32E+00	9.28E-02	1.43E-02	7.58E-02	7.35E-02	6.16E+00	5.09E+00	3.30E+00	4.20E-03	1.61E+00	6.07E-04	9.61E-04	3.76E+00	3.02E-01	4.77E+00	1.11E-01	1.71E-02	6.80E-03	3.21E-02	2.28E-02	6.08E+00	4.47E+00	3.88E-01	2.98E-02	3.53E-01	2.77E-04	3.80E-05	3.31E-01	9.41E-03	2.86E-01	3.21E+00	7.57E-02	7.46E-03	4.37E-02	5.06E-02	8.56E-02	6.26E-01
2002	4	26	2.30E+00	8.13E-07	1.87E+00	0.00E+00	0.00E+00	2.69E+00	5.67E-03	1.77E+00	1.50E+00	1.23E-04	5.89E-05	1.61E-04	1.38E-04	2.12E+00	2.59E+00	1.99E+00	8.13E-07	1.68E+00	0.00E+00	0.00E+00	2.52E+00	5.67E-03	1.77E+00	3.63E-03	1.23E-04	2.34E-05	1.61E-04	1.38E-04	2.12E+00	1.97E+00	3.06E-01	0.00E+00	1.82E-01	0.00E+00	0.00E+00	1.75E-01	0.00E+00	1.19E-05	1.49E+00	0.00E+00	3.55E-05	0.00E+00	0.00E+00	3.52E-05	6.21E-01
2002	4	27	9.34E-01	1.20E-01	6.77E-01	4.14E-02	4.13E-02	2.82E+00	6.64E-01	3.87E+00	1.67E+00	1.55E+00	1.05E+00	2.60E-01	1.29E-01	3.66E+00	1.24E+00	9.29E-01	6.16E-03	6.26E-01	2.60E-03	2.61E-03	2.73E+00	6.42E-01	3.44E+00	7.45E-02	1.44E-02	6.59E-03	2.65E-02	2.01E-02	3.62E+00	1.22E+00	5.31E-03	1.14E-01	5.08E-02	3.88E-02	3.87E-02	9.29E-02	2.20E-02	4.37E-01	1.60E+00	1.53E+00	1.04E+00	2.34E-01	1.09E-01	3.17E-02	2.06E-02
2002	4	28	8.42E-01	3.70E-04	4.72E-01	3.07E-05	1.08E-04	2.17E+00	1.10E+00	4.43E+00	8.24E-02	5.58E+00	4.44E-03	6.79E-01	6.35E-01	3.46E+00	1.61E+00	7.65E-01	1.20E-04	4.56E-01	1.01E-05	5.07E-05	2.12E+00	1.07E+00	4.06E+00	6.56E-02	9.28E-03	1.24E-03	3.04E-02	1.78E-02	3.45E+00	1.28E+00	7.75E-02	2.50E-04	1.56E-02	2.06E-05	5.72E-05	5.27E-02	2.94E-02	3.79E-01	1.68E-02	5.57E+00	3.21E-03	6.48E-01	6.17E-01	9.23E-03	3.27E-01
2002	4	29	4.14E-01	3.00E-03	2.13E-01	1.36E-04	6.45E-04	2.11E+00	7.71E-01	4.00E+00	5.73E-01	6.47E+00	1.07E-02	8.15E-01	1.47E+00	3.53E+00	5.48E-01	3.85E-01	1.44E-04	1.69E-01	2.30E-05	5.48E-05	2.06E+00	6.84E-01	3.03E+00	4.92E-02	4.86E-03	7.42E-04	2.62E-02	1.31E-02	3.48E+00	5.01E-01	2.90E-02	2.85E-03	4.39E-02	1.13E-04	5.90E-04	4.90E-02	8.68E-02	9.67E-01	5.23E-01	6.46E+00	9.96E-03	7.89E-01	1.46E+00	5.37E-02	4.74E-02
2002	4	30	1.23E+00	3.28E-01	7.81E-01	6.52E-03	8.30E-03	1.56E+00	3.18E-01	2.25E+00	2.68E+00	2.09E-01	1.67E-01	4.70E-02	7.37E-02	3.12E+00	1.69E+00	1.16E+00	1.02E-04	5.84E-01	2.53E-06	8.84E-06	1.37E+00	3.01E-01	2.21E+00	1.20E-02	9.34E-04	2.22E-04	3.90E-03	1.73E-03	3.08E+00	1.61E+00	6.58E-02	3.28E-01	1.98E-01	6.52E-03	8.29E-03	1.83E-01	1.72E-02	3.63E-02	2.66E+00	2.09E-01	1.67E-01	4.31E-02	7.19E-02	3.41E-02	7.95E-02
2002	5	1	5.52E+00	3.41E-01	2.65E+00	1.10E-01	2.60E-01	1.18E+01	6.25E+00	1.39E+01	3.54E+00	1.32E+01	2.95E+00	1.58E+00	2.81E+00	1.19E+01	7.76E+00	5.44E+00	1.75E-02	2.60E+00	2.34E-03	4.71E-03	1.17E+01	6.16E+00	1.35E+01	2.79E-01	6.50E-02	3.05E-02	1.09E-01	8.33E-02	1.18E+01	7.61E+00	8.26E-02	3.24E-01	5.14E-02	1.07E-01	2.55E-01	6.51E-02	8.39E-02	3.74E-01	3.27E+00	1.31E+01	2.91E+00	1.47E+00	2.72E+00	5.56E-02	1.57E-01
2002	5	2	1.96E+00	0.00E+00	3.56E-01	0.00E+00	1.90E-05	3.99E+00	3.47E+00	6.01E+00	7.45E-01	3.44E+00	4.66E-01	4.01E-01	5.22E-01	4.65E+00	2.55E+00	1.87E+00	0.00E+00	3.56E-01	0.00E+00	0.00E+00	3.99E+00	3.45E+00	5.85E+00	1.10E-01	1.09E-02	2.91E-04	3.55E-02	2.83E-02	4.57E+00	2.46E+00	8.42E-02	0.00E+00	2.02E-06	0.00E+00	1.90E-05	3.30E-05	2.58E-02	1.56E-01	6.35E-01	3.43E+00	4.66E-01	3.66E-01	4.94E-01	8.94E-02	8.54E-02
2002	5	3	4.08E+00	1.26E-01	1.41E+00	8.96E-02	1.33E-01	4.95E+00	3.57E+00	1.09E+01	1.68E+00	3.94E+00	2.10E+00	1.44E-01	4.80E-01	1.37E+01	5.42E+00	4.06E+00	1.75E-02	1.33E+00	1.04E-02	1.44E-02	4.89E+00	3.57E+00	1.07E+01	2.58E-01	7.10E-02	4.34E-02	5.67E-02	6.13E-02	1.36E+01	5.39E+00	2.30E-02	1.08E-01	8.53E-02	7.93E-02	1.19E-01	6.07E-02	3.28E-04	1.44E-01	1.42E+00	3.87E+00	2.06E+00	8.77E-02	4.18E-01	1.59E-02	2.65E-02
2002	5	4	4.41E+00	6.54E-03	1.02E+00	8.59E-03	1.50E-01	6.30E+00	5.20E+00	1.14E+01	4.10E-01	3.90E+00	2.14E+00	4.25E-01	9.42E-01	1.01E+01	5.30E+00	4.31E+00	6.45E-03	1.02E+00	7.80E-03	2.37E-02	6.29E+00	5.19E+00	1.10E+01	3.66E-01	8.45E-02	5.30E-02	9.38E-02	9.87E-02	1.01E+01	5.13E+00	9.95E-02	8.54E-05	4.24E-04	7.92E-04	1.26E-01	1.20E-02	9.25E-03	3.28E-01	4.33E-02	3.82E+00	2.09E+00	3.31E-01	8.43E-01	2.56E-03	1.63E-01
2002	5	5	5.75E+00	1.91E-02	1.91E+00	2.90E-01	4.86E-01	1.89E+01	6.44E+00	2.07E+01	5.74E-01	3.50E+00	4.37E+00	4.14E-01	1.26E+00	1.78E+01	7.91E+00	5.63E+00	1.74E-02	1.90E+00	1.48E-02	1.76E-02	1.88E+01	6.40E+00	1.99E+01	5.66E-01	1.33E-01	4.00E-02	2.31E-01	2.05E-01	1.78E+01	7.66E+00	1.18E-01	1.77E-03	9.93E-03	2.75E-01	4.69E-01	2.60E-02	4.73E-02	8.79E-01	8.32E-03	3.37E+00	4.33E+00	1.83E-01	1.06E+00	3.38E-02	2.52E-01
2002	5	6	5.14E+00	1.37E-04	2.15E+00	0.00E+00	2.52E-05	1.24E+01	1.45E+00	1.33E+01	1.64E+00	2.60E+00	1.24E-02	5.50E-01	5.37E-01	9.60E+00	5.95E+00	4.76E+00	1.37E-04	1.99E+00	0.00E+00	2.52E-05	1.23E+01	1.36E+00	1.26E+01	2.05E-01	2.34E-02	3.40E-03	6.42E-02	4.33E-02	9.41E+00	5.46E+00	3.88E-01	0.00E+00	1.57E-01	0.00E+00	0.00E+00	1.87E-01	8.16E-02	6.58E-01	1.44E+00	2.58E+00	9.04E-03	4.86E-01	4.93E-01	1.84E-01	4.85E-01
2002	5	7	1.41E+01	3.43E-03	8.84E+00	1.87E-04	8.48E-04	2.19E+01	2.88E+00	2.53E+01	7.19E+00	5.35E-02	1.41E-02	9.40E-02	7.89E-02	2.29E+01	1.45E+01	1.36E+01	2.58E-03	7.58E+00	1.86E-04	8.40E-04	2.09E+01	2.88E+00	2.51E+01	1.30E-01	1.60E-02	7.34E-03	3.90E-02	2.56E-02	2.29E+01	1.37E+01	4.86E-01	8.54E-04	1.25E+00	3.73E-07	7.70E-06	9.74E-01	2.54E-03	1.85E-01	7.06E+00	3.75E-02	6.73E-03	5.50E-02	5.33E-02	5.43E-02	8.05E-01
2002	5	8	2.32E+00	2.25E-01	1.44E+00	1.73E-01	2.76E-01	2.14E+01	7.97E+00	2.63E+01	7.80E-01	1.79E+01	1.25E+00	4.87E+00	7.37E+00	2.74E+01	2.90E+00	2.26E+00	1.45E-02	1.39E+00	6.60E-03	1.19E-02	2.13E+01	7.71E+00	2.49E+01	3.64E-01	9.75E-02	3.75E-02	2.82E-01	1.71E-01	2.72E+01	2.76E+00	6.81E-02	2.10E-01	5.07E-02	1.67E-01	2.64E-01	3.94E-02	2.55E-01	1.43E+00	4.16E-01	1.78E+01	1.22E+00	4.59E+00	7.20E+00	2.01E-01	1.42E-01
2002	5	9	5.09E+00	1.36E+00	2.82E+00	3.19E-01	3.73E-01	2.38E+01	8.58E+00	2.92E+01	1.41E+00	1.62E+01	4.69E+00	1.77E+00	1.36E+00	2.83E+01	6.68E+00	4.93E+00	4.11E-02	2.81E+00	1.77E-02	2.13E-02	2.38E+01	8.50E+00	2.79E+01	4.49E-01	1.09E-01	5.82E-02	2.41E-01	1.57E-01	2.82E+01	6.37E+00	1.53E-01	1.31E+00	8.86E-03	3.01E-01	3.52E-01	1.81E-02	7.82E-02	1.21E+00	9.58E-01	1.61E+01	4.63E+00	1.53E+00	1.20E+00	9.07E-02	3.15E-01
2002	5	10	3.89E+00	4.21E-01	1.75E+00	9.92E-02	2.29E-01	2.38E+01	1.24E+01	2.84E+01	6.15E-01	2.30E+01	5.09E+00	5.12E+00	8.70E+00	2.34E+01	5.16E+00	3.83E+00	9.77E-03	1.74E+00	2.87E-03	7.88E-03	2.38E+01	1.21E+01	2.70E+01	5.32E-01	1.38E-01	4.88E-02	3.50E-01	2.25E-01	2.32E+01	5.02E+00	6.01E-02	4.12E-01	9.59E-03	9.64E-02	2.21E-01	2.18E-02	3.01E-01	1.43E+00	8.36E-02	2.28E+01	5.04E+00	4.77E+00	8.47E+00	1.59E-01	1.41E-01
2002	5	11	1.56E+00	3.98E-03	1.28E+00	4.61E-04	1.37E-03	1.93E+01	5.46E+00	2.45E+01	3.34E-01	1.27E+01	3.12E-02	2.01E+00	1.95E+00	2.02E+01	2.28E+00	1.47E+00	3.93E-03	1.28E+00	4.59E-04	1.35E-03	1.93E+01	5.36E+00	2.34E+01	3.31E-01	5.79E-02	1.47E-02	1.62E-01	1.01E-01	2.02E+01	2.09E+00	8.36E-02	4.24E-05	3.03E-04	2.00E-06	1.95E-05	8.56E-04	1.02E-01	1.10E+00	3.02E-03	1.27E+01	1.66E-02	1.85E+00	1.85E+00	6.60E-02	1.90E-01
2002	5	12	7.75E+00	6.90E-01	2.86E+00	1.63E-01	2.15E-01	2.32E+01	4.53E+00	3.12E+01	1.72E+00	5.60E+00	2.04E+00	9.63E-01	1.38E+00	2.34E+01	1.16E+01	7.07E+00	2.02E-02	2.74E+00	9.56E-03	1.35E-02	2.30E+01	3.88E+00	2.98E+01	5.20E-01	8.86E-02	3.63E-02	1.69E-01	1.21E-01	2.26E+01	1.08E+01	6.81E-01	6.70E-01	1.22E-01	1.53E-01	2.01E-01	2.14E-01	6.51E-01	1.34E+00	1.20E+00	5.51E+00	2.00E+00	7.94E-01	1.26E+00	8.27E-01	8.25E-01
2002	5	13	6.03E+00	9.28E-01	2.52E+00	3.11E-01	7.08E-01	2.16E+01	8.82E+00	2.07E+01	1.55E+00	1.14E+01	5.59E+00	9.11E-01	1.75E+00	1.62E+01	8.87E+00	5.98E+00	6.71E-02	2.51E+00	3.19E-02	5.06E-02	2.16E+01	8.80E+00	1.99E+01	8.07E-01	2.77E-01	1.39E-01	4.41E-01	3.61E-01	1.60E+01	8.74E+00	5.11E-02	8.61E-01	7.60E-03	2.79E-01	6.57E-01	1.71E-02	2.08E-02	8.93E-01	7.40E-01	1.11E+01	5.45E+00	4.69E-01	1.39E+00	1.27E-01	1.27E-01
2002	5	14	1.65E+00	1.31E-03	2.81E-01	6.71E-05	6.77E-04	4.83E+00	1.86E+00	5.75E+00	9.17E-02	3.91E+00	1.12E-01	4.60E-01	7.88E-01	4.64E+00	2.31E+00	1.63E+00	1.24E-03	2.72E-01	6.47E-05	6.61E-04	4.81E+00	1.84E+00	5.31E+00	8.43E-02	2.48E-02	8.33E-03	5.07E-02	3.60E-02	4.63E+00	2.26E+00	1.78E-02	7.39E-05	8.38E-03	2.38E-06	1.68E-05	2.30E-02	1.85E-02	4.34E-01	7.38E-03	3.89E+00	1.04E-01	4.09E-01	7.52E-01	6.02E-03	5.82E-02
2002	5	15	6.02E+00	2.29E-03	2.89E+00	4.15E-04	1.46E-03	1.65E+01	6.56E+00	2.00E+01	7.39E-01	1.49E+01	1.50E-01	1.03E+00	2.74E+00	2.18E+01	7.47E+00	5.82E+00	2.19E-03	2.88E+00	4.13E-04	1.44E-03	1.65E+01	6.53E+00	1.95E+01	1.78E-01	3.11E-02	1.06E-02	6.80E-02	4.54E-02	2.17E+01	7.03E+00	2.03E-01	9.57E-05	1.19E-02	2.02E-06	2.64E-05	4.19E-02	3.08E-02	5.80E-01	5.61E-01	1.49E+01	1.39E-01	9.62E-01	2.69E+00	3.36E-02	4.39E-01
2002	5	16	6.70E+00	6.77E-03	2.73E+00	1.02E-03	2.64E-03	1.99E+01	5.83E+00	1.97E+01	1.95E+00	1.06E+01	4.39E-01	1.01E+00	4.95E-01	2.71E+01	9.05E+00	6.53E+00	2.95E-03	2.66E+00	3.93E-04	1.59E-03	1.98E+01	5.72E+00	1.88E+01	2.19E-01	3.58E-02	1.69E-02	9.20E-02	5.22E-02	2.68E+01	8.77E+00	1.70E-01	3.82E-03	7.49E-02	6.26E-04	1.05E-03	9.31E-02	1.03E-01	9.36E-01	1.73E+00	1.05E+01	4.23E-01	9.17E-01	4.43E-01	2.24E-01	2.76E-01
2002	5	17	1.02E+01	1.06E+00	5.91E+00	1.26E-01	4.17E-01	2.63E+01	4.64E+00	2.25E+01	2.29E+00	6.49E+00	1.96E+00	5.82E-01	6.73E-01	2.72E+01	1.23E+01	9.76E+00	2.58E-02	5.87E+00	6.83E-03	8.28E-03	2.62E+01	4.61E+00	2.19E+01	2.51E-01	5.77E-02	3.15E-02	1.63E-01	1.11E-01	2.72E+01	1.15E+01	4.48E-01	1.03E+00	3.05E-02	1.19E-01	4.09E-01	3.01E-02	3.01E-02	6.51E-01	2.03E+00	6.43E+00	1.93E+00	4.20E-01	5.62E-01	6.90E-02	8.15E-01
2002	5	18	9.49E+00	2.68E-03	4.78E+00	5.76E-05	3.73E-04	1.74E+01	2.69E+00	1.89E+01	2.60E+00	3.13E+00	8.44E-03	7.74E-01	7.18E-01	2.53E+01	1.28E+01	9.19E+00	2.68E-03	4.47E+00	5.76E-05	3.73E-04	1.71E+01	2.63E+00	1.84E+01	3.30E-01	3.60E-02	8.38E-03	1.22E-01	7.36E-02	2.52E+01	1.23E+01	3.00E-01	3.17E-08	3.04E-01	0.00E+00	0.00E+00	2.35E-01	6.38E-02	4.83E-01	2.27E+00	3.09E+00	6.44E-05	6.52E-01	6.45E-01	1.00E-01	5.31E-01
2002	5	19	1.04E+01	2.77E-03	5.99E+00	1.29E-04	5.76E-04	1.26E+01	4.36E-02	9.62E+00	1.79E+00	1.99E-02	5.93E-03	2.82E-02	2.16E-02	1.39E+01	1.12E+01	1.00E+01	2.77E-03	5.87E+00	1.29E-04	5.76E-04	1.25E+01	4.28E-02	9.59E+00	1.19E-01	1.60E-02	5.91E-03	2.79E-02	2.14E-02	1.38E+01	1.05E+01	4.33E-01	5.66E-06	1.21E-01	1.09E-08	1.61E-07	6.69E-02	7.65E-04	2.78E-02	1.67E+00	3.89E-03	2.09E-05	2.49E-04	1.62E-04	3.00E-02	6.65E-01
2002	5	20	8.05E+00	5.41E-02	4.21E+00	8.26E-03	2.16E-02	1.45E+01	4.11E+00	2.21E+01	1.33E+00	5.38E+00	8.77E-02	6.05E-01	1.08E+00	2.27E+01	1.04E+01	7.86E+00	3.69E-03	4.17E+00	9.55E-04	1.41E-03	1.44E+01	4.10E+00	2.18E+01	2.14E-01	2.45E-02	8.55E-03	6.32E-02	3.92E-02	2.27E+01	1.01E+01	1.89E-01	5.04E-02	3.92E-02	7.31E-03	2.02E-02	4.33E-02	1.02E-02	3.01E-01	1.12E+00	5.36E+00	7.92E-02	5.42E-01	1.04E+00	2.74E-02	3.46E-01
2002	5	21	9.30E+00	2.34E-02	3.16E+00	2.40E-02	5.49E-02	1.22E+01	7.47E+00	1.79E+01	1.49E+00	1.44E+01	3.00E-01	1.82E+00	2.25E+00	1.96E+01	1.37E+01	9.07E+00	4.13E-03	2.81E+00	1.06E-03	1.80E-03	1.19E+01	7.35E+00	1.72E+01	3.92E-01	6.63E-02	1.72E-02	1.48E-01	1.03E-01	1.95E+01	1.34E+01	2.37E-01	1.92E-02	3.47E-01	2.29E-02	5.31E-02	3.43E-01	1.19E-01	6.90E-01	1.10E+00	1.44E+01	2.83E-01	1.67E+00	2.15E+00	1.62E-01	2.99E-01
2002	5	22	1.25E+01	2.65E-04	3.73E+00	1.01E-05	4.95E-05	9.93E+00	6.82E-02	1.32E+01	1.96E+00	3.82E-03	9.04E-04	8.37E-03	5.21E-03	8.44E+00	1.41E+01	1.08E+01	2.65E-04	3.64E+00	1.01E-05	4.95E-05	9.83E+00	6.03E-02	1.24E+01	2.87E-02	3.17E-03	9.04E-04	8.34E-03	5.20E-03	7.65E+00	1.24E+01	1.63E+00	0.00E+00	8.90E-02	0.00E+00	0.00E+00	1.03E-01	7.97E-03	8.41E-01	1.93E+00	6.42E-04	0.00E+00	2.60E-05	8.41E-06	7.86E-01	1.71E+00
2002	5	23	7.56E+00	8.17E-02	3.55E+00	1.69E-01	4.58E-01	1.47E+01	4.64E+00	1.91E+01	3.14E+00	1.09E+01	3.43E+00	1.12E+00	2.95E+00	1.45E+01	8.29E+00	7.24E+00	3.70E-03	2.82E+00	4.77E-04	1.50E-03	1.41E+01	4.52E+00	1.83E+01	2.73E-01	5.19E-02	1.60E-02	9.65E-02	7.28E-02	1.44E+01	7.91E+00	3.19E-01	7.80E-02	7.32E-01	1.68E-01	4.57E-01	6.08E-01	1.18E-01	7.70E-01	2.86E+00	1.09E+01	3.41E+00	1.02E+00	2.87E+00	1.32E-01	3.76E-01
2002	5	24	3.78E+00	2.84E-04	2.58E+00	2.82E-05	1.14E-04	1.57E+01	4.54E+00	1.95E+01	2.01E-01	1.21E+01	1.25E-02	1.51E+00	1.84E+00	1.87E+01	4.90E+00	3.69E+00	2.42E-04	2.57E+00	2.59E-05	1.04E-04	1.56E+01	4.48E+00	1.85E+01	1.93E-01	2.03E-02	2.56E-03	9.49E-02	4.55E-02	1.87E+01	4.64E+00	9.23E-02	4.19E-05	1.05E-02	2.31E-06	9.67E-06	2.29E-02	6.35E-02	1.02E+00	7.78E-03	1.21E+01	9.90E-03	1.42E+00	1.79E+00	4.29E-02	2.61E-01
2002	5	25	1.90E+00	2.42E-03	1.36E+00	6.58E-04	1.22E-03	1.72E+01	5.35E+00	2.16E+01	2.87E-01	1.11E+01	1.54E-01	1.38E+00	9.04E-01	1.93E+01	2.12E+00	1.89E+00	2.41E-03	1.36E+00	6.56E-04	1.15E-03	1.72E+01	5.29E+00	2.06E+01	2.84E-01	3.78E-02	8.14E-03	1.54E-01	9.45E-02	1.92E+01	2.09E+00	8.12E-03	1.06E-05	1.08E-03	1.92E-06	6.89E-05	6.63E-03	6.23E-02	9.93E-01	2.65E-03	1.11E+01	1.45E-01	1.22E+00	8.10E-01	8.31E-02	3.06E-02
2002	5	26	6.44E-01	2.87E-04	6.60E-01	1.09E-05	1.16E-04	1.52E+01	4.83E+00	1.92E+01	1.89E-01	1.12E+01	4.87E-02	1.00E+00	1.23E+00	1.84E+01	1.07E+00	6.43E-01	2.82E-04	6.60E-01	1.08E-05	1.14E-04	1.52E+01	4.76E+00	1.80E+01	1.88E-01	1.69E-02	1.81E-03	9.32E-02	5.45E-02	1.84E+01	1.06E+00	5.59E-04	5.01E-06	1.39E-04	8.15E-08	1.35E-06	4.48E-04	7.33E-02	1.19E+00	8.63E-04	1.12E+01	4.69E-02	9.11E-01	1.18E+00	7.73E-02	3.97E-03
2002	5	27	2.20E+00	8.05E-04	1.18E+00	4.92E-06	1.60E-04	1.39E+01	4.33E+00	1.86E+01	3.28E-01	5.74E+00	1.28E-01	8.19E-01	8.87E-01	1.58E+01	3.20E+00	2.14E+00	7.66E-04	1.17E+00	2.16E-06	1.44E-04	1.39E+01	4.30E+00	1.77E+01	3.01E-01	5.34E-02	1.01E-02	8.97E-02	7.68E-02	1.57E+01	3.05E+00	6.51E-02	3.84E-05	6.83E-03	2.76E-06	1.59E-05	1.95E-02	3.41E-02	8.78E-01	2.73E-02	5.68E+00	1.18E-01	7.29E-01	8.10E-01	3.49E-02	1.54E-01
2002	5	28	9.17E-01	2.07E-03	1.03E+00	3.01E-04	1.58E-03	1.30E+01	4.47E+00	1.20E+01	1.50E-01	6.94E+00	2.20E-01	8.71E-01	7.24E-01	1.74E+01	1.52E+00	8.80E-01	2.07E-03	1.03E+00	3.01E-04	1.50E-03	1.30E+01	4.43E+00	1.12E+01	1.44E-01	3.11E-02	9.59E-03	9.01E-02	5.85E-02	1.74E+01	1.43E+00	3.69E-02	0.00E+00	8.54E-07	0.00E+00	8.36E-05	3.45E-04	3.84E-02	7.77E-01	5.42E-03	6.91E+00	2.11E-01	7.81E-01	6.65E-01	7.48E-02	8.73E-02
2002	5	29	8.98E-01	0.00E+00	7.66E-02	0.00E+00	4.99E-07	4.22E+00	7.93E-01	1.61E+00	1.61E-02	1.83E+00	2.58E-01	1.67E-01	4.53E-01	2.59E+00	2.06E+00	8.98E-01	0.00E+00	7.66E-02	0.00E+00	3.68E-07	4.22E+00	7.92E-01	1.54E+00	1.61E-02	4.01E-03	2.36E-04	1.83E-02	8.25E-03	2.59E+00	2.06E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-07	0.00E+00	6.57E-04	7.02E-02	4.07E-17	1.82E+00	2.57E-01	1.48E-01	4.45E-01	0.00E+00	0.00E+00
2002	5	30	1.86E-01	0.00E+00	1.50E-02	0.00E+00	0.00E+00	3.42E+00	1.73E+00	4.45E+00	1.29E-04	5.32E+00	1.08E-01	6.22E-01	5.71E-01	3.17E+00	3.68E-01	1.86E-01	0.00E+00	1.50E-02	0.00E+00	0.00E+00	3.42E+00	1.71E+00	4.12E+00	1.29E-04	8.22E-06	0.00E+00	2.06E-03	2.91E-04	3.17E+00	3.68E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E-02	3.32E-01	8.48E-17	5.32E+00	1.08E-01	6.20E-01	5.71E-01	0.00E+00	0.00E+00
2002	5	31	8.32E-01	1.46E-04	4.65E-01	8.96E-06	1.01E-03	1.03E+01	3.99E+00	1.53E+01	1.22E-01	9.99E+00	2.83E-01	1.51E+00	2.05E+00	1.29E+01	1.17E+00	8.25E-01	1.46E-04	4.65E-01	8.96E-06	1.33E-04	1.03E+01	3.93E+00	1.48E+01	1.21E-01	1.78E-02	2.67E-03	6.29E-02	3.74E-02	1.28E+01	1.14E+00	7.52E-03	0.00E+00	0.00E+00	0.00E+00	8.80E-04	1.49E-07	5.17E-02	4.70E-01	1.08E-03	9.97E+00	2.80E-01	1.45E+00	2.01E+00	1.02E-01	2.38E-02
2002	6	1	5.83E+00	6.86E-01	2.89E+00	1.38E-02	1.79E-02	1.37E+01	3.43E+00	2.14E+01	3.92E+00	8.28E-01	1.80E+00	4.83E-01	4.95E-01	2.10E+01	7.21E+00	5.51E+00	2.96E-02	2.64E+00	4.96E-03	9.55E-03	1.32E+01	3.39E+00	2.10E+01	5.64E-01	1.20E-01	6.45E-02	1.59E-01	1.35E-01	2.09E+01	6.80E+00	3.20E-01	6.56E-01	2.53E-01	8.81E-03	8.34E-03	5.00E-01	3.89E-02	3.89E-01	3.36E+00	7.08E-01	1.74E+00	3.24E-01	3.59E-01	1.02E-01	4.04E-01
2002	6	2	9.40E+00	8.46E-01	3.88E+00	1.95E-02	1.64E-02	1.82E+01	2.64E+00	1.78E+01	5.57E+00	5.10E-01	1.46E+00	2.14E-01	1.54E-01	1.95E+01	1.29E+01	8.86E+00	5.58E-02	3.36E+00	1.45E-02	1.47E-02	1.75E+01	2.57E+00	1.70E+01	3.69E-01	1.33E-01	8.64E-02	1.67E-01	1.38E-01	1.91E+01	1.23E+01	5.44E-01	7.90E-01	5.20E-01	5.06E-03	1.68E-03	6.94E-01	7.73E-02	7.09E-01	5.20E+00	3.78E-01	1.37E+00	4.73E-02	1.61E-02	3.99E-01	6.43E-01
2002	6	3	9.49E+00	7.56E-01	5.33E+00	1.62E-01	2.66E-01	2.30E+01	8.53E+00	2.97E+01	5.91E+00	2.07E+01	3.62E+00	3.37E+00	6.44E+00	2.61E+01	1.36E+01	9.09E+00	5.60E-02	4.96E+00	1.60E-02	2.76E-02	2.26E+01	8.09E+00	2.89E+01	8.57E-01	2.27E-01	1.11E-01	3.42E-01	2.76E-01	2.56E+01	1.31E+01	3.99E-01	7.00E-01	3.69E-01	1.46E-01	2.39E-01	4.15E-01	4.35E-01	8.15E-01	5.06E+00	2.05E+01	3.51E+00	3.03E+00	6.16E+00	4.72E-01	5.01E-01
2002	6	4	4.44E-01	1.57E-03	6.93E-01	4.54E-03	2.87E-02	1.73E+01	3.19E+00	1.56E+01	2.70E-01	7.30E+00	2.51E-01	7.44E-01	9.84E-01	1.54E+01	1.75E+00	4.33E-01	1.56E-03	6.93E-01	8.61E-04	2.27E-03	1.73E+01	3.14E+00	1.45E+01	2.69E-01	4.65E-02	1.19E-02	1.26E-01	9.10E-02	1.53E+01	1.71E+00	1.03E-02	6.74E-06	0.00E+00	3.67E-03	2.65E-02	2.11E-06	4.89E-02	1.10E+00	6.56E-04	7.26E+00	2.39E-01	6.18E-01	8.93E-01	5.10E-02	3.82E-02
2002	6	5	1.22E-01	1.62E-03	5.47E-01	1.56E-04	9.97E-04	9.46E+00	2.45E+00	1.11E+01	2.33E-01	1.74E+00	2.07E-01	2.29E-01	7.13E-01	8.61E+00	7.47E-01	1.14E-01	1.62E-03	5.47E-01	1.56E-04	9.97E-04	9.46E+00	2.42E+00	1.06E+01	2.32E-01	4.78E-02	1.35E-02	7.66E-02	6.59E-02	8.57E+00	7.29E-01	7.84E-03	0.00E+00	1.78E-04	0.00E+00	1.37E-07	6.20E-04	2.31E-02	5.75E-01	4.23E-04	1.69E+00	1.94E-01	1.52E-01	6.47E-01	3.87E-02	1.83E-02
2002	6	6	5.02E-01	0.00E+00	3.82E-01	0.00E+00	0.00E+00	6.66E+00	2.29E+00	9.70E+00	2.06E-02	4.43E+00	5.27E-02	5.14E-01	3.68E-01	8.07E+00	9.47E-01	4.92E-01	0.00E+00	3.82E-01	0.00E+00	0.00E+00	6.66E+00	2.26E+00	9.19E+00	2.03E-02	7.19E-04	4.65E-05	6.20E-03	2.71E-03	8.06E+00	9.04E-01	1.06E-02	0.00E+00	1.38E-04	0.00E+00	0.00E+00	8.84E-04	2.15E-02	5.05E-01	2.32E-04	4.43E+00	5.27E-02	5.07E-01	3.65E-01	1.50E-02	4.33E-02
2002	6	7	1.54E+00	2.49E-05	4.33E-01	1.53E-07	2.72E-03	1.85E+01	4.96E+00	1.98E+01	4.29E-01	8.25E+00	3.13E-01	1.19E+00	7.98E-01	1.49E+01	2.04E+00	1.54E+00	2.49E-05	4.33E-01	1.53E-07	4.18E-05	1.85E+01	4.87E+00	1.85E+01	4.29E-01	5.24E-02	5.31E-03	1.76E-01	1.12E-01	1.48E+01	2.04E+00	4.69E-04	0.00E+00	7.16E-05	0.00E+00	2.68E-03	2.05E-04	8.87E-02	1.30E+00	1.62E-04	8.20E+00	3.08E-01	1.01E+00	6.86E-01	4.82E-02	5.62E-04
2002	6	8	7.14E+00	2.01E-03	4.80E+00	1.47E-04	5.11E-04	1.61E+01	3.10E+00	1.78E+01	4.20E+00	7.23E-01	5.99E-03	2.81E-01	2.72E-01	1.50E+01	8.64E+00	6.53E+00	1.96E-03	3.07E+00	1.47E-04	5.09E-04	1.48E+01	2.98E+00	1.72E+01	7.41E-02	1.57E-02	5.62E-03	3.08E-02	2.24E-02	1.45E+01	7.75E+00	6.11E-01	4.36E-05	1.72E+00	8.73E-08	1.16E-06	1.39E+00	1.21E-01	5.38E-01	4.12E+00	7.07E-01	3.68E-04	2.50E-01	2.49E-01	4.40E-01	8.86E-01
2002	6	9	7.10E+00	4.56E-11	3.76E+00	0.00E+00	5.46E-16	1.39E+01	3.97E-03	1.31E+01	4.64E+00	6.05E-05	3.45E-07	6.35E-04	2.01E-04	1.32E+01	9.68E+00	6.70E+00	0.00E+00	3.00E+00	0.00E+00	0.00E+00	1.28E+01	3.72E-03	1.30E+01	1.03E-02	5.99E-05	3.35E-07	6.23E-04	1.98E-04	1.31E+01	9.13E+00	4.03E-01	4.56E-11	7.63E-01	0.00E+00	5.46E-16	1.06E+00	2.52E-04	1.55E-01	4.63E+00	6.19E-07	9.69E-09	1.20E-05	2.80E-06	1.07E-01	5.57E-01
2002	6	10	7.29E+00	2.36E-03	4.15E+00	7.80E-04	5.43E-03	1.64E+01	4.19E+00	1.92E+01	4.91E+00	6.88E+00	8.17E-02	1.03E+00	1.24E+00	1.56E+01	1.11E+01	6.54E+00	3.25E-04	3.76E+00	8.06E-05	7.64E-04	1.56E+01	4.00E+00	1.86E+01	2.44E-01	4.68E-02	8.99E-03	1.40E-01	9.11E-02	1.52E+01	1.01E+01	7.51E-01	2.03E-03	3.88E-01	7.00E-04	4.67E-03	8.01E-01	1.91E-01	5.56E-01	4.67E+00	6.84E+00	7.27E-02	8.85E-01	1.15E+00	4.47E-01	1.04E+00
2002	6	11	2.58E+00	5.96E-01	9.86E-01	1.00E-01	1.02E-01	1.60E+01	5.28E+00	2.53E+01	5.51E-01	1.40E+01	1.96E+00	2.35E+00	3.56E+00	1.64E+01	3.65E+00	2.54E+00	1.15E-02	9.81E-01	4.51E-03	6.39E-03	1.60E+01	5.16E+00	2.43E+01	5.11E-01	7.97E-02	2.82E-02	2.05E-01	1.30E-01	1.63E+01	3.56E+00	3.66E-02	5.84E-01	4.67E-03	9.57E-02	9.53E-02	9.36E-03	1.18E-01	1.00E+00	4.00E-02	1.39E+01	1.93E+00	2.14E+00	3.43E+00	7.56E-02	8.90E-02
2002	6	12	4.78E+00	5.18E-01	1.43E+00	2.93E-03	4.21E-03	1.79E+01	3.39E+00	2.25E+01	1.62E+00	3.82E+00	2.22E+00	1.02E+00	7.28E-01	1.73E+01	6.53E+00	4.21E+00	2.93E-02	1.29E+00	3.13E-04	8.81E-04	1.77E+01	2.83E+00	2.10E+01	5.21E-01	1.10E-01	4.19E-02	2.26E-01	1.52E-01	1.67E+01	5.86E+00	5.77E-01	4.89E-01	1.44E-01	2.61E-03	3.32E-03	2.00E-01	5.58E-01	1.44E+00	1.10E+00	3.71E+00	2.18E+00	7.93E-01	5.76E-01	6.27E-01	6.67E-01
2002	6	13	7.78E+00	1.70E+00	2.82E+00	3.07E-01	5.39E-01	2.12E+01	5.33E+00	2.45E+01	1.76E+00	4.01E+00	1.12E+01	5.56E-01	1.02E+00	1.78E+01	1.13E+01	7.64E+00	8.93E-02	2.76E+00	3.67E-02	4.66E-02	2.11E+01	5.31E+00	2.40E+01	7.11E-01	2.23E-01	1.34E-01	3.04E-01	2.64E-01	1.76E+01	1.10E+01	1.48E-01	1.61E+00	6.02E-02	2.70E-01	4.92E-01	8.14E-02	2.32E-02	4.44E-01	1.05E+00	3.79E+00	1.10E+01	2.52E-01	7.51E-01	1.33E-01	2.93E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	6	14	5.26E+00	1.21E+00	2.39E+00	1.94E-01	2.97E-01	2.02E+01	9.53E+00	2.15E+01	2.03E+00	1.06E+01	3.14E+00	1.77E+00	2.80E+00	2.23E+01	6.97E+00
2002	6	15	1.01E+01	1.52E+00	5.60E+00	2.71E-01	2.89E-01	1.99E+01	7.20E+00	2.64E+01	3.64E+00	1.14E+01	5.00E+00	2.04E+00	3.66E+00	2.61E+01	1.33E+01
2002	6	16	1.34E+00	2.96E-01	5.66E-01	1.23E-01	2.11E-01	1.30E+01	5.74E+00	1.31E+01	3.00E-01	5.68E+00	2.76E+00	1.08E+00	1.71E+00	1.23E+01	1.97E+00
2002	6	17	7.65E-01	0.00E+00	2.79E-01	0.00E+00	5.32E-09	6.73E+00	1.78E+00	7.99E+00	2.50E-02	3.50E+00	1.80E-01	4.90E-01	5.47E-01	5.69E+00	1.61E+00
2002	6	18	1.29E+00	3.95E-05	3.87E-01	4.03E-04	6.34E-03	1.12E+01	4.13E+00	1.48E+01	3.47E-01	9.42E+00	2.64E-01	9.34E-01	1.71E+00	1.12E+01	2.07E+00
2002	6	19	4.30E+00	3.23E-04	1.63E+00	3.11E-06	4.04E-05	1.25E+01	3.80E+00	2.42E+01	3.75E-01	1.11E+01	3.44E-02	8.44E-01	2.05E+00	1.65E+01	6.79E+00
2002	6	20	1.88E+00	3.75E-02	1.20E+00	1.63E-01	3.46E-01	1.97E+01	8.90E+00	2.34E+01	5.76E-01	2.46E+01	2.33E+00	2.68E+00	4.28E+00	2.10E+01	3.12E+00
2002	6	21	3.41E+00	4.64E-01	1.01E+00	1.98E-01	2.79E-01	2.35E+01	8.39E+00	2.71E+01	1.07E+00	1.74E+01	3.59E+00	4.45E+00	7.17E+00	1.93E+01	5.91E+00
2002	6	22	3.83E+00	5.60E-01	2.38E+00	6.48E-02	7.59E-02	1.43E+01	5.44E+00	1.93E+01	1.35E+00	1.19E+01	8.64E-01	2.45E+00	3.52E+00	2.10E+01	4.74E+00
2002	6	23	8.81E-01	1.53E-03	1.14E+00	1.68E-03	3.66E-03	1.70E+01	4.06E+00	2.13E+01	2.01E-01	9.09E+00	3.62E-01	9.38E-01	8.78E-01	1.96E+01	1.51E+00
2002	6	24	6.33E-01	4.25E-04	6.19E-01	1.04E-05	2.04E-04	8.34E+00	2.58E+00	1.28E+01	1.26E-01	4.63E+00	1.27E-01	4.47E-01	7.01E-01	9.51E+00	1.56E+00
2002	6	25	2.10E+00	3.80E-05	6.71E-01	6.98E-04	9.96E-03	1.83E+01	3.93E+00	2.18E+01	2.03E-01	1.26E+01	2.72E-01	1.40E+00	2.43E+00	1.65E+01	2.60E+00
2002	6	26	2.41E+00	2.27E-02	6.36E-01	1.28E-01	3.27E-01	1.75E+01	5.34E+00	2.28E+01	7.40E-01	1.63E+01	1.34E+00	2.00E+00	4.22E+00	1.52E+01	3.27E+00
2002	6	27	2.13E+00	1.57E-03	5.79E-01	4.57E-04	3.26E-02	1.71E+01	4.15E+00	1.56E+01	3.67E-01	6.04E+00	6.89E-01	8.39E-01	1.00E+00	1.45E+01	3.42E+00
2002	6	28	2.04E+00	2.02E-03	1.31E+00	3.16E-04	2.99E-03	1.09E+01	4.67E+00	1.31E+01	2.89E-01	4.70E+00	5.64E-01	3.21E-01	8.30E-01	1.04E+01	4.44E+00
2002	6	29	5.52E-01	0.00E+00	4.86E-02	0.00E+00	1.96E-04	3.35E+00	1.28E+00	3.87E+00	2.60E-03	2.03E+00	2.66E-01	2.80E-01	4.41E-01	3.16E+00	8.22E-01
2002	6	30	3.50E-01	0.00E+00	4.01E-02	0.00E+00	7.18E-05	4.13E+00	1.51E+00	4.73E+00	5.02E-05	4.21E+00	2.02E-01	5.00E-01	5.25E-01	3.84E+00	1.01E+00
2002	7	1	1.86E+00	3.07E-04	8.73E-01	5.18E-05	1.34E-04	8.52E+00	3.14E+00	1.02E+01	1.30E-01	6.38E+00	6.84E-02	7.80E-01	5.64E-01	1.00E+01	3.40E+00
2002	7	2	9.01E-01	1.01E-04	3.94E-01	0.00E+00	3.00E-05	8.82E+00	2.55E+00	9.16E+00	1.92E-01	3.96E+00	1.38E-01	7.89E-01	5.76E-01	8.47E+00	1.24E+00
2002	7	3	1.68E+00	5.38E-01	7.12E-01	2.90E-01	3.62E-01	1.90E+01	6.03E+00	2.00E+01	4.23E-01	1.61E+01	3.50E+00	1.98E+00	3.63E+00	1.91E+01	3.20E+00
2002	7	4	1.42E+00	1.92E-04	4.03E-01	5.54E-06	6.77E-04	4.14E+00	1.58E+00	6.86E+00	8.62E-02	2.49E+00	2.50E-01	2.23E-01	5.13E-01	4.05E+00	1.92E+00
2002	7	5	1.95E-01	1.09E-06	3.01E-01	0.00E+00	0.00E+00	7.00E+00	2.33E+00	9.99E+00	8.50E-02	4.50E+00	1.06E-01	6.05E-01	6.39E-01	7.76E+00	2.70E-01
2002	7	6	2.86E+00	3.80E-01	1.46E+00	1.83E-01	3.51E-01	2.51E+01	8.75E+00	3.15E+01	1.23E+00	2.03E+01	2.02E+00	2.25E+00	2.43E+00	2.40E+01	4.97E+00
2002	7	7	5.54E+00	2.27E-01	2.68E+00	8.79E-02	1.35E-01	1.95E+01	5.27E+00	2.50E+01	3.34E+00	8.75E+00	1.14E+00	9.84E-01	6.72E-01	2.13E+01	6.96E+00
2002	7	8	8.94E+00	1.98E-01	3.84E+00	4.65E-02	9.15E-02	1.09E+01	1.31E+00	9.90E+00	2.53E+00	2.07E+00	1.04E+00	2.04E-01	3.50E-01	1.29E+01	1.01E+01
2002	7	9	5.00E+00	4.32E-02	1.88E+00	2.13E-02	8.93E-02	8.15E+00	9.03E-01	9.60E+00	1.29E+00	4.73E+00	1.30E+00	2.99E-01	6.61E-01	9.35E+00	5.85E+00
2002	7	10	1.42E+01	5.91E-01	5.51E+00	5.94E-03	9.07E-03	2.17E+01	3.43E+00	2.98E+01	4.99E+00	9.35E-01	1.23E+00	2.31E-01	2.67E-01	2.85E+01	1.84E+01
2002	7	11	1.78E+00	1.01E-01	6.20E-01	4.86E-02	1.66E-01	2.00E+01	3.41E+00	1.60E+01	5.24E-01	7.45E+00	1.85E+00	6.05E-01	9.26E-01	1.19E+01	2.88E+00
2002	7	12	1.49E+00	5.30E-04	3.91E-01	4.52E-05	2.27E-04	1.94E+01	5.23E+00	2.56E+01	1.75E-01	1.10E+01	6.89E-02	1.51E+00	1.97E+00	1.84E+01	1.62E+00
2002	7	13	2.38E+00	2.70E-01	7.47E-01	2.10E-01	3.73E-01	1.70E+01	3.54E+00	2.08E+01	4.40E-01	6.29E+00	3.00E+00	2.96E+00	3.38E+00	1.63E+01	3.88E+00
2002	7	14	7.55E-01	0.00E+00	2.83E-01	0.00E+00	4.72E-03	9.01E+00	2.27E+00	1.12E+01	2.70E-01	2.86E+00	2.92E-01	3.71E-01	7.18E-01	9.15E+00	1.66E+00
2002	7	15	1.48E+00	1.12E-03	1.07E+00	1.75E-04	4.95E-03	1.97E+01	4.23E+00	1.33E+01	4.06E-01	1.14E+01	4.72E-01	1.37E+00	1.29E+00	1.61E+01	2.44E+00
2002	7	16	1.05E+00	1.08E-01	8.71E-01	1.19E-01	8.90E-02	2.03E+01	4.93E+00	2.32E+01	5.82E-01	1.25E+01	9.73E-01	1.81E+00	8.77E-01	1.86E+01	2.69E+00
2002	7	17	1.94E+00	3.37E-04	8.01E-01	5.85E-05	1.58E-02	1.94E+01	5.16E+00	1.66E+01	3.55E-01	9.61E+00	3.17E-01	1.27E+00	1.08E+00	1.86E+01	3.17E+00
2002	7	18	1.68E+00	1.03E-03	6.46E-01	1.10E-04	8.01E-03	1.74E+01	4.07E+00	1.86E+01	3.62E-01	8.06E+00	2.90E-01	1.02E+00	7.97E-01	1.56E+01	2.83E+00
2002	7	19	3.12E+00	5.50E-04	9.91E-01	5.51E-04	3.34E-02	1.17E+01	4.00E+00	1.44E+01	3.26E-01	7.82E+00	4.67E-01	7.79E-01	9.82E-01	1.15E+01	4.75E+00
2002	7	20	5.43E+00	5.45E-01	3.93E+00	1.03E-01	7.08E-02	8.29E+00	3.25E+00	1.28E+01	5.06E+00	2.35E+00	1.69E-01	3.62E-01	5.48E-01	1.71E+01	6.65E+00
2002	7	21	7.99E+00	9.07E-04	4.25E+00	3.15E-07	4.69E-07	9.04E+00	9.42E-02	1.12E+01	2.91E+00	8.72E-04	5.33E-05	2.41E-03	1.67E-03	1.45E+01	9.04E+00
2002	7	22	1.47E+01	1.07E-03	7.24E+00	7.08E-05	1.79E-04	2.06E+01	5.72E-01	1.81E+01	4.04E+00	1.13E-02	3.59E-03	3.07E-02	1.73E-02	2.57E+01	1.76E+01
2002	7	23	4.11E+00	4.90E-01	1.90E+00	9.10E-02	1.63E-01	2.34E+01	8.07E+00	2.63E+01	1.04E+00	2.11E+01	2.61E+00	2.87E+00	4.64E+00	1.85E+01	5.11E+00
2002	7	24	4.21E-01	8.49E-04	8.53E-01	3.24E-05	2.26E-04	2.23E+01	3.56E+00	2.02E+01	5.25E-01	9.28E+00	4.20E-02	1.30E+00	9.02E-01	1.68E+01	7.81E-01
2002	7	25	2.03E+00	1.56E-07	1.08E+00	0.00E+00	4.72E-06	1.83E+01	4.46E+00	1.46E+01	2.53E-01	1.13E+01	1.20E-01	1.32E+00	8.66E-01	1.39E+01	2.56E+00
2002	7	26	5.92E+00	5.14E-04	2.81E+00	1.86E-05	2.43E-04	1.44E+01	5.47E+00	1.74E+01	3.29E-01	9.87E+00	8.04E-02	8.73E-01	9.83E-01	1.64E+01	8.88E+00
2002	7	27	1.42E+00	2.29E-03	9.71E-01	7.01E-05	2.64E-03	1.82E+01	4.04E+00	1.79E+01	4.50E-01	7.68E+00	2.03E-01	2.00E+00	2.50E+00	1.65E+01	2.72E+00
2002	7	28	1.21E+00	4.14E-04	1.06E+00	5.95E-05	1.39E-04	1.36E+01	3.04E+00	1.40E+01	4.42E-02	7.36E+00	5.73E-02	1.41E+00	1.97E+00	9.97E+00	1.97E+00
2002	7	29	4.38E+00	3.87E-04	2.22E+00	9.25E-06	1.72E-04	1.28E+01	5.02E+00	1.67E+01	1.51E-01	6.82E+00	1.17E-01	6.14E-01	1.45E+00	1.73E+01	6.17E+00
2002	7	30	3.34E+00	6.40E-04	2.15E+00	3.09E-05	2.25E-04	9.86E+00	3.01E+00	1.31E+01	2.97E-01	5.20E+00	1.19E-01	5.95E-01	8.27E-01	1.03E+01	3.93E+00
2002	7	31	3.05E+00	1.65E-01	1.92E+00	5.22E-02	1.41E-01	5.21E+00	5.23E-01	9.10E+00	3.01E+00	3.61E+00	6.17E-01	2.59E-01	6.79E-01	1.12E+01	3.83E+00
2002	8	1	3.34E+00	1.24E-01	1.97E+00	7.85E-03	1.36E-03	4.42E+00	2.97E-01	7.24E+00	1.42E+00	1.14E-03	2.20E-03	8.40E-04	8.81E-04	1.36E+01	4.35E+00
2002	8	2	5.26E+00	3.31E-01	2.23E+00	3.07E-01	2.61E-01	6.08E+00	5.84E-01	8.16E+00	4.85E+00	1.40E+00	1.55E+00	1.02E-01	2.10E-01	1.32E+01	6.44E+00
2002	8	3	2.55E+00	1.11E-02	1.73E+00	5.32E-04	1.18E-04	4.08E+00	2.17E+00	8.41E+00	1.82E+00	3.95E-03	9.73E-04	1.42E-02	6.87E-03	1.24E+01	3.27E+00
2002	8	4	1.02E+01	9.81E-01	4.20E+00	5.54E-02	6.48E-02	1.23E+01	2.45E+00	1.72E+01	3.78E+00	7.70E-01	1.86E+00	7.56E-02	1.06E-01	1.83E+01	1.23E+01
2002	8	5	2.54E+00	4.01E-01	1.03E+00	3.41E-01	5.46E-01	1.71E+01	9.15E+00	2.17E+01	8.51E-01	1.06E+01	4.82E+00	8.90E-01	1.45E+00	1.77E+01	4.12E+00
2002	8	6	3.69E+00	5.98E-02	1.39E+00	2.25E-01	5.62E-01	1.93E+01	7.08E+00	2.18E+01	9.34E-01	1.15E+01	5.14E+00	1.54E+00	2.09E+00	1.69E+01	5.12E+00
2002	8	7	6.76E+00	1.17E-01	4.24E+00	9.88E-02	1.69E-01	2.48E+01	5.23E+00	2.39E+01	2.65E+00	1.82E+01	5.94E-01	1.62E+00	2.42E+00	1.92E+01	8.04E+00
2002	8	8	8.72E+00	1.14E+00	3.72E+00	1.72E-01	3.97E-01	2.56E+01	8.88E+00	2.78E+01	4.26E+00	1.40E+01	7.76E+00	2.02E+00	3.25E+00	2.67E+01	1.14E+01
2002	8	9	7.41E-01	2.87E-04	3.06E-01	2.50E-05	1.12E-04	1.26E+01	2.29E+00	1.70E+01	5.79E-02	7.49E+00	2.95E-02	1.68E+00	3.06E+00	9.36E+00	9.46E-01
2002	8	10	4.50E+00	2.87E-01	2.08E+00	6.83E-02	1.69E-01	1.89E+01	8.14E+00	2.35E+01	1.72E+00	1.98E+01	1.17E+00	3.57E+00	7.03E+00	2.91E+01	6.52E+00
2002	8	11	8.59E+00	5.75E-01	4.52E+00	1.35E-02	1.63E-02	1.09E+01	4.77E+00	1.77E+01	6.89E+00	1.03E+00	2.45E+00	1.88E-01	2.00E-01	1.89E+01	1.03E+01
2002	8	12	7.02E+00	8.13E-01	3.66E+00	1.49E-01	2.75E-01	2.76E+01	1.08E+01	2.86E+01	2.66E+00	1.38E+01	6.28E+00	1.55E+00	3.28E+00	2.99E+01	9.30E+00
2002	8	13	2.02E+00	2.24E-01	9.87E-01	4.08E-02	8.60E-02	1.14E+01	6.02E+00	1.87E+01	7.15E-01	1.25E+01	8.16E-01	3.08E+00	2.61E+00	1.48E+01	2.82E+00
2002	8	14	6.65E+00	1.29E-02	3.45E+00	2.54E-03	5.94E-03	9.08E+00	3.34E+00	1.83E+01	4.11E+00	1.22E+01	1.69E-01	2.17E+00	4.04E+00	1.83E+01	8.69E+00
2002	8	15	7.77E+00	1.32E+00	4.18E+00	3.59E-01	6.02E-01	1.45E+01	5.04E+00	1.44E+01	2.52E+00	9.50E+00	4.60E+00	8.99E-01	1.71E+00	1.78E+01	1.07E+01
2002	8	16	9.17E+00	4.86E-01	5.21E+00	1.45E-02	2.36E-02	1.46E+01	2.40E+00	1.64E+01	6.12E+00	7.37E+00	4.01E+00	9.41E-01	2.35E+00	2.02E+01	1.20E+01
2002	8	17	5.05E+00	1.66E-01	1.79E+00	1.63E-01	3.24E-01	2.22E+01	7.36E+00	1.95E+01	8.28E-01	1.56E+01	1.92E+00	1.23E+00	1.98E+00	2.10E+01	6.88E+00
2002	8	18	6.16E+00	4.57E-02	2.67E+00	8.95E-03	2.70E-02	1.74E+01	2.80E+00	1.79E+01	3.00E+00	6.79E+00	3.75E-01	7.71E-01	1.95E+00	1.78E+01	7.93E+00
2002	8	19	1.46E+00	1.82E-03	7.71E-01	1.12E-03	5.12E-02	1.98E+01	6.28E+00	2.53E+01	1.69E-01	1.38E+01	1.12E+00	1.79E+00	1.82E+00	2.09E+01	2.95E+00
2002	8	20	1.44E+01	1.86E-02	6.80E+00	2.97E-04	8.40E-04	2.09E+01	8.95E-01	2.50E+01	6.85E+00	1.09E-01	1.80E-02	1.11E-01	7.23E-02	2.58E+01	1.77E+01
2002	8	21	4.98E+00	2.02E+00	2.68E+00	2.11E-01	3.83E-01	1.77E+01	4.63E+00	2.06E+01	1.65E+00	6.19E+00	3.18E+00	8.59E-01	7.47E-01	2.09E+01	6.69E+00
2002	8	22	2.06E+00	2.77E-01	8.71E-01	6.12E-02	9.26E-02	2.51E+01	5.60E+00	2.49E+01	5.61E-01	1.39E+01	1.20E+00	1.64E+00	1.63E+00	2.73E+01	3.01E+00
2002	8	23	4.12E+00	7.36E-01	1.35E+00	8.81E-02	5.22E-02	1.98E+01	4.27E+00	2.42E+01	8.68E-01	8.63E+00	2.87E+00	1.54E+00	2.08E+00	1.96E+01	5.36E+00
2002	8	24	2.07E+00	5.00E-01	8.89E-01	4.04E-02	1.02E-01	2.30E+01	5.95E+00	2.52E+01	6.92E-01	1.04E+01	8.05E-01	1.49E+00	1.93E+00	2.33E+01	3.39E+00
2002	8	25	1.86E+00	1.62E-01	6.96E-01	4.97E-02	9.67E-02	2.03E+01	6.00E+00	2.61E+01	8.19E-01	1.77E+01	8.17E-01	2.87E+00	3.96E+00	2.47E+01	2.59E+00
2002	8	26	8.47E+00	1.06E-01	2.82E+00	8.03E-03	1.39E-02	2.36E+01	7.64E+00	2.91E+01	5.20E+00	6.80E+00	3.18E-01	2.36E+00	2.63E+00	2.81E+01	1.09E+01
2002	8	27	1.34E+01	3.90E-01	6.19E+00	1.78E-03	4.14E-03	1.88E+01	2.14E+00	2.26E+01	4.68E+00	3.56E-01	1.06E+00	2.55E-01	1.83E-01	2.01E+01	1.66E+01
2002	8	28	6.11E+00	9.69E-01	3.19E+00	1.27E-01	2.44E-01	2.67E+01	1.47E+01	3.33E+01	2.49E+00	2.00E+01	3.64E+00	3.41E+00	4.61E+00	3.18E+01	9.31E+00
2002	8	29	3.41E+00	7.17E-02	1.20E+00	1.39E-01	2.79E-01	2.19E+01	5.25E+00	2.72E+01	4.96E-01	1.24E+01	2.28E+00	1.18E+00	1.93E+00	2.06E+01	5.02E+00
2002	8	30	4.71E+00	8.61E-03	4.18E+00	2.84E-04	2.31E-03	2.52E+01	6.41E+00	2.34E+01	2.53E+00	1.71E+01	3.89E-01	2.43E+00	2.90E+00	2.40E+01	5.88E+00
2002	8	31	4.94E+00	5.53E-01	3.28E+00	1.73E-01	2.95E-01	1.65E+01	1.07E+01	2.39E+01	2.81E+00	1.79E+01	2.89E+00	2.60E+00	3.63E+00	1.93E+01	7.83E+00
2002	9	1	3.91E-01	0.00E+00	7.07E-02	0.00E+00	0.00E+00	3.92E+00	1.89E+00	5.04E+00	8.52E-03	4.10E+00	8.84E-02	4.16E-01	5.06E-01	3.52E+00	7.40E-01
2002	9	2	6.46E-01	8.94E-04	9.12E-01	7.88E-05	5.33E-04	1.76E+01	5.63E+00	1.44E+01	2.52E-01	8.81E+00	2.03E-01	1.05E+00	7.61E-01	1.59E+01	2.47E+00
2002	9	3	2.07E+00	1.21E-05	5.85E-01	3.13E-07	2.03E-02	1.52E+01	4.50E+00	1.35E+01	1.91E-01	4.36E+00	5.33E-01	6.90E-01	6.41E-01	1.19E+01	3.72E+00

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	6	14	5.13E+00	7.85E-02	2.34E+00	2.81E-02	4.06E-02	2.01E+01	9.42E+00	2.07E+01	6.25E-01	1.98E-01	1.18E-01	3.34E-01	2.55E-01	2.20E+01	6.72E+00
2002	6	15	9.64E+00	1.27E-02	5.36E+00	2.68E-03	5.67E-03	1.96E+01	7.00E+00	2.56E+01	2.81E-01	5.99E-02	2.59E-02	1.45E-01	9.33E-02	2.59E+01	1.27E+01
2002	6	16	1.34E+00	9.88E-03	5.62E-01	3.80E-03	7.59E-03	1.30E+01	5.68E+00	1.22E+01	2.67E-01	6.13E-02	2.14E-02	2.11E-01	1.18E-01	1.23E+01	1.97E+00
2002	6	17	7.59E-01	0.00E+00	2.79E-01	0.00E+00	0.00E+00	6.73E+00	1.77E+00	7.41E+00	2.50E-02	1.38E-03	1.98E-05	2.95E-02	8.08E-03	5.68E+00	1.58E+00
2002	6	18	1.27E+00	3.91E-05	3.87E-01	5.64E-05	3.03E-04	1.12E+01	4.11E+00	1.40E+01	3.29E-01	3.68E-02	5.85E-03	8.87E-02	6.84E-02	1.11E+01	2.01E+00
2002	6	19	4.23E+00	1.82E-04	1.62E+00	0.00E+00	1.73E-05	1.25E+01	3.79E+00	2.39E+01	3.54E-01	3.10E-02	3.57E-03	1.03E-01	6.23E-02	1.64E+01	6.58E+00
2002	6	20	1.84E+00	1.35E-03	1.20E+00	2.35E-03	4.47E-03	1.97E+01	8.74E+00	2.23E+01	2.99E-01	3.51E-02	8.46E-03	1.76E-01	8.40E-02	2.08E+01	3.02E+00
2002	6	21	3.32E+00	3.28E-02	9.78E-01	8.95E-03	1.71E-02	2.35E+01	8.17E+00	2.59E+01	6.87E-01	1.77E-01	7.27E-02	3.39E-01	2.45E-01	1.91E+01	5.80E+00
2002	6	22	3.71E+00	2.98E-02	2.36E+00	7.48E-03	1.12E-02	1.43E+01	5.32E+00	1.84E+01	4.15E-01	1.02E-01	4.71E-02	1.97E-01	1.48E-01	2.09E+01	4.46E+00
2002	6	23	8.71E-01	1.53E-03	1.14E+00	1.67E-03	2.69E-03	1.70E+01	4.00E+00	2.03E+01	2.01E-01	3.29E-02	5.80E-03	7.28E-02	5.81E-02	1.95E+01	1.47E+00
2002	6	24	6.07E-01	3.87E-04	6.18E-01	3.97E-06	1.85E-04	8.34E+00	2.55E+00	1.23E+01	1.25E-01	2.65E-02	6.65E-03	3.89E-02	3.39E-02	9.46E+00	1.50E+00
2002	6	25	2.09E+00	3.77E-05	6.71E-01	4.69E-08	3.84E-05	1.83E+01	3.85E+00	2.06E+01	1.95E-01	2.15E-02	2.26E-03	1.28E-01	6.65E-02	1.64E+01	2.57E+00
2002	6	26	2.37E+00	9.09E-04	6.33E-01	1.30E-03	3.64E-03	1.75E+01	5.22E+00	2.13E+01	5.26E-01	7.97E-02	1.51E-02	2.36E-01	1.53E-01	1.51E+01	3.18E+00
2002	6	27	2.13E+00	1.57E-03	5.79E-01	4.48E-04	2.10E-03	1.71E+01	4.09E+00	1.43E+01	3.67E-01	7.28E-02	1.80E-02	2.00E-01	1.34E-01	1.44E+01	3.42E+00
2002	6	28	2.00E+00	1.97E-03	1.31E+00	3.08E-04	1.81E-03	1.09E+01	4.64E+00	1.27E+01	2.41E-01	3.86E-02	1.26E-02	9.45E-02	6.84E-02	1.04E+01	4.37E+00
2002	6	29	5.52E-01	0.00E+00	4.86E-02	0.00E+00	1.88E-06	3.35E+00	1.28E+00	3.67E+00	2.60E-03	9.73E-04	1.57E-04	3.43E-03	1.00E-03	3.14E+00	8.22E-01
2002	6	30	3.50E-01	0.00E+00	4.01E-02	0.00E+00	0.00E+00	4.13E+00	1.49E+00	4.49E+00	5.02E-05	1.08E-06	0.00E+00	6.09E-03	1.27E-04	3.79E+00	1.01E+00
2002	7	1	1.80E+00	1.99E-04	8.70E-01	4.75E-05	1.13E-04	8.51E+00	3.12E+00	9.95E+00	1.24E-01	2.45E-02	4.14E-03	4.25E-02	3.64E-02	9.98E+00	3.26E+00
2002	7	2	8.97E-01	1.01E-04	3.94E-01	0.00E+00	1.84E-05	8.82E+00	2.52E+00	8.32E+00	1.91E-01	2.30E-02	3.26E-03	6.59E-02	4.64E-02	8.46E+00	1.23E+00
2002	7	3	1.65E+00	2.05E-02	7.10E-01	1.43E-02	2.08E-02	1.90E+01	5.97E+00	1.89E+01	2.74E-01	7.60E-02	3.81E-02	1.98E-01	1.23E-01	1.90E+01	3.14E+00
2002	7	4	1.35E+00	1.91E-04	4.01E-01	5.54E-06	1.27E-04	4.14E+00	1.58E+00	6.72E+00	4.54E-02	1.17E-02	3.05E-03	1.67E-02	1.15E-02	4.04E+00	1.83E+00
2002	7	5	1.95E-01	1.09E-06	3.01E-01	0.00E+00	0.00E+00	7.00E+00	2.30E+00	9.51E+00	8.50E-02	1.14E-02	1.74E-03	3.83E-02	2.15E-02	7.75E+00	2.67E-01
2002	7	6	2.73E+00	2.24E-02	1.42E+00	8.80E-03	1.62E-02	2.50E+01	8.65E+00	3.00E+01	5.45E-01	1.24E-01	5.71E-02	2.56E-01	1.77E-01	2.38E+01	4.67E+00
2002	7	7	5.45E+00	9.71E-03	2.56E+00	2.94E-03	4.05E-03	1.94E+01	5.21E+00	2.42E+01	3.97E-01	6.20E-02	1.98E-02	1.63E-01	1.02E-01	2.12E+01	6.74E+00
2002	7	8	8.81E+00	1.28E-02	3.76E+00	3.92E-03	5.16E-03	1.08E+01	1.30E+00	9.70E+00	1.63E-01	2.60E-02	1.53E-02	3.77E-02	2.81E-02	1.28E+01	9.88E+00
2002	7	9	4.86E+00	5.29E-03	1.86E+00	1.80E-03	2.92E-03	8.14E+00	8.85E-01	9.31E+00	5.26E-02	1.00E-02	8.51E-03	1.43E-02	1.14E-02	9.32E+00	5.59E+00
2002	7	10	1.39E+01	2.55E-02	5.36E+00	2.76E-03	5.89E-03	2.15E+01	3.42E+00	2.96E+01	6.05E-01	1.07E-01	4.80E-02	1.80E-01	1.37E-01	2.84E+01	1.78E+01
2002	7	11	1.78E+00	1.03E-02	6.19E-01	4.33E-03	1.02E-02	2.00E+01	3.38E+00	1.47E+01	5.20E-01	1.21E-01	4.31E-02	2.56E-01	1.83E-01	1.18E+01	2.87E+00
2002	7	12	1.49E+00	5.30E-04	3.91E-01	4.52E-05	2.27E-04	1.94E+01	5.13E+00	2.43E+01	1.75E-01	2.30E-02	4.10E-03	1.26E-01	6.04E-02	1.83E+01	1.62E+00
2002	7	13	2.30E+00	1.14E-02	7.46E-01	5.63E-03	7.46E-03	1.70E+01	3.15E+00	1.97E+01	3.13E-01	5.45E-02	1.50E-02	1.93E-01	1.18E-01	1.61E+01	3.76E+00
2002	7	14	7.55E-01	0.00E+00	2.83E-01	0.00E+00	1.40E-05	9.01E+00	2.24E+00	1.04E+01	2.70E-01	3.42E-02	2.95E-03	9.11E-02	7.77E-02	9.13E+00	1.66E+00
2002	7	15	1.39E+00	1.12E-03	1.07E+00	1.75E-04	5.53E-04	1.97E+01	4.17E+00	1.21E+01	4.06E-01	3.89E-02	5.73E-03	1.55E-01	9.37E-02	1.60E+01	2.25E+00
2002	7	16	1.04E+00	7.58E-03	8.71E-01	2.47E-03	2.34E-03	2.03E+01	4.84E+00	2.17E+01	5.75E-01	6.85E-02	1.17E-02	1.97E-01	1.25E-01	1.85E+01	2.65E+00
2002	7	17	1.94E+00	3.37E-04	8.01E-01	1.97E-05	1.97E-04	1.94E+01	5.07E+00	1.54E+01	3.55E-01	4.79E-02	6.84E-03	1.77E-01	1.03E-01	1.85E+01	3.17E+00
2002	7	18	1.67E+00	1.03E-03	6.46E-01	1.10E-04	6.13E-04	1.74E+01	4.00E+00	1.76E+01	3.62E-01	4.75E-02	9.74E-03	1.48E-01	9.36E-02	1.56E+01	2.82E+00
2002	7	19	3.10E+00	5.49E-04	9.91E-01	2.39E-05	8.05E-04	1.17E+01	3.98E+00	1.38E+01	3.18E-01	5.51E-02	1.08E-02	1.20E-01	9.54E-02	1.15E+01	4.70E+00
2002	7	20	5.36E+00	1.29E-02	3.57E+00	6.52E-03	5.48E-03	8.02E+00	3.23E+00	1.28E+01	2.73E-02	6.49E-03	7.20E-03	9.47E-03	7.00E-03	1.70E+01	6.52E+00
2002	7	21	7.84E+00	2.36E-05	4.00E+00	0.00E+00	0.00E+00	8.86E+00	9.39E-02	1.12E+01	3.70E-02	8.60E-04	5.14E-05	2.31E-03	1.61E-03	1.45E+01	8.74E+00
2002	7	22	1.41E+01	1.04E-03	7.18E+00	7.08E-05	1.79E-04	2.05E+01	5.72E-01	1.80E+01	1.42E-01	1.02E-02	2.97E-03	3.03E-02	1.68E-02	2.56E+01	1.66E+01
2002	7	23	3.98E+00	4.60E-02	1.87E+00	1.41E-02	2.41E-02	2.34E+01	7.87E+00	2.47E+01	4.91E-01	1.58E-01	8.61E-02	2.80E-01	1.98E-01	1.83E+01	4.93E+00
2002	7	24	4.20E-01	8.49E-04	8.53E-01	3.24E-05	2.26E-04	2.23E+01	3.50E+00	1.88E+01	5.25E-01	4.55E-02	5.75E-03	1.53E-01	9.68E-02	1.67E+01	7.76E-01
2002	7	25	1.99E+00	1.56E-07	1.08E+00	0.00E+00	4.72E-06	1.83E+01	4.39E+00	1.35E+01	2.53E-01	3.01E-02	2.52E-03	1.39E-01	7.23E-02	1.38E+01	2.45E+00
2002	7	26	5.79E+00	4.14E-04	2.79E+00	6.04E-06	1.94E-04	1.44E+01	5.45E+00	1.71E+01	2.94E-01	4.71E-02	6.85E-03	1.24E-01	8.33E-02	1.64E+01	8.56E+00
2002	7	27	1.27E+00	6.91E-05	9.60E-01	1.94E-05	7.56E-05	1.82E+01	3.52E+00	1.68E+01	8.99E-02	2.84E-03	5.27E-04	4.12E-02	1.15E-02	1.62E+01	2.47E+00
2002	7	28	1.14E+00	4.12E-04	1.06E+00	5.95E-05	1.39E-04	1.35E+01	2.99E+00	1.34E+01	4.35E-02	4.14E-03	1.05E-03	2.05E-02	9.48E-03	9.92E+00	1.81E+00
2002	7	29	4.25E+00	2.64E-04	2.20E+00	9.72E-07	4.60E-05	1.27E+01	5.01E+00	1.63E+01	1.37E-01	1.83E-02	3.33E-03	4.89E-02	3.17E-02	1.72E+01	5.85E+00
2002	7	30	3.20E+00	6.08E-04	2.12E+00	3.09E-05	2.19E-04	9.83E+00	2.98E+00	1.27E+01	1.55E-01	2.35E-02	4.92E-03	8.08E-02	4.63E-02	1.02E+01	3.70E+00
2002	7	31	2.97E+00	3.73E-03	1.48E+00	1.15E-03	3.20E-03	4.93E+00	5.03E-01	9.06E+00	3.09E-02	1.90E-02	1.09E-02	2.56E-02	2.22E-02	1.12E+01	3.68E+00
2002	8	1	3.34E+00	6.64E-03	1.89E+00	1.11E-03	6.80E-04	4.38E+00	2.97E-01	7.24E+00	5.59E-03	3.06E-04	1.33E-03	4.20E-05	6.81E-05	1.36E+01	4.34E+00
2002	8	2	5.15E+00	1.78E-02	2.02E+00	1.10E-02	1.14E-02	5.84E+00	5.63E-01	8.11E+00	4.69E-02	2.20E-02	2.07E-02	2.33E-02	2.05E-02	1.31E+01	6.31E+00
2002	8	3	2.51E+00	6.39E-04	1.47E+00	6.28E-05	1.61E-05	3.88E+00	2.15E+00	8.38E+00	3.03E-02	4.15E-04	3.21E-05	5.65E-03	1.28E-03	1.23E+01	3.23E+00
2002	8	4	9.87E+00	2.08E-02	4.16E+00	9.56E-04	2.11E-03	1.22E+01	2.45E+00	1.72E+01	1.96E-01	3.43E-02	2.15E-02	5.62E-02	3.94E-02	1.83E+01	1.17E+01
2002	8	5	2.46E+00	2.75E-02	1.02E+00	1.26E-02	1.91E-02	1.71E+01	9.12E+00	2.09E+01	3.40E-01	1.07E-01	4.95E-02	2.97E-01	1.65E-01	1.77E+01	3.91E+00
2002	8	6	3.57E+00	1.83E-02	1.36E+00	1.19E-02	1.88E-02	1.92E+01	7.00E+00	2.09E+01	6.53E-01	1.36E-01	5.75E-02	2.33E-01	1.82E-01	1.68E+01	4.91E+00
2002	8	7	6.55E+00	5.34E-03	4.12E+00	5.22E-03	7.42E-03	2.47E+01	5.14E+00	2.27E+01	4.37E-01	7.06E-02	1.91E-02	1.60E-01	1.11E-01	1.90E+01	7.68E+00
2002	8	8	8.38E+00	4.29E-02	3.58E+00	9.57E-03	1.86E-02	2.54E+01	8.73E+00	2.71E+01	7.77E-01	2.07E-01	9.68E-02	3.82E-01	2.81E-01	2.65E+01	1.08E+01
2002	8	9	7.31E-01	2.81E-04	3.06E-01	2.41E-05	1.09E-04	1.26E+01	2.25E+00	1.63E+01	5.76E-02	7.10E-03	1.56E-03	2.70E-02	1.49E-02	9.29E+00	9.19E-01
2002	8	10	4.21E+00	1.35E-02	1.98E+00	5.24E-03	1.02E-02	1.87E+01	7.75E+00	2.20E+01	2.92E-01	6.44E-02	3.17E-02	1.50E-01	9.40E-02	2.88E+01	6.14E+00
2002	8	11	8.57E+00	1.98E-02	3.68E+00	3.19E-03	5.97E-03	1.05E+01	4.77E+00	1.74E+01	2.66E-01	7.01E-02	3.39E-02	1.59E-01	1.04E-01	1.89E+01	1.03E+01
2002	8	12	6.68E+00	5.83E-02	3.50E+00	2.40E-02	3.51E-02	2.74E+01	1.07E+01	2.76E+01	7.17E-01	2.19E-01	1.11E-01	3.78E-01	2.88E-01	2.98E+01	8.77E+00
2002	8	13	1.65E+00	2.40E-02	9.70E-01	8.68E-03	1.57E-02	1.14E+01	5.01E+00	1.72E+01	2.81E-01	9.29E-02	4.98E-02	1.87E-01	1.27E-01	1.41E+01	2.24E+00
2002	8	14	6.42E+00	1.06E-03	3.15E+00	1.98E-04	5.07E-04	8.64E+00	3.19E+00	1.82E+01	9.06E-02	1.22E-02	3.60E-03	4.55E-02	2.56E-02	1.82E+01	8.30E+00
2002	8	15	7.73E+00	3.12E-02	4.06E+00	1.14E-02	1.98E-02	1.44E+01	5.02E+00	1.41E+01	3.47E-01	8.76E-02	5.01E-02	1.62E-01	1.18E-01	1.77E+01	1.06E+01
2002	8	16	8.87E+00	4.64E-03	4.33E+00	1.13E-04	9.54E-04	1.36E+01	2.31E+00	1.62E+01	1.60E-01	3.39E-02	1.23E-02	7.67E-02	4.89E-02	2.01E+01	1.15E+01
2002	8	17	4.96E+00	4.01E-02	1.78E+00	1.24E-02	2.39E-02	2.22E+01	7.31E+00	1.86E+01	5.54E-01	1.69E-01	8.75E-02	2.86E-01	2.21E-01	2.09E+01	6.73E+00
2002	8	18	5.32E+00	3.01E-03	2.57E+00	2.81E-04	9.99E-04	1.71E+01	2.56E+00	1.63E+01	3.47E-01	6.04E-02	1.49E-02	1.36E-01	1.02E-01	1.70E+01	6.94E+00
2002	8	19	1.46E+00	1.76E-03	7.71E-01	9.68E-04	2.06E-03	1.98E+01	6.19E+00	2.38E+01	1.67E-01	1.57E-02	2.98E-03	1.53E-01	5.74E-02	2.08E+01	2.95E+00
2002	8	20	1.42E+01	6.42E-03	5.99E+00	2.89E-04	8.35E-04	1.96E+01	8.74E-01	2.48E+01	3.76E-01	3.99E-02	1.44E-02	7.70E-02	5.47E-02	2.57E+01	1.73E+01
2002	8	21	4.88E+00	4.44E-02	2.65E+00	1.38E-02	2.58E-02	1.77E+01	4.59E+00	1.97E+01	5.74E-01	1.67E-01	7.62E-02	3.16E-01	2.32E-01	2.08E+01	6.43E+00
2002	8	22	2.05E+00	4.36E-03	8.69E-01	2.43E-03	4.27E-03	2.51E+01	5.51E+00	2.29E+01	5.24E-01	8.19E-02	1.56E-02	2.98E-01	1.85E-01	2.72E+01	3.00E+00
2002	8	23	4.05E+00	3.39E-02	1.33E+00	7.65E-03	9.62E-03	1.98E+01	4.18E+00	2.31E+01	5.65E-01	1.67E-01	7.07E-02	3.00E-01	2.24E-01	1.95E+01	5.21E+00
2002	8	24	2.05E+00	7.53E-03	8.73E-01	4.99E-03	7.32E-03	2.30E+01	5.84E+00	2.33E+01	4.94E-01	1.03E-01	3.43E-02	2.54E-01	1.76E-01	2.32E+01	3.36E+00
2002	8	25	1.76E+00	3.21E-03	6.29E-01	1.07E-03	2.37E-03	2.02E+01	5.73E+00	2.45E+01	3.35E-01	5.17E-02	1.39E-02	1.66E-01	1.01E-01	2.45E+01	2.45E+00
2002	8	26	6.77E+00	6.18E-03	2.43E+00	9.03E-04	1.93E-03	2.31E+01	6.72E+00	2.68E+01	3.37E-01	5.48E-02	1.54E-02	1.57E-01	9.87E-02	2.67E+01	9.05E+00
2002	8	27	1.25E+01	3.16E-02	6.09E+00	1.76E-03	4.07E-03	1.87E+01	2.13E+00	2.23E+01	5.64E-01	1.34E-01	5.76E-02	2.50E-01	1.79E-01	1.99E+01	1.55E+01
2002	8	28	5.89E+00	9.39E-02	3.07E+00	2.63E-02	4.31E-02	2.65E+01	1.45E+01	3.20E+01	1.09E+00	3.28E-01	1.69E-01	5.93E-01	4.27E-01	3.16E+01	8.87E+00
2002	8	29	3.34E+00	5.18E-03	1.19E+00	3.10E-03	7.27E-03	2.18E+01	5.19E+00	2.58E+01	4.87E-01	1.05E-01	2.88E-02	2.04E-01	1.60E-01	2.04E+01	4.81E+00
2002	8	30	4.53E+00	1.48E-03	4.14E+00	7.60E-05	2.76E-04	2.51E+01	6.23E+00	2.23E+01	3.18E-01	4.16E-02	8.79E-03	1.25E-01	7.62E-02	2.38E+01	5.58E+00
2002	8	31	4.55E+00	8.05E-02	3.03E+00	2.70E-02	4.27E-02	1.62E+01	1.04E+01	2.29E+01	7.33E-01	2.48E-01	1.36E-01	4.37E-01	3.27E-01	1.89E+01	7.24E+00
2002	9	1	3.91E-01	0.00E+00	7.07E-02	0.00E+00	0.00E+00	3.92E+00	1.87E+00	4.80E+00	8.52E-03	5.70E-04	0.00E+00	2.22E-02	6.76E-03	3.52E+00	7.40E-01
2002	9	2	6.06E-01	8.94E-04	9.12E-01	7.88E-05	5.33E-04	1.76E+01	5.57E+00	1.34E+01	2.50E-01	3.60E-02	8.71E-03	1.17E-01	6.59E-02	1.59E+01	2.36E+00
2002	9	3	2.06E+00	1.21E-05	5.84E-01	3.13E-07	1.19E-04	1.52E+01	4.46E+00	1.25E+01	1.91E-01	2.19E-02	1.97E-03	5.80E-02	5.10E-02	1.18E+01	3.67E+00

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	6	14	1.26E-01	1.13E+00	5.23E-02	1.66E-01	2.56E-01	6.46E-02	1.13E-01	8.38E-01	1.41E+00	1.04E+01	3.02E+00	1.43E+00	2.54E+00	2.54E-01	2.58E-01
2002	6	15	4.06E-01	1.50E+00	2.42E-01	2.68E-01	2.84E-01	2.33E-01	1.99E-01	7.50E-01	3.36E+00	1.13E+01	4.98E+00	1.89E+00	3.57E+00	2.42E-01	6.61E-01
2002	6	16	5.83E-03	2.86E-01	4.12E-03	1.19E-01	2.03E-01	5.85E-03	6.23E-02	9.01E-01	3.29E-02	5.62E+00	2.74E+00	8.72E-01	1.59E+00	6.09E-02	8.83E-03
2002	6	17	6.65E-03	0.00E+00	0.00E+00	0.00E+00	5.32E-09	0.00E+00	1.55E-02	5.83E-01	4.87E-22	3.50E+00	1.80E-01	4.60E-01	5.39E-01	1.10E-02	3.31E-02
2002	6	18	1.48E-02	3.41E-07	2.07E-04	3.47E-04	6.04E-03	8.43E-04	2.50E-02	7.11E-01	1.84E-02	9.39E+00	2.58E-01	8.45E-01	1.64E+00	8.66E-02	5.34E-02
2002	6	19	6.80E-02	1.40E-04	7.57E-03	3.11E-06	2.31E-05	3.10E-02	1.39E-02	3.48E-01	2.07E-02	1.11E+01	3.08E-02	7.41E-01	1.98E+00	3.76E-02	2.07E-01
2002	6	20	4.81E-02	3.61E-02	1.64E-03	1.61E-01	3.41E-01	5.56E-03	1.59E-01	1.14E+00	2.77E-01	2.46E+01	2.32E+00	2.50E+00	4.20E+00	1.51E-01	9.96E-02
2002	6	21	8.80E-02	4.31E-01	3.03E-02	1.89E-01	2.62E-01	4.89E-02	2.22E-01	1.13E+00	3.80E-01	1.72E+01	3.52E+00	4.11E+00	6.93E+00	1.96E-01	1.14E-01
2002	6	22	1.19E-01	5.30E-01	2.37E-02	5.73E-02	6.48E-02	4.10E-02	1.16E-01	9.56E-01	9.40E-01	1.18E+01	8.17E-01	2.26E+00	3.37E+00	9.55E-02	2.78E-01
2002	6	23	9.44E-03	2.97E-07	0.00E+00	1.01E-05	9.69E-04	0.00E+00	5.78E-02	1.06E+00	5.29E-09	9.06E+00	3.56E-01	8.65E-01	8.20E-01	9.11E-02	4.04E-02
2002	6	24	2.55E-02	3.77E-05	3.88E-04	6.43E-06	1.90E-05	1.06E-03	3.02E-02	4.29E-01	8.80E-04	4.61E+00	1.20E-01	4.08E-01	6.68E-01	4.26E-02	6.01E-02
2002	6	25	9.12E-03	3.34E-07	1.39E-09	6.98E-04	9.92E-03	4.63E-06	7.46E-02	1.22E+00	7.92E-03	1.25E+01	2.70E-01	1.27E+00	2.36E+00	9.58E-02	2.45E-02
2002	6	26	4.39E-02	2.18E-02	2.31E-03	1.27E-01	3.23E-01	7.28E-03	1.18E-01	1.42E+00	2.15E-01	1.62E+01	1.32E+00	1.77E+00	4.07E+00	1.10E-01	8.48E-02
2002	6	27	2.15E-04	0.00E+00	0.00E+00	8.66E-06	3.05E-02	0.00E+00	5.61E-02	1.34E+00	1.19E-04	5.97E+00	6.71E-01	6.38E-01	8.68E-01	5.17E-02	2.55E-03
2002	6	28	3.37E-02	4.93E-05	4.19E-03	7.50E-06	1.18E-03	1.52E-02	2.38E-02	4.00E-01	4.82E-02	4.66E+00	5.51E-01	2.27E-01	7.62E-01	3.75E-02	6.99E-02
2002	6	29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-04	0.00E+00	4.05E-03	1.96E-01	3.71E-25	2.03E+00	2.66E-01	2.76E-01	4.40E-01	1.65E-02	0.00E+00
2002	6	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-05	0.00E+00	1.71E-02	2.42E-01	7.69E-23	4.21E+00	2.02E-01	4.93E-01	5.25E-01	5.71E-02	0.00E+00
2002	7	1	5.66E-02	1.09E-04	3.23E-03	4.23E-06	2.15E-05	1.22E-02	2.16E-02	2.69E-01	5.60E-03	6.36E+00	6.43E-02	7.38E-01	5.28E-01	3.32E-02	1.40E-01
2002	7	2	3.57E-03	0.00E+00	0.00E+00	0.00E+00	1.15E-05	1.32E-04	3.82E-02	8.36E-01	1.06E-03	3.93E+00	1.35E-01	7.23E-01	5.30E-01	1.43E-02	7.67E-03
2002	7	3	2.49E-02	5.18E-01	1.63E-03	2.75E-01	3.41E-01	3.85E-03	5.36E-02	1.04E+00	1.49E-01	1.60E+01	3.46E+00	1.78E+00	3.51E+00	7.91E-02	5.80E-02
2002	7	4	6.79E-02	6.44E-07	2.09E-03	0.00E+00	5.49E-04	5.59E-03	3.81E-03	1.41E-01	4.08E-02	2.48E+00	2.47E-01	2.06E-01	5.02E-01	1.24E-02	8.91E-02
2002	7	5	1.39E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.73E-02	4.73E-01	8.37E-22	4.49E+00	1.04E-01	5.66E-01	6.17E-01	1.56E-02	2.96E-03
2002	7	6	1.25E-01	3.58E-01	4.10E-02	1.74E-01	3.34E-01	6.04E-02	9.97E-02	1.49E+00	6.83E-01	2.01E+01	1.96E+00	2.00E+00	2.25E+00	1.31E-01	3.02E-01
2002	7	7	8.99E-02	2.17E-01	1.23E-01	8.49E-02	1.31E-01	9.48E-02	6.28E-02	8.24E-01	2.94E+00	8.69E+00	1.12E+00	8.21E-01	5.71E-01	1.24E-01	2.25E-01
2002	7	8	1.32E-01	1.85E-01	8.30E-02	4.26E-02	8.63E-02	5.37E-02	3.82E-03	1.93E-01	2.36E+00	2.05E+00	1.02E+00	1.67E-01	3.22E-01	2.65E-02	1.90E-01
2002	7	9	1.40E-01	3.80E-02	1.63E-02	1.95E-02	8.64E-02	1.60E-02	1.77E-02	2.93E-01	1.24E+00	4.72E+00	1.30E+00	2.85E-01	6.49E-01	2.88E-02	2.55E-01
2002	7	10	3.17E-01	5.66E-01	1.53E-01	3.18E-03	3.18E-03	1.67E-01	8.04E-03	2.15E-01	4.38E+00	8.28E-01	1.18E+00	5.06E-02	1.30E-01	7.52E-02	6.32E-01
2002	7	11	2.17E-03	9.10E-02	2.79E-04	4.43E-02	1.56E-01	5.44E-04	2.80E-02	1.35E+00	3.73E-03	7.33E+00	1.81E+00	3.50E-01	7.43E-01	1.03E-01	3.29E-03
2002	7	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-01	1.32E+00	7.44E-28	1.09E+01	6.48E-02	1.39E+00	1.91E+00	1.11E-01	2.80E-04
2002	7	13	7.93E-02	2.59E-01	7.37E-04	2.04E-01	3.66E-01	3.41E-03	3.88E-01	1.18E+00	1.28E-01	6.23E+00	2.98E+00	2.76E+00	3.26E+00	2.15E-01	1.21E-01
2002	7	14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E-03	0.00E+00	2.74E-02	8.15E-01	1.36E-24	2.83E+00	2.89E-01	2.80E-01	6.41E-01	1.93E-02	8.24E-06
2002	7	15	8.69E-02	0.00E+00	0.00E+00	0.00E+00	4.40E-03	1.14E-04	6.49E-02	1.16E+00	9.40E-06	1.14E+01	4.66E-01	1.22E+00	1.20E+00	4.98E-02	1.90E-01
2002	7	16	8.41E-03	1.00E-01	5.52E-05	1.16E-01	8.67E-02	3.71E-04	8.99E-02	1.54E+00	6.81E-03	1.24E+01	9.62E-01	1.61E+00	7.52E-01	5.61E-02	3.95E-02
2002	7	17	4.21E-05	0.00E+00	0.00E+00	3.87E-05	1.57E-02	0.00E+00	9.14E-02	1.16E+00	7.96E-06	9.56E+00	3.10E-01	1.09E+00	9.78E-01	6.88E-02	2.96E-03
2002	7	18	1.79E-03	0.00E+00	0.00E+00	0.00E+00	7.39E-03	0.00E+00	6.94E-02	1.03E+00	0.00E+00	8.01E+00	2.80E-01	8.70E-01	7.04E-01	8.11E-02	7.42E-03
2002	7	19	1.74E-02	1.22E-06	1.56E-04	5.27E-04	3.26E-02	9.08E-04	2.68E-02	6.39E-01	7.90E-03	7.76E+00	4.56E-01	6.59E-01	8.87E-01	2.63E-02	4.34E-02
2002	7	20	6.68E-02	5.32E-01	3.58E-01	9.68E-02	6.53E-02	2.64E-01	2.13E-02	8.91E-02	5.03E+00	2.35E+00	1.62E-01	3.53E-01	5.41E-01	1.84E-02	1.23E-01
2002	7	21	1.54E-01	8.83E-04	2.54E-01	3.15E-07	4.69E-07	1.78E-01	3.23E-04	2.86E-02	2.88E+00	1.28E-05	1.94E-06	1.03E-04	6.81E-05	2.55E-02	3.02E-01
2002	7	22	5.45E-01	2.57E-05	6.14E-02	0.00E+00	0.00E+00	4.09E-02	3.04E-04	7.15E-02	3.90E+00	1.04E-03	6.18E-04	3.98E-04	4.66E-04	2.12E-02	1.01E+00
2002	7	23	1.28E-01	4.44E-01	3.40E-02	7.69E-02	1.39E-01	5.87E-02	2.03E-01	1.56E+00	5.49E-01	2.09E+01	2.53E+00	2.59E+00	4.44E+00	2.64E-01	1.78E-01
2002	7	24	8.87E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.28E-02	1.40E+00	4.44E-18	9.24E+00	3.62E-02	1.15E+00	8.05E-01	7.29E-02	5.26E-03
2002	7	25	3.74E-02	0.00E+00	4.80E-04	0.00E+00	0.00E+00	2.20E-03	7.13E-02	1.05E+00	2.90E-05	1.12E+01	1.18E-01	1.18E+00	7.93E-01	6.30E-02	1.09E-01
2002	7	26	1.23E-01	1.01E-04	1.70E-02	1.26E-05	4.83E-05	5.30E-02	1.74E-02	2.63E-01	3.45E-02	9.82E+00	7.36E-02	7.49E-01	9.00E-01	4.43E-02	3.23E-01
2002	7	27	1.47E-01	2.22E-03	1.13E-02	5.07E-05	2.57E-03	3.39E-02	5.21E-01	1.05E+00	3.60E-01	7.68E+00	2.03E-01	1.96E+00	2.49E+00	2.90E-01	2.54E-01
2002	7	28	6.86E-02	1.71E-06	4.35E-03	1.17E-10	2.17E-07	1.20E-02	5.07E-02	6.00E-01	7.10E-04	7.35E+00	5.62E-02	1.39E+00	1.96E+00	4.90E-02	1.64E-01
2002	7	29	1.29E-01	1.23E-04	1.44E-02	8.27E-06	1.27E-04	4.18E-02	9.38E-03	3.30E-01	1.38E-02	6.80E+00	1.14E-01	5.65E-01	1.42E+00	1.53E-02	3.22E-01
2002	7	30	1.34E-01	3.14E-05	2.77E-02	8.62E-08	6.72E-06	2.82E-02	2.99E-02	3.86E-01	1.42E-01	5.18E+00	1.14E-01	5.14E-01	7.81E-01	3.65E-02	2.26E-01
2002	7	31	8.67E-02	1.62E-01	4.41E-01	5.10E-02	1.37E-01	2.75E-01	2.04E-02	4.28E-02	2.98E+00	3.59E+00	6.06E-01	2.34E-01	6.57E-01	2.46E-02	1.45E-01
2002	8	1	1.28E-03	1.17E-01	8.12E-02	6.74E-03	6.81E-04	3.75E-02	6.66E-04	9.03E-04	1.41E+00	8.35E-04	8.76E-04	7.98E-04	8.13E-04	8.93E-04	7.17E-03
2002	8	2	1.04E-01	3.13E-01	2.09E-01	2.96E-01	2.50E-01	2.34E-01	2.12E-02	5.08E-02	4.80E+00	1.38E+00	1.53E+00	7.82E-02	1.89E-01	3.38E-02	1.29E-01
2002	8	3	3.52E-02	1.05E-02	2.66E-01	4.69E-04	1.02E-04	1.93E-01	2.03E-02	2.71E-02	1.79E+00	3.54E-03	9.40E-04	8.58E-03	5.59E-03	2.82E-02	3.67E-02
2002	8	4	2.99E-01	9.60E-01	3.79E-02	5.44E-02	6.27E-02	5.48E-02	3.72E-05	4.49E-03	3.58E+00	7.36E-01	1.84E+00	1.94E-02	6.64E-02	2.86E-03	5.73E-01
2002	8	5	8.39E-02	3.74E-01	1.09E-02	3.28E-01	5.27E-01	1.38E-02	2.96E-02	8.42E-01	5.12E-01	1.05E+01	4.77E+00	5.93E-01	1.29E+00	3.45E-02	2.14E-01
2002	8	6	1.18E-01	4.16E-02	2.62E-02	2.13E-01	5.43E-01	3.66E-02	8.64E-02	9.05E-01	2.80E-01	1.13E+01	5.08E+00	1.30E+00	1.90E+00	6.86E-02	2.15E-01
2002	8	7	2.13E-01	1.12E-01	1.15E-01	9.36E-02	1.61E-01	1.05E-01	8.60E-02	1.22E+00	2.22E+00	1.81E+01	5.75E-01	1.46E+00	2.31E+00	1.26E-01	3.57E-01
2002	8	8	3.42E-01	1.09E+00	1.36E-01	1.63E-01	3.78E-01	1.84E-01	1.50E-01	7.25E-01	3.48E+00	1.37E+01	7.66E+00	1.64E+00	2.97E+00	1.76E-01	6.21E-01
2002	8	9	1.03E-02	5.53E-06	1.65E-04	8.47E-07	3.46E-06	6.46E-04	4.26E-02	7.89E-01	2.83E-04	7.48E+00	2.79E-02	1.65E+00	3.05E+00	7.35E-02	2.72E-02
2002	8	10	2.95E-01	2.73E-01	9.82E-02	6.31E-02	1.59E-01	1.79E-01	3.88E-01	1.46E+00	1.43E+00	1.97E+01	1.14E+00	3.42E+00	6.94E+00	3.40E-01	3.87E-01
2002	8	11	1.48E-02	5.56E-01	8.41E-01	1.03E-02	1.03E-02	4.49E-01	5.47E-03	2.36E-01	6.62E+00	9.57E-01	2.42E+00	2.86E-02	9.61E-02	1.62E-02	4.13E-02
2002	8	12	3.36E-01	7.55E-01	1.60E-01	1.25E-01	2.40E-01	1.96E-01	1.05E-01	9.55E-01	1.94E+00	1.35E+01	6.16E+00	1.17E+00	2.99E+00	1.76E-01	5.25E-01
2002	8	13	3.66E-01	2.00E-01	1.71E-02	3.21E-02	7.03E-02	2.86E-02	1.01E+00	1.51E+00	4.34E-01	1.24E+01	7.66E-01	2.89E+00	2.49E+00	7.00E-01	5.81E-01
2002	8	14	2.26E-01	1.19E-02	3.06E-01	2.34E-03	5.43E-03	4.40E-01	1.52E-01	1.86E-01	4.02E+00	1.22E+01	1.65E-01	2.12E+00	4.01E+00	9.48E-02	3.91E-01
2002	8	15	4.14E-02	1.29E+00	1.16E-01	3.48E-01	5.82E-01	1.22E-01	2.80E-02	3.06E-01	2.17E+00	9.42E+00	4.55E+00	7.37E-01	1.59E+00	3.87E-02	5.93E-02
2002	8	16	3.04E-01	4.81E-01	8.80E-01	1.44E-02	2.26E-02	1.07E+00	8.62E-02	2.25E-01	5.96E+00	7.34E+00	4.00E+00	8.64E-01	2.30E+00	1.68E-01	4.48E-01
2002	8	17	8.65E-02	1.26E-01	4.53E-03	1.50E-01	3.00E-01	8.76E-03	4.76E-02	9.05E-01	2.74E-01	1.54E+01	1.84E+00	9.41E-01	1.76E+00	1.10E-01	1.50E-01
2002	8	18	8.44E-01	4.26E-02	1.03E-01	8.67E-03	2.60E-02	2.22E-01	2.36E-01	1.60E+00	2.65E+00	6.73E+00	3.60E-01	6.35E-01	1.85E+00	7.34E-01	9.94E-01
2002	8	19	6.58E-04	5.97E-05	6.43E-05	1.52E-04	4.92E-02	5.60E-04	8.91E-02	1.56E+00	2.34E-03	1.38E+01	1.12E+00	1.64E+00	1.76E+00	7.96E-02	2.54E-03
2002	8	20	2.48E-01	1.22E-02	8.09E-01	8.17E-06	4.96E-06	1.29E+00	2.16E-02	1.09E-01	6.47E+00	6.95E-02	3.61E-03	3.42E-02	1.76E-02	6.57E-02	3.97E-01
2002	8	21	9.99E-02	1.97E+00	3.22E-02	1.97E-01	3.57E-01	3.30E-02	3.33E-02	8.58E-01	1.07E+00	6.02E+00	3.10E+00	5.43E-01	5.15E-01	5.01E-02	2.53E-01
2002	8	22	1.38E-03	2.73E-01	1.67E-03	5.88E-02	8.83E-02	2.15E-03	9.47E-02	1.99E+00	3.72E-02	1.39E+01	1.19E+00	1.34E+00	1.44E+00	1.40E-01	2.33E-03
2002	8	23	7.38E-02	7.02E-01	1.97E-02	8.05E-02	4.26E-02	2.79E-02	9.23E-02	1.08E+00	3.02E-01	8.47E+00	2.80E+00	1.24E+00	1.86E+00	1.11E-01	1.53E-01
2002	8	24	1.49E-02	4.93E-01	1.56E-02	3.54E-02	9.44E-02	1.79E-02	1.03E-01	1.82E+00	1.98E-01	1.03E+01	7.71E-01	1.24E+00	1.76E+00	1.28E-01	3.16E-02
2002	8	25	1.05E-01	1.59E-01	6.66E-02	4.86E-02	9.44E-02	9.08E-02	2.69E-01	1.57E+00	4.84E-01	1.76E+01	8.03E-01	2.71E+00	3.86E+00	1.64E-01	1.42E-01
2002	8	26	1.70E+00	9.99E-02	3.83E-01	7.13E-03	1.20E-02	5.59E-01	9.20E-01	2.29E+00	4.87E+00	6.75E+00	3.02E-01	2.21E+00	2.53E+00	1.38E+00	1.87E+00
2002	8	27	9.32E-01	3.59E-01	1.00E-01	2.52E-05	6.55E-05	1.46E-01	4.31E-03	3.06E-01	4.12E+00	2.22E-01	1.01E+00	4.90E-03	3.87E-03	2.32E-01	1.17E+00
2002	8	28	2.23E-01	8.75E-01	1.12E-01	1.01E-01	2.01E-01	1.38E-01	1.93E-01	1.28E+00	1.41E+00	1.97E+01	3.47E+00	2.82E+00	4.18E+00	1.94E-01	4.47E-01
2002	8	29	6.97E-02	6.65E-02	3.83E-03	1.36E-01	2.72E-01	1.52E-02	6.07E-02	1.31E+00	9.04E-03	1.23E+01	2.25E+00	9.75E-01	1.77E+00	1.56E-01	2.15E-01
2002	8	30	1.75E-01	7.14E-03	3.89E-02	2.08E-04	2.03E-03	7.90E-02	1.77E-01	1.14E+00	2.21E+00	1.70E+01	3.80E-01	2.31E+00	2.82E+00	2.09E-01	2.96E-01
2002	8	31	3.85E-01	4.73E-01	2.51E-01	1.46E-01	2.53E-01	2.83E-01	3.30E-01	9.42E-01	2.07E+00	1.77E+01	2.76E+00	2.16E+00	3.30E+00	3.35E-01	5.91E-01
2002	9	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.95E-02	2.35E-01	9.88E-16	4.10E+00	8.84E-02	3.94E-01	4.99E-01	0.00E+00	0.00E+00
2002	9	2	4.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-08	6.46E-02	9.26E-01	1.38E-03	8.78E+00	1.94E-01	9.37E-01	6.95E-01	5.23E-02	1.09E-01
2002	9	3	1.40E-02	0.00E+00	2.07E-04	0.00E+00	2.02E-02	3.61E-03	4.65E-02	9.79E-01	1.27E-05	4.34E+00	5.31E-01	6.32E-01	5.90E-01	3.26E-02	5.01E-02

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	9	4	1.09E+01	3.11E-01	6.99E+00	2.50E-01	3.68E-01	1.42E+01	8.65E+00	2.00E+01	4.96E+00	1.15E+01	2.61E+00	1.81E+00	2.99E+00	2.08E+01	1.39E+01	1.09E+01	2.76E-02	6.89E+00	1.13E-02	1.37E-02	1.41E+01	8.56E+00	1.97E+01	2.84E-01	6.28E-02	3.57E-02	1.06E-01	7.82E-02	2.07E+01	1.37E+01	7.64E-02	2.84E-01	1.05E-01	2.39E-01	3.54E-01	1.64E-01	8.90E-02	2.56E-01	4.67E+00	1.14E+01	2.57E+00	1.70E+00	2.91E+00	3.96E-02	1.67E-01
2002	9	5	1.29E+01	1.39E+00	4.97E+00	8.87E-01	1.97E+00	1.74E+01	7.52E+00	2.44E+01	1.64E+00	1.93E+00	1.21E+01	2.72E-01	2.21E-01	2.58E+01	1.71E+01	1.26E+01	7.88E-02	4.95E+00	4.08E-02	5.44E-02	1.73E+01	7.52E+00	2.43E+01	7.29E-01	1.82E-01	1.11E-01	2.64E-01	2.05E-01	2.57E+01	1.65E+01	3.06E-01	1.31E+00	2.13E-02	8.46E-01	1.92E+00	4.50E-02	9.06E-04	1.33E-01	9.07E-01	1.75E+00	1.19E+01	8.43E-03	1.68E-02	2.61E-02	5.40E-01
2002	9	6	7.26E+00	1.56E+00	4.17E+00	1.42E-01	1.95E-01	1.83E+01	8.09E+00	2.44E+01	2.34E+00	1.49E+01	4.00E+00	1.38E+00	1.17E+00	2.37E+01	9.61E+00	7.23E+00	7.50E-02	4.15E+00	1.75E-02	2.69E-02	1.83E+01	8.05E+00	2.41E+01	6.50E-01	2.01E-01	1.09E-01	3.05E-01	2.47E-01	2.36E+01	9.55E+00	2.34E-02	1.49E+00	1.68E-02	1.25E-01	1.68E-01	2.35E-02	4.55E-02	3.43E-01	1.69E+00	1.47E+01	3.89E+00	1.08E+00	9.23E-01	1.30E-01	5.64E-02
2002	9	7	8.08E+00	7.84E-01	4.27E+00	9.11E-02	1.71E-01	2.46E+01	1.19E+01	2.79E+01	3.18E+00	1.35E+01	2.52E+00	1.62E+00	2.50E+00	2.21E+01	1.08E+01	7.79E+00	4.80E-02	4.06E+00	1.14E-02	1.94E-02	2.44E+01	1.16E+01	2.66E+01	8.04E-01	1.91E-01	8.35E-02	3.33E-01	2.68E-01	2.17E+01	1.04E+01	2.84E-01	7.36E-01	2.10E-01	7.97E-02	1.51E-01	2.51E-01	2.79E-01	1.35E+00	2.38E+00	1.33E+01	2.44E+00	1.29E+00	2.24E+00	3.23E-01	4.11E-01
2002	9	8	1.17E+00	7.33E-06	4.67E-01	2.06E-08	1.00E-04	6.44E+00	2.86E+00	8.27E+00	5.25E-02	4.37E+00	2.70E-01	7.20E-01	6.62E-01	7.99E+00	1.95E+00	1.12E+00	7.33E-06	4.67E-01	2.06E-08	1.02E-06	6.44E+00	2.85E+00	7.92E+00	4.73E-02	6.17E-03	1.76E-04	6.67E-02	2.89E-02	7.99E+00	1.84E+00	5.02E-02	0.00E+00	2.45E-04	0.00E+00	9.94E-05	1.51E-03	1.35E-02	3.53E-01	5.12E-03	4.36E+00	2.69E-01	6.53E-01	6.34E-01	2.01E-03	1.13E-01
2002	9	9	9.27E-01	9.99E-07	6.02E-01	0.00E+00	1.23E-07	8.33E+00	3.79E+00	1.44E+01	1.36E-01	6.51E+00	8.53E-02	1.01E+00	6.27E-01	1.01E+01	1.38E+00	8.94E-01	9.99E-07	6.01E-01	0.00E+00	1.23E-07	8.32E+00	3.76E+00	1.38E+01	1.33E-01	8.30E-03	2.03E-04	6.31E-02	3.31E-02	1.01E+01	1.26E+00	3.24E-02	0.00E+00	5.00E-04	0.00E+00	0.00E+00	6.36E-03	2.98E-02	5.82E-01	3.23E-03	6.50E+00	8.51E-02	9.51E-01	5.93E-01	7.54E-03	1.18E-01
2002	9	10	1.62E+00	6.04E-04	2.16E+00	4.30E-03	5.00E-02	2.35E+01	9.23E+00	2.54E+01	3.68E-01	1.69E+01	3.26E-01	1.94E+00	1.35E+00	2.62E+01	2.80E+00	1.55E+00	5.99E-04	2.15E+00	1.62E-05	3.60E-04	2.35E+01	9.15E+00	2.41E+01	3.51E-01	5.33E-02	1.09E-02	1.84E-01	1.09E-01	2.61E+01	2.66E+00	6.84E-02	5.13E-06	1.24E-03	4.28E-03	4.97E-02	4.48E-03	8.63E-02	1.28E+00	1.75E-02	1.69E+01	3.15E-01	1.75E+00	1.24E+00	6.44E-02	1.42E-01
2002	9	11	1.26E+00	1.48E-01	1.47E+00	1.73E-01	3.53E-01	2.55E+01	9.76E+00	2.90E+01	6.86E-01	1.62E+01	2.26E+00	2.31E+00	1.10E+00	2.72E+01	1.68E+00	1.26E+00	1.63E-02	1.47E+00	9.60E-03	1.34E-02	2.55E+01	9.62E+00	2.70E+01	6.73E-01	1.27E-01	4.25E-02	3.19E-01	2.14E-01	2.71E+01	1.68E+00	1.29E-03	1.32E-01	3.80E-05	1.64E-01	3.40E-01	4.80E-04	1.40E-01	1.95E+00	1.28E-02	1.61E+01	2.21E+00	1.99E+00	8.90E-01	9.79E-02	7.45E-03
2002	9	12	1.38E+00	2.89E-04	1.04E+00	6.02E-05	8.35E-03	1.87E+01	7.56E+00	2.04E+01	2.12E-01	1.41E+01	4.24E-01	1.44E+00	1.34E+00	2.09E+01	2.91E+00	1.36E+00	2.89E-04	1.04E+00	1.87E-05	1.36E-04	1.87E+01	7.44E+00	1.92E+01	2.06E-01	3.20E-02	4.30E-03	1.26E-01	7.01E-02	2.08E+01	2.84E+00	2.30E-02	0.00E+00	7.12E-04	4.15E-05	8.21E-03	2.12E-03	1.13E-01	1.23E+00	5.95E-03	1.41E+01	4.19E-01	1.31E+00	1.27E+00	1.01E-01	6.98E-02
2002	9	13	7.49E+00	2.34E-01	4.29E+00	6.45E-02	4.54E-02	1.90E+01	4.21E+00	1.92E+01	1.93E+00	6.61E+00	7.62E-02	1.33E+00	1.70E+00	2.44E+01	8.91E+00	7.33E+00	1.53E-02	4.24E+00	6.64E-03	5.44E-03	1.89E+01	4.10E+00	1.84E+01	1.18E-01	1.54E-02	9.37E-03	3.78E-02	2.29E-02	2.43E+01	8.60E+00	1.58E-01	2.18E-01	5.02E-02	5.79E-02	4.00E-02	6.99E-02	1.06E-01	8.52E-01	1.81E+00	6.60E+00	6.68E-02	1.29E+00	1.67E+00	1.46E-01	3.13E-01
2002	9	14	8.76E+00	4.50E-01	4.36E+00	5.49E-02	4.05E-01	2.57E+01	8.90E+00	2.38E+01	3.16E+00	1.05E+01	3.81E+00	1.05E+00	1.65E+00	2.58E+01	1.16E+01	8.58E+00	3.44E-02	4.33E+00	1.09E-02	2.17E-02	2.57E+01	8.86E+00	2.29E+01	7.39E-01	1.83E-01	8.36E-02	3.31E-01	2.51E-01	2.57E+01	1.12E+01	1.75E-01	4.16E-01	3.24E-02	4.40E-02	3.83E-01	2.95E-02	4.34E-02	9.10E-01	2.42E+00	1.03E+01	3.73E+00	7.15E-01	1.40E+00	1.33E-01	4.31E-01
2002	9	15	5.16E+00	4.62E-03	2.27E+00	1.03E-01	3.34E-01	1.68E+01	5.79E+00	2.18E+01	3.20E-01	6.64E+00	1.78E+00	4.89E-01	1.53E+00	2.77E+01	8.66E+00	5.07E+00	3.29E-03	2.25E+00	2.65E-03	9.51E-03	1.67E+01	5.77E+00	2.13E+01	2.98E-01	8.14E-02	2.75E-02	1.86E-01	1.44E-01	2.76E+01	8.36E+00	9.15E-02	1.33E-03	1.60E-02	1.00E-01	3.24E-01	5.12E-02	2.38E-02	5.12E-01	2.23E-02	6.55E+00	1.75E+00	3.03E-01	1.39E+00	6.64E-02	2.95E-01
2002	9	16	3.12E+00	1.97E-04	7.00E-01	6.48E-05	1.23E-02	8.82E+00	4.63E+00	7.91E+00	1.08E-01	6.52E+00	3.57E-01	8.78E-01	6.25E-01	1.00E+01	4.22E+00	3.08E+00	1.92E-04	6.95E-01	6.31E-05	5.02E-04	8.80E+00	4.59E+00	7.44E+00	6.93E-02	1.53E-02	2.94E-03	3.12E-02	2.13E-02	9.98E+00	4.08E+00	4.34E-02	4.82E-06	4.91E-03	1.75E-06	1.18E-02	2.07E-02	3.65E-02	4.69E-01	3.82E-02	6.50E+00	3.54E-01	8.46E-01	6.04E-01	3.71E-02	1.36E-01
2002	9	17	4.68E+00	8.08E-01	1.91E+00	3.26E-01	3.76E-01	2.06E+01	1.07E+01	2.90E+01	1.40E+00	1.73E+01	4.55E+00	2.50E+00	1.91E+00	3.13E+01	5.81E+00	4.16E+00	2.67E-02	1.72E+00	9.42E-03	1.50E-02	2.03E+01	1.03E+01	2.75E+01	4.04E-01	1.08E-01	5.44E-02	1.81E-01	1.39E-01	3.07E+01	5.19E+00	5.14E-01	7.81E-01	1.91E-01	3.16E-01	3.61E-01	2.81E-01	4.01E-01	1.45E+00	9.99E-01	1.72E+01	4.49E+00	2.32E+00	1.77E+00	5.60E-01	6.21E-01
2002	9	18	1.04E+00	1.65E-04	5.77E-01	3.79E-06	3.94E-05	1.22E+01	4.47E+00	1.89E+01	1.67E-01	7.79E+00	3.44E-02	3.54E+00	3.68E+00	1.40E+01	3.00E+00	1.03E+00	1.65E-04	5.77E-01	3.79E-06	3.94E-05	1.22E+01	4.33E+00	1.81E+01	1.67E-01	1.85E-02	2.28E-03	7.17E-02	3.99E-02	1.40E+01	2.96E+00	9.49E-03	2.70E-09	2.82E-05	0.00E+00	2.33E-08	9.12E-05	1.48E-01	8.25E-01	1.17E-04	7.77E+00	3.22E-02	3.46E+00	3.64E+00	6.36E-02	3.60E-02
2002	9	19	2.16E-01	0.00E+00	1.10E-01	0.00E+00	8.97E-09	2.76E+00	1.91E+00	3.38E+00	1.67E-02	5.20E+00	9.98E-02	4.66E-01	4.98E-01	2.64E+00	4.85E-01	2.16E-01	0.00E+00	1.10E-01	0.00E+00	0.00E+00	2.76E+00	1.89E+00	3.24E+00	1.51E-02	4.28E-04	1.28E-05	6.02E-03	1.71E-03	2.64E+00	4.85E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.97E-09	1.23E-05	1.79E-02	1.44E-01	1.57E-03	5.20E+00	9.97E-02	4.60E-01	4.97E-01	4.60E-07	2.17E-07
2002	9	20	3.60E+00	7.28E-05	1.15E+00	7.77E-06	6.89E-05	1.60E+01	3.80E+00	2.19E+01	2.50E-01	9.77E+00	5.71E-03	1.38E+00	2.09E+00	1.59E+01	4.64E+00	3.51E+00	7.28E-05	1.15E+00	7.77E-06	6.89E-05	1.60E+01	3.75E+00	2.10E+01	2.46E-01	2.44E-02	3.77E-03	1.12E-01	5.94E-02	1.59E+01	4.36E+00	9.31E-02	0.00E+00	2.38E-03	0.00E+00	0.00E+00	1.97E-02	5.55E-02	8.62E-01	3.48E-03	9.74E+00	1.94E-03	1.27E+00	2.03E+00	3.54E-02	2.82E-01
2002	9	21	2.01E+00	1.40E-03	1.13E+00	1.40E-04	4.69E-03	2.06E+01	8.52E+00	3.62E+01	3.79E-01	1.56E+01	1.79E-01	4.40E+00	5.09E+00	2.72E+01	3.44E+00	1.92E+00	6.86E-04	1.13E+00	4.87E-05	4.74E-04	2.06E+01	8.26E+00	3.52E+01	2.75E-01	4.57E-02	9.61E-03	1.28E-01	8.12E-02	2.70E+01	3.22E+00	8.48E-02	7.19E-04	2.06E-03	9.15E-05	4.21E-03	6.70E-03	2.63E-01	1.03E+00	1.03E-01	1.56E+01	1.70E-01	4.27E+00	5.01E+00	1.54E-01	2.17E-01
2002	9	22	4.33E+00	2.10E-05	2.39E+00	2.72E-07	3.27E-06	5.93E+00	1.05E+00	8.75E+00	2.52E+00	7.92E+00	6.87E-04	7.09E-01	1.55E+00	9.72E+00	5.86E+00	4.30E+00	2.02E-05	2.31E+00	2.68E-07	3.21E-06	5.81E+00	1.00E+00	8.63E+00	1.81E-02	3.97E-03	4.07E-04	8.78E-03	6.98E-03	9.69E+00	5.83E+00	2.53E-02	7.88E-07	8.43E-02	4.67E-09	6.50E-08	1.14E-01	4.52E-02	1.18E-01	2.50E+00	7.92E+00	2.79E-04	7.00E-01	1.55E+00	3.62E-02	2.99E-02
2002	9	23	9.35E+00	5.81E-01	4.75E+00	1.14E-01	1.97E-01	2.34E+01	6.55E+00	1.99E+01	3.45E+00	4.75E+00	4.25E+00	9.50E-01	1.37E+00	2.02E+01	1.28E+01	9.09E+00	3.65E-02	4.72E+00	1.14E-02	1.82E-02	2.34E+01	6.47E+00	1.92E+01	4.15E-01	1.21E-01	6.53E-02	2.10E-01	1.56E-01	2.01E+01	1.24E+01	2.66E-01	5.45E-01	3.26E-02	1.03E-01	1.79E-01	7.94E-02	8.43E-02	7.53E-01	3.04E+00	4.63E+00	4.18E+00	7.40E-01	1.21E+00	1.50E-01	4.32E-01
2002	9	24	1.24E+01	7.16E-03	5.76E+00	1.56E-03	1.68E-03	1.20E+01	5.40E-01	1.18E+01	9.40E+00	3.15E-02	4.25E-03	2.93E-02	1.37E-02	2.02E+01	1.56E+01	1.23E+01	4.04E-03	5.47E+00	7.17E-04	7.87E-04	1.18E+01	5.33E-01	1.17E+01	6.00E-02	3.65E-03	2.24E-03	4.93E-03	4.12E-03	2.02E+01	1.53E+01	1.50E-01	3.12E-03	2.88E-01	8.40E-04	8.89E-04	1.85E-01	7.38E-03	2.58E-02	9.34E+00	2.78E-02	2.01E-03	2.43E-02	9.62E-03	1.75E-02	2.16E-01
2002	9	25	1.04E+01	5.06E-01	5.04E+00	5.64E-02	9.13E-02	2.37E+01	8.26E+00	3.05E+01	3.56E+00	1.31E+01	1.80E+00	1.75E+00	2.45E+00	2.36E+01	1.24E+01	1.03E+01	2.86E-02	5.00E+00	9.21E-03	1.58E-02	2.37E+01	8.20E+00	2.95E+01	6.25E-01	1.49E-01	6.24E-02	3.40E-01	2.26E-01	2.36E+01	1.21E+01	1.39E-01	4.77E-01	3.76E-02	4.72E-02	7.55E-02	5.55E-02	6.20E-02	9.92E-01	2.94E+00	1.30E+01	1.74E+00	1.41E+00	2.23E+00	3.38E-02	2.56E-01
2002	9	26	7.23E+00	8.11E-02	3.29E+00	1.32E-02	5.61E-02	2.04E+01	5.14E+00	3.01E+01	3.77E+00	1.12E+01	4.10E-01	2.17E+00	3.30E+00	2.21E+01	9.00E+00	7.01E+00	6.14E-03	2.94E+00	9.45E-04	3.04E-03	2.01E+01	5.02E+00	2.94E+01	1.82E-01	4.26E-02	1.75E-02	1.08E-01	6.76E-02	2.20E+01	8.69E+00	2.14E-01	7.49E-02	3.45E-01	1.23E-02	5.30E-02	3.13E-01	1.25E-01	7.18E-01	3.59E+00	1.11E+01	3.93E-01	2.06E+00	3.23E+00	1.41E-01	3.08E-01
2002	9	27	1.32E+01	6.56E-01	6.63E+00	9.37E-02	1.42E-01	2.04E+01	3.52E+00	1.81E+01	5.68E+00	7.48E-01	3.57E+00	2.51E-01	3.29E-01	1.91E+01	1.67E+01	1.30E+01	3.22E-02	6.45E+00	1.32E-02	1.94E-02	2.02E+01	3.51E+00	1.78E+01	5.50E-01	1.63E-01	7.51E-02	2.45E-01	2.08E-01	1.91E+01	1.64E+01	1.50E-01	6.24E-01	1.73E-01	8.05E-02	1.22E-01	1.42E-01	7.05E-03	2.70E-01	5.13E+00	5.85E-01	3.50E+00	6.18E-03	1.22E-01	3.37E-02	2.92E-01
2002	9	28	5.57E-01	6.17E-04	7.18E-01	4.59E-05	4.11E-04	9.37E+00	3.67E+00	1.10E+01	2.54E-01	4.49E+00	6.28E-02	9.33E-01	7.56E-01	1.20E+01	1.39E+00	5.27E-01	5.86E-04	7.17E-01	4.57E-05	4.08E-04	9.36E+00	3.63E+00	1.02E+01	2.45E-01	3.67E-02	5.73E-03	9.83E-02	7.80E-02	1.20E+01	1.31E+00	3.02E-02	3.02E-05	1.07E-03	1.85E-07	3.27E-06	4.24E-03	3.48E-02	8.07E-01	8.45E-03	4.46E+00	5.71E-02	8.35E-01	6.78E-01	1.13E-02	8.00E-02
2002	9	29	4.00E+00	4.19E-04	7.84E-01	3.46E-04	3.87E-02	1.07E+01	4.64E+00	1.43E+01	3.59E-01	4.41E+00	8.10E-01	5.85E-01	8.70E-01	1.66E+01	6.66E+00	3.98E+00	4.19E-04	7.84E-01	3.43E-04	3.22E-03	1.07E+01	4.61E+00	1.38E+01	3.58E-01	6.51E-02	1.42E-02	1.01E-01	1.07E-01	1.66E+01	6.60E+00	1.71E-02	0.00E+00	5.70E-06	3.76E-06	3.54E-02	2.18E-04	2.77E-02	5.51E-01	4.57E-04	4.34E+00	7.95E-01	4.84E-01	7.63E-01	3.10E-02	5.90E-02
2002	9	30	1.28E+01	2.35E-03	7.07E+00	1.31E-04	6.17E-04	2.45E+01	5.60E+00	3.53E+01	6.57E+00	4.92E+00	3.46E-02	2.12E+00	2.10E+00	2.88E+01	1.77E+01	1.23E+01	2.32E-03	6.30E+00	1.31E-04	6.17E-04	2.38E+01	5.30E+00	3.40E+01	5.75E-01	8.36E-02	1.72E-02	1.32E-01	1.13E-01	2.82E+01	1.69E+01	5.37E-01	3.46E-05	7.70E-01	0.00E+00	5.98E-07	6.93E-01	3.02E-01	1.27E+00	6.00E+00	4.83E+00	1.74E-02	1.99E+00	1.99E+00	6.14E-01	7.86E-01
2002	10	1	1.68E+00	1.88E-01	1.41E+00	6.03E-02	1.56E-01	5.20E+00	2.07E+00	6.57E+00	2.83E+00	1.03E+01	1.25E+00	1.34E+00	1.92E+00	5.27E+00	2.36E+00	1.42E+00	2.81E-03	1.26E+00	8.95E-04	1.61E-03	5.09E+00	1.95E+00	5.51E+00	1.23E-01	2.30E-02	7.28E-03	6.20E-02	3.97E-02	5.18E+00	1.86E+00	2.67E-01	1.85E-01	1.49E-01	5.94E-02	1.54E-01	1.04E-01	1.14E-01	1.05E+00	2.70E+00	1.03E+01	1.24E+00	1.27E+00	1.88E+00	9.58E-02	4.92E-01
2002	10	2	2.82E-01	1.20E-04	1.13E-01	8.57E-06	4.55E-05	9.87E-01	4.90E-01	2.19E+00	2.41E-02	2.89E+00	1.22E-02	5.29E-01	1.89E-01	1.23E+00	5.02E-01	2.61E-01	1.17E-04	1.03E-01	8.57E-06	4.55E-05	9.56E-01	4.65E-01	1.71E+00	2.00E-02	4.36E-03	7.80E-04	1.15E-02	7.83E-03	1.23E+00	4.40E-01	2.06E-02	3.53E-06	1.02E-02	0.00E+00	0.00E+00	3.09E-02	2.43E-02	4.89E-01	4.08E-03	2.89E+00	1.15E-02	5.18E-01	1.81E-01	1.93E-03	6.19E-02
2002	10	3	2.19E+00	3.39E-03	1.25E+00	7.09E-06	2.15E-05	2.03E+00	9.65E-01	2.39E+00	4.35E+00	3.63E+00	2.48E-02	4.71E-01	4.65E-01	3.34E+00	2.98E+00	2.06E+00	4.58E-04	1.17E+00	6.76E-06	1.69E-05	1.92E+00	9.13E-01	2.23E+00	2.16E-02	1.89E-03	7.21E-04	4.42E-03	2.62E-03	3.27E+00	2.73E+00	1.29E-01	2.94E-03	7.74E-02	3.31E-07	4.63E-06	1.03E-01	5.20E-02	1.63E-01	4.33E+00	3.63E+00	2.41E-02	4.67E-01	4.63E-01	6.15E-02	2.57E-01
2002	10	4	2.78E+00	2.78E-01	1.82E+00	3.78E-02	1.37E-01	4.44E+00	1.65E+00	6.37E+00	4.53E+00	8.01E+00	1.20E+00	1.21E+00	1.70E+00	5.92E+00	3.73E+00	2.27E+00	5.19E-03	1.61E+00	8.73E-04	2.15E-03	4.24E+00	1.47E+00	5.61E+00	1.17E-01	3.12E-02	1.33E-02	5.26E-02	4.12E-02	5.73E+00	2.90E+00	5.05E-01	2.73E-01	2.06E-01	3.69E-02	1.34E-01	2.01E-01	1.81E-01	7.54E-01	4.41E+00	7.98E+00	1.18E+00	1.16E+00	1.66E+00	1.88E-01	8.28E-01
2002	10	5	6.86E-01	2.02E-04	2.81E-01	4.10E-05	1.07E-04	2.75E+00	1.13E+00	5.62E+00	6.57E-02	7.88E+00	1.81E-03	1.16E+00	1.39E+00	4.56E+00	1.10E+00	5.95E-01	1.86E-04	2.78E-01	4.04E-05	1.03E-04	2.73E+00	1.04E+00	4.48E+00	2.92E-02	3.22E-03	6.37E-04	1.70E-02	7.65E-03	4.51E+00	9.09E-01	9.12E-02	1.67E-05	3.49E-03	6.01E-07	4.39E-06	1.94E-02	8.38E-02	1.14E+00	3.64E-02	7.87E+00	1.17E-03	1.14E+00	1.38E+00	5.08E-02	1.93E-01
2002	10	6	3.65E-01	0.00E+00	2.17E-02	0.00E+00	1.10E-07	1.20E+00	8.82E-01	2.98E+00	1.24E-02	4.27E+00	3.65E-03	1.06E+00	1.82E-01	1.93E+00	4.52E-01	3.65E-01	0.00E+00	2.17E-02	0.00E+00	1.10E-07	1.20E+00	7.98E-01	1.95E+00	1.24E-02	8.08E-04	5.63E-05	8.83E-03	3.07E-03	1.91E+00	4.52E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.37E-02	1.03E+00	2.43E-18	4.27E+00	3.59E-03	1.06E+00	1.79E-01	2.34E-02	0.00E+00
2002	10	7	7.08E-01	4.47E-06	2.40E-01	6.47E-09	1.50E-07	1.54E+00	1.10E+00	3.27E+00	2.10E-01	6.23E+00	2.20E-04	1.07E+00	1.26E+00	2.38E+00	9.42E-01	6.83E-01	2.72E-06	2.40E-01	6.25E-09	1.30E-07	1.54E+00	1.03E+00	2.75E+00	6.99E-03	6.11E-04	7.40E-05	2.51E-03	1.32E-03	2.35E+00	8.93E-01	2.43E-02	1.75E-06	7.75E-04	2.29E-10	1.97E-08	1.91E-03	7.64E-02	5.19E-01	2.03E-01	6.23E+00	1.47E-04	1.07E+00	1.26E+00	2.67E-02	4.88E-02
2002	10	8	9.99E-01	8.95E-02	6.53E-01	2.75E-02	5.77E-02	4.36E+00	2.14E+00	6.98E+00	7.71E-01	5.43E+00	6.06E-01	1.04E+00	8.81E-01	5.98E+00	1.60E+00	7.79E-01	4.86E-03	6.03E-01	1.39E-03	2.70E-03	4.30E+00	2.05E+00	5.74E+00	1.15E-01	2.64E-02	1.11E-02	6.02E-02	4.01E-02	5.85E+00	1.09E+00	2.20E-01	8.46E-02	5.06E-02	2.61E-02	5.49E-02	6.01E-02	8.35E-02	1.23E+00	6.56E-01	5.40E+00	5.95E-01	9.83E-01	8.41E-01	1.32E-01	5.05E-01
2002	10	9	3.81E-02	4.64E-05	1.50E-01	1.24E-06	1.52E-04	1.73E+00	9.08E-01	3.30E+00	2.44E-02	4.01E+00	7.62E-02	8.02E-01	3.02E-01	2.44E+00	9.48E-02	3.72E-02	4.64E-05	1.50E-01	1.24E-06	9.47E-06	1.73E+00	8.68E-01	2.39E+00	2.44E-02	3.42E-03	6.28E-04	1.03E-02	6.04E-03	2.42E+00	8.97E-02	9.11E-04	0.00E+00	0.00E+00	0.00E+00	1.43E-04	0.00E+00	4.05E-02	9.17E-01	4.70E-19	4.00E+00	7.56E-02	7.91E-01	2.96E-01	2.72E-02	5.13E-03
2002	10	10	7.57E-01	3.10E-04	2.87E-01	1.97E-04	8.73E-03	1.80E+00	1.06E+00	2.71E+00	8.73E-02	5.29E+00	5.59E-01	6.83E-01	6.07E-01	2.51E+00	1.29E+00	7.00E-01	2.99E-04	2.85E-01	1.89E-04	1.36E-03	1.79E+00	1.03E+00	2.40E+00	7.21E-02	1.01E-02	2.97E-03	3.12E-02	2.14E-02	2.49E+00	1.14E+00	5.70E-02	1.10E-05	1.65E-03	7.59E-06	7.36E-03	1.12E-02	3.00E-02	3.06E-01	1.52E-02	5.28E+00	5.56E-01	6.52E-01	5.86E-01	1.49E-02	1.50E-01
2002	10	11	1.76E+00	5.14E-02	5.93E-01	1.89E-02	4.43E-02	4.66E+00	2.57E+00	8.62E+00	8.42E-01	1.03E+01	3.18E-01	1.95E+00	2.29E+00	6.44E+00	2.31E+00	1.54E+00	1.29E-03	5.69E-01	3.26E-04	1.00E-03	4.58E+00	2.15E+00	7.10E+00	6.80E-02	1.29E-02	4.61E-03	3.58E-02	2.15E-02	6.14E+00	2.02E+00	2.25E-01	5.01E-02	2.39E-02	1.86E-02	4.33E-02	7.83E-02	4.21E-01	1.53E+00	7.74E-01	1.03E+01	3.13E-01	1.91E+00	2.27E+00	3.01E-01	2.94E-01
2002	10	12	3.72E-01	4.03E-04	1.47E-01	2.89E-05	1.15E-04	2.52E+00	1.12E+00	5.35E+00	4.23E-02	5.71E+00	6.77E-03	7.45E-01	4.48E-01	3.30E+00	5.52E-01	3.60E-01	4.03E-04	1.46E-01	2.89E-05	1.15E-04	2.51E+00	1.02E+00	4.12E+00	4.11E-02	5.40E-03	1.44E-03	2.33E-02	1.22E-02	3.25E+00	4.83E-01	1.20E-02	0.00E+00	4.14E-04	0.00E+00	0.00E+00	7.13E-03	9.47E-02	1.24E+00	1.18E-03	5.71E+00	5.33E-03	7.22E-01	4.35E-01	4.71E-02	6.91E-02
2002	10	13	3.08E-01	6.36E-07	1.02E-01	0.00E+00	0.00E+00	1.45E+00	4.76E-01	2.45E+00	9.77E-04	3.07E+00	1.15E-02	6.06E-01	5.64E-01	1.49E+00	3.97E-01	2.54E-01	1.71E-07	9.93E-02	0.00E+00	0.00E+00	1.45E+00	4.29E-01	1.81E+00	5.40E-04	3.26E-05	2.66E-06	1.71E-04	7.80E-05	1.47E+00	2.88E-01	5.37E-02	4.64E-07	2.20E-03	0.00E+00	0.00E+00	4.83E-03	4.66E-02	6.41E-01	4.38E-04	3.07E+00	1.15E-02	6.06E-01	5.64E-01	2.40E-02	1.08E-01
2002	10	14	4.89E-01	3.07E-03	2.59E-01	1.21E-03	6.50E-03	4.53E+00	1.64E+00	7.39E+00	4.25E-01	7.95E+00	1.86E-01	2.18E+00	2.72E+00	5.09E+00	9.23E-01	4.56E-01	1.12E-03	2.58E-01	3.67E-04	8.58E-04	4.53E+00	1.49E+00	6.19E+00	7.63E-02	1.33E-02	4.16E-03	3.75E-02	2.24E-02	4.98E+00	8.54E-01	3.38E-02	1.95E-03	1.44E-03	8.41E-04	5.65E-03	3.65E-03	1.51E-01	1.20E+00	3.49E-01	7.93E+00	1.82E-01	2.15E+00	2.70E+00	1.04E-01	6.96E-02
2002	10	15	1.73E+00	2.14E-02	6.13E-01	3.16E-03	8.00E-03	4.29E+00	1.64E+00	6.35E+00	1.28E+00	1.02E+01	1.48E-01	1.25E+00	1.94E+00	4.95E+00	2.09E+00	1.60E+00	9.34E-04	5.56E-01	3.47E-04	9.93E-04	4.22E+00	1.56E+00	5.46E+00	5.87E-02	1.22E-02	3.81E-03	4.58E-02	2.36E-02	4.84E+00	1.85E+00	1.34E-01	2.04E-02	5.69E-02	2.81E-03	7.01E-03	6.84E-02	8.19E-02	8.87E-01	1.22E+00	1.02E+01	1.44E-01	1.20E+00	1.92E+00	1.03E-01	2.35E-01
2002	10	16	1.27E+00	3.28E-02	1.08E+00	8.71E-03	1.63E-02	4.99E+00	2.40E+00	7.76E+00	1.53E+00	1.14E+01	1.69E-01	1.59E+00	2.19E+00	7.56E+00	1.79E+00	1.09E+00	6.86E-03	1.01E+00	1.88E-03	3.71E-03	4.91E+00	2.28E+00	6.75E+00	1.34E-01	3.19E-02	1.41E-02	7.64E-02	4.97E-02	7.38E+00	1.42E+00	1.75E-01	2.59E-02	7.68E-02	6.83E-03	1.26E-02	8.17E-02	1.22E-01	1.01E+00	1.40E+00	1.13E+01	1.55E-01	1.52E+00	2.14E+00	1.77E-01	3.76E-01
2002	10	17	3.19E-01	0.00E+00	1.79E-01	0.00E+00	0.00E+00	2.12E+00	8.92E-01	3.60E+00	4.54E-02	5.84E+00	3.13E-05	9.29E-01	6.41E-01	2.11E+00	4.25E-01	2.97E-01	0.00E+00	1.79E-01	0.00E+00	0.00E+00	2.11E+00	8.35E-01	2.91E+00	4.40E-02	6.01E-04	7.25E-06	9.72E-03	2.93E-03	2.09E+00	3.57E-01	2.24E-02	0.00E+00	4.65E-04	0.00E+00	0.00E+00	6.79E-03	5.73E-02	6.92E-01	1.41E-03	5.84E+00	2.40E-05	9.19E-01	6.38E-01	1.84E-02	6.80E-02
2002	10	18	8.90E-01	1.38E-03	2.83E-01	4.80E-03	3.31E-02	3.45E+00	2.59E+00	7.21E+00	3.08E-01	1.47E+01	4.81E-01	2.91E+00	4.03E+00	6.15E+00	1.28E+00	8.59E-01	3.25E-04	2.73E-01	1.25E-04	3.75E-04	3.41E+00	2.31E+00	5.58E+00	6.16E-02	6.60E-03	1.62E-03	3.87E-02	1.94E-02	6.05E+00	1.21E+00	3.09E-02	1.06E-03	1.01E-02	4.67E-03	3.28E-02	3.71E-02	2.81E-01	1.63E+00	2.47E-01	1.47E+01	4.79E-01	2.87E+00	4.01E+00	9.29E-02	6.55E-02
2002	10	19	1.30E+00	3.17E-04	5.35E-01	2.55E-05	2.60E-04	3.70E+00	1.70E+00	5.52E+00	6.98E-02	9.15E+00	6.50E-03	1.39E+00	4.35E-01	5.14E+00	1.64E+00	1.23E+00	3.07E-04	5.12E-01	2.55E-05	2.54E-04	3.65E+00	1.60E+00	4.10E+00	6.39E-02	1.12E-02	2.37E-03	4.84E-02	2.42E-02	5.08E+00	1.40E+00	7.38E-02	1.08E-05	2.29E-02	0.00E+00	5.12E-06	5.44E-02	1.06E-01	1.42E+00	5.85E-03	9.14E+00	4.13E-03	1.34E+00	4.11E-01	5.83E-02	2.34E-01
2002	10	20	6.28E-01	1.15E-01	2.70E-01	3.70E-02	8.60E-02	4.38E+00	3.33E+00	8.93E+00	6.14E-01	1.28E+01	1.52E+00	3.87E+00	4.56E+00	7.13E+00	9.35E-01	4.64E-01	1.16E-03	2.39E-01	4.16E-04	1.15E-03	4.32E+00	2.74E+00	6.83E+00	1.08E-01	1.97E-02	4.70E-03	8.50E-02	4.61E-02	6.82E+00	7.36E-01	1.63E-01	1.13E-01	3.17E-02	3.66E-02	8.48E-02	5.68E-02	5.85E-01	2.10E+00	5.06E-01	1.28E+01	1.52E+00	3.79E+00	4.51E+00	3.09E-01	1.99E-01
2002	10	21	5.44E-01	7.73E-03	2.65E-01	7.50E-05	3.04E-04	2.73E+00	1.54E+00	5.03E+00	8.73E-01	7.48E+00	9.44E-03	1.29E+00	2.27E+00	4.39E+00	6.55E-01	5.18E-01	1.79E-04	2.36E-01	4.44E-05	1.40E-04	2.69E+00	1.42E+00	3.79E+00	4.78E-02	6.23E-03	1.16E-03	4.25E-02	1.98E-02	4.27E+00	6.23E-01	2.56E-02	7.55E-03	2.89E-02	3.06E-05	1.64E-04	3.80E-02	1.23E-01	1.24E+00	8.25E-01	7.48E+00	8.28E-03	1.25E+00	2.25E+00	1.18E-01	3.19E-02
2002	10	22	1.67E+00	0.00E+00	1.06E+00	0.00E+00	0.00E+00	1.28E+00	6.28E-03	1.77E+00	3.93E+00	5.03E-08	5.16E-05	0.00E+00	0.00E+00	2.42E+00	1.86E+00	1.65E+00	0.00E+00	9.94E-01	0.00E+00	0.00E+00	1.23E+00	6.28E-03	1.77E+00	1.43E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E+00	1.77E+00	2.05E-02	0.00E+00	6.19E-02	0.00E+00	0.00E+00	5.62E-02	0.00E+00	0.00E+00	3.93E+00	5.03E-08	5.16E-05	0.00E+00	0.00E+00	0.00E+00	8.75E-02
2002	10	23	4.30E+00	2.22E-01	2.63E+00	2.86E-03	8.27E-03	6.25E+00	1.31E+00	8.08E+00	3.32E+00	2.61E+00	7.02E-01	5.50E-01	6.66E-01	7.82E+00	5.64E+00	3.75E+00	4.07E-03	2.35E+00	6.87E-04	1.66E-03	5.99E+00	1.27E+00	7.55E+00	1.42E-01	2.90E-02	1.06E-02	6.72E-02	4.44E-02	7.66E+00	4.71E+00	5.55E-01	2.18E-01	2.76E-01	2.17E-03	6.61E-03	2.63E-01	4.22E-02	5.37E-01	3.18E+00	2.58E+00	6.91E-01	4.82E-01	6.21E-01	1.66E-01	9.28E-01
2002	10	24	1.04E+00	2.99E-02	6.87E-01	8.85E-03	3.79E-02	5.22E+00	2.31E+00	8.21E+00	1.21E+00	6.98E+00	7.51E-01	1.84E+00	1.58E+00	6.94E+00	1.43E+00	5.69E-01	7.21E-03	4.62E-01	2.42E-03	4.61E-03	4.94E+00	1.81E+00	6.28E+00	9.77E-02	3.02E-02	1.52E-02	6.44E-02	4.36E-02	6.34E+00	8.70E-01	4.68E-01	2.27E-02	2.24E-01	6.43E-03	3.33E-02	2.85E-01	4.99E-01	1.93E+00	1.11E+00	6.95E+00	7.36E-01	1.78E+00	1.54E+00	6.02E-01	5.59E-01
2002	10	25	9.96E-01	1.24E-02	4.26E-01	1.43E-01	1.59E-01	5.35E+00	2.91E+00	9.04E+00	1.32E-01	1.18E+01	1.80E+00	2.58E+00	2.85E+00	6.61E+00	1.40E+00	9.19E-01	5.93E-04	4.19E-01	1.17E-04	4.34E-04	5.33E+00	2.50E+00	7.13E+00	5.77E-02	1.08E-02	2.84E-03	4.32E-02	2.21E-02	6.34E+00	1.24E+00	7.71E-02	1.18E-02	6.74E-03	1.43E-01	1.58E-01	1.96E-02	4.10E-01	1.90E+00	7.43E-02	1.18E+01	1.79E+00	2.53E+00	2.83E+00	2.61E-01	1.56E-01
2002	10	26	1.61E+00	5.84E-01	6.86E-01	4.71E-01	6.01E-01	2.53E+00	1.66E+00	4.10E+00	3.17E+00	6.86E+00	3.26E+00	1.47E+00	2.10E+00	3.88E+00	2.14E+00	1.42E+00	2.13E-02	5.52E-01	1.49E-02	2.28E-02	2.32E+00	1.41E+00	3.58E+00	1.17E-01	5.38E-02	3.96E-02	6.76E-02	5.91E-02	3.67E+00	1.91E+00	1.90E-01	5.63E-01	1.34E-01	4.56E-01	5.78E-01	2.11E-01	2.54E-01	5.17E-01	3.06E+00	6.80E+00	3.22E+00	1.40E+00	2.04E+00	2.17E-01	2.28E-01
2002	10	27	1.86E-01	3.68E-04	1.79E-01	3.17E-05	1.20E-04	2.33E+00	9.62E-01	4.62E+00	6.99E-02	4.07E+00	1.39E-02	1.04E+00	3.04E-01	2.92E+00	4.38E-01	1.44E-01	3.68E-04	1.79E-01	3.17E-05	1.20E-04	2.33E+00	8.67E-01	3.40E+00	6.97E-02	9.48E-03	1.94E-03	2.98E-02	1.86E-02	2.88E+00	2.99E-01	4.17E-02	0.00E+00	1.38E-05	0.00E+00	0.00E+00	7.27E-05	9.46E-02	1.22E+00	2.05E-04	4.06E+00	1.20E-02	1.01E+00	2.86E-01	3.87E-02	1.40E-01
2002	10	28	1.30E+00	1.84E-04	7.88E-01	3.75E-06	4.91E-05	2.59E+00	1.07E+00	5.15E+00	1.32E+00	6.13E+00	2.16E-03	1.01E+00	6.97E-01	5.13E+00	1.84E+00	1.10E+00	1.72E-04	5.03E-01	3.49E-06	4.60E-05	2.31E+00	9.64E-01	4.57E+00	3.65E-02	7.55E-03	1.66E-03	1.88E-02	1.23E-02	4.97E+00	1.52E+00	2.02E-01	1.18E-05	2.85E-01	2.57E-07	3.07E-06	2.83E-01	1.09E-01	5.87E-01	1.28E+00	6.12E+00	5.01E-04	9.88E-01	6.85E-01	1.67E-01	3.22E-01
2002	10	29	1.82E+00	0.00E+00	7.46E-01	0.00E+00	0.00E+00	2.16E+00	3.52E-04	1.52E+00	9.62E-01	2.81E-06	1.32E-07	1.62E-05	6.23E-06	1.46E+00	2.16E+00	1.31E+00	0.00E+00	5.41E-01	0.00E+00	0.00E+00	2.00E+00	3.52E-04	1.52E+00	7.71E-04	2.81E-06	1.32E-07	1.62E-05	6.23E-06	1.46E+00	1.25E+00	5.09E-01	0.00E+00	2.05E-01	0.00E+00	0.00E+00	1.65E-01	0.00E+00	2.21E-06	9.61E-01	1.44E-14	0.00E+00	0.00E+00	8.55E-19	2.69E-05	9.14E-01
2002	10	30	3.15E+00	5.55E-02	1.53E+00	6.29E-03	1.52E-02	5.02E+00	1.42E+00	5.52E+00	1.38E+00	4.58E+00	2.83E-01	5.81E-01	6.25E-01	4.71E+00	3.92E+00	2.15E+00	4.00E-03	1.34E+00	1.04E-03	2.02E-03	4.95E+00	1.38E+00	4.94E+00	7.48E-02	1.94E-02	8.81E-03	4.16E-02	2.85E-02	4.67E+00	2.30E+00	1.00E+00	5.15E-02	1.89E-01	5.24E-03	1.32E-02	6.81E-02	3.38E-02	5.81E-01	1.30E+00	4.56E+00	2.74E-01	5.39E-01	5.96E-01	4.35E-02	1.61E+00
2002	10	31	4.91E-01	8.74E-03	1.64E-01	2.60E-03	1.09E-02	4.76E+00	1.89E+00	9.47E+00	1.77E-01	1.11E+01	3.15E-01	2.24E+00	2.64E+00	5.75E+00	6.71E-01	4.46E-01	2.04E-03	1.62E-01	7.23E-04	1.40E-03	4.76E+00	1.58E+00	7.06E+00	8.17E-02	1.46E-02	5.04E-03	5.53E-02	3.06E-02	5.56E+00	5.95E-01	4.50E-02	6.70E-03	1.75E-03	1.88E-03	9.49E-03	3.27E-03	3.07E-01	2.41E+00	9.49E-02	1.11E+01	3.10E-01	2.18E+00	2.61E+00	1.84E-01	7.60E-02
2002	11	1	3.66E-01	3.68E-05	1.32E-01	0.00E+00	4.03E-07	3.64E+00	1.26E+00	6.61E+00	4.55E-02	9.36E+00	1.46E-02	1.44E+00	1.63E+00	4.47E+00	5.26E-01	3.57E-01	3.68E-05	1.32E-01	0.00E+00	4.03E-07	3.64E+00	1.11E+00	4.72E+00	4.55E-02	2.61E-03	1.90E-04	3.27E-02	1.21E-02	4.43E+00	4.84E-01	9.08E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-01	1.89E+00	4.40E-07	9.36E+00	1.44E-02	1.41E+00	1.61E+00	3.99E-02	4.28E-02
2002	11	2	3.98E-01	9.04E-04	2.79E-01	4.94E-02	2.13E-01	5.72E+00	1.84E+00	7.51E+00	9.17E-02	1.02E+01	6.35E-01	3.21E+00	4.26E+00	5.92E+00	4.89E-01	3.77E-01	7.40E-04	2.79E-01	1.01E-04	3.43E-04	5.72E+00	1.54E+00	5.63E+00	7.86E-02	1.08E-02	2.82E-03	4.03E-02	2.27E-02	5.77E+00	4.35E-01	2.06E-02	1.64E-04	0.00E+00	4.93E-02	2.13E-01	1.27E-07	2.95E-01	1.88E+00	1.31E-02	1.02E+01	6.33E-01	3.17E+00	4.24E+00	1.48E-01	5.43E-02
2002	11	3	1.26E+00	4.72E-04	4.42E-01	3.77E-05	1.43E-04	2.37E+00	8.54E-01	3.30E+00	9.55E-02	5.79E+00	8.22E-03	8.24E-01	2.96E-01	2.70E+00	1.89E+00	1.17E+00	4.54E-04	4.07E-01	3.77E-05	1.39E-04	2.20E+00	8.20E-01	3.15E+00	8.07E-02	1.42E-02	2.46E-03	3.32E-02	2.48E-02	2.66E+00	1.59E+00	9.35E-02	1.88E-05	3.52E-02	0.00E+00	3.95E-06	1.66E-01	3.36E-02	1.45E-01	1.48E-02	5.77E+00	5.76E-03	7.91E-01	2.71E-01	3.84E-02	3.02E-01
2002	11	4	4.29E-01	5.62E-05	3.75E-01	1.93E-07	1.22E-05	2.66E+00	8.27E-01	4.56E+00	3.38E-02	6.05E+00	9.41E-04	9.09E-01	3.38E-01	3.48E+00	7.79E-01	3.43E-01	3.39E-05	3.57E-01	1.93E-07	9.13E-06	2.58E+00	7.84E-01	3.83E+00	2.77E-02	3.43E-03	3.80E-04	1.45E-02	8.21E-03	3.44E+00	5.68E-01	8.61E-02	2.23E-05	1.85E-02	0.00E+00	3.06E-06	7.71E-02	4.23E-02	7.28E-01	6.09E-03	6.05E+00	5.61E-04	8.95E-01	3.30E-01	3.85E-02	2.11E-01
2002	11	5	1.73E-01	4.22E-06	6.71E-02	0.00E+00	2.07E-06	1.28E+00	4.05E-01	2.32E+00	3.90E-02	2.78E+00	1.42E-02	5.12E-01	3.00E-01	1.04E+00	3.32E-01	1.44E-01	0.00E+00	6.51E-02	0.00E+00	0.00E+00	1.27E+00	3.73E-01	1.60E+00	3.72E-02	2.74E-03	5.19E-05	3.60E-03	7.32E-03	1.03E+00	2.61E-01	2.89E-02	4.22E-06	2.02E-03	0.00E+00	2.07E-06	4.98E-03	3.23E-02	7.29E-01	1.76E-03	2.78E+00	1.41E-02	5.09E-01	2.93E-01	1.61E-02	7.08E-02
2002	11	6	6.76E-02	0.00E+00	2.83E-03	0.00E+00	1.01E-09	4.17E-01	3.68E-01	1.05E+00	4.56E-04	1.75E+00	4.11E-02	5.37E-01	1.96E-01	6.68E-01	1.40E-01	6.76E-02	0.00E+00	2.83E-03	0.00E+00	0.00E+00	4.17E-01	3.36E-01	7.52E-01	4.56E-04	1.95E-05	0.00E+00	5.05E-04	2.89E-04	6.67E-01	1.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-09	0.00E+00	3.19E-02	2.98E-01	1.05E-16	1.75E+00	4.11E-02	5.37E-01	1.96E-01	1.70E-03	0.00E+00
2002	11	7	6.13E-02	0.00E+00	2.57E-02	0.00E+00	9.75E-06	8.18E-01	3.92E-01	1.72E+00	4.04E-04	3.05E+00	6.41E-02	4.00E-01	2.84E-01	8.67E-01	9.16E-02	6.13E-02	0.00E+00	2.57E-02	0.00E+00	0.00E+00	8.18E-01	3.66E-01	1.28E+00	4.04E-04	3.29E-06	0.00E+00	5.64E-03	7.01E-04	8.36E-01	9.16E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.75E-06	0.00E+00	2.53E-02	4.38E-01	3.14E-22	3.05E+00	6.41E-02	3.94E-01	2.84E-01	3.08E-02	0.00E+00
2002	11	8	1.47E+00	4.19E-01	5.85E-01	9.83E-02	1.66E-01	3.49E+00	1.08E+00	4.94E+00	3.09E-01	2.02E+00	5.19E+00	1.84E-01	5.43E-01	2.36E+00	2.32E+00	1.47E+00	1.58E-02	5.80E-01	5.42E-03	8.49E-03	3.48E+00	1.07E+00	4.18E+00	2.53E-01	5.72E-02	2.86E-02	8.98E-02	7.88E-02	2.33E+00	2.30E+00	4.40E-03	4.03E-01	4.45E-03	9.29E-02	1.58E-01	1.34E-02	9.64E-03	7.64E-01	5.67E-02	1.96E+00	5.17E+00	9.46E-02	4.64E-01	2.77E-02	1.83E-02
2002	11	9	1.60E+00	3.44E-05	3.51E-01	2.41E-08	1.52E-05	1.86E+00	6.32E-01	4.25E+00	9.88E-02	2.20E+00	3.76E-02	3.99E-01	6.49E-01	3.01E+00	2.57E+00	1.57E+00	3.24E-05	3.46E-01	0.00E+00	1.45E-05	1.83E+00	6.21E-01	3.55E+00	9.34E-02	1.79E-02	1.29E-03	3.02E-02	3.33E-02	3.00E+00	2.46E+00	2.41E-02	1.99E-06	5.05E-03	2.41E-08	7.13E-07	3.15E-02	1.13E-02	7.07E-01	5.40E-03	2.18E+00	3.63E-02	3.69E-01	6.15E-01	9.42E-03	1.08E-01
2002	11	10	5.38E-01	3.06E-05	3.22E-01	1.59E-07	3.28E-05	2.75E+00	9.97E-01	4.61E+00	4.16E-02	2.83E+00	7.36E-02	5.18E-01	3.75E-01	2.92E+00	9.10E-01	4.86E-01	3.06E-05	3.20E-01	1.59E-07	3.13E-05	2.74E+00	9.53E-01	3.79E+00	4.07E-02	4.12E-03	7.32E-04	1.81E-02	1.07E-02	2.89E+00	7.46E-01	5.18E-02	0.00E+00	2.65E-03	0.00E+00	1.48E-06	7.72E-03	4.42E-02	8.21E-01	9.21E-04	2.83E+00	7.29E-02	5.00E-01	3.64E-01	2.58E-02	1.63E-01
2002	11	11	8.00E-02	0.00E+00	7.84E-03	0.00E+00	0.00E+00	5.49E-01	4.49E-01	1.50E+00	1.20E-03	2.59E+00	7.67E-03	7.16E-01	2.32E-01	8.34E-01	1.29E-01	7.35E-02	0.00E+00	7.82E-03	0.00E+00	0.00E+00	5.48E-01	4.11E-01	8.28E-01	1.20E-03	2.94E-05	0.00E+00	9.87E-04	2.68E-04	8.28E-01	1.17E-01	6.43E-03	0.00E+00	2.62E-05	0.00E+00	0.00E+00	8.35E-04	3.82E-02	6.67E-01	1.76E-16	2.59E+00	7.67E-03	7.15E-01	2.31E-01	6.07E-03	1.23E-02
2002	11	12	3.01E-02	0.00E+00	3.37E-03	0.00E+00	0.00E+00	3.91E-01	2.67E-01	1.04E+00	3.09E-17	9.33E-01	5.17E-02	4.19E-01	1.77E-01	4.79E-01	5.18E-02	3.01E-02	0.00E+00	3.37E-03	0.00E+00	0.00E+00	3.91E-01	2.59E-01	6.02E-01	0.00E+00	0.00E+00	0.00E+00	3.93E-06	0.00E+00	4.79E-01	5.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.89E-03	4.41E-01	3.09E-17	9.33E-01	5.17E-02	4.19E-01	1.77E-01	0.00E+00	0.00E+00
2002	11	13	6.46E-02	0.00E+00	1.32E-03	0.00E+00	0.00E+00	5.18E-01	4.02E-01	1.39E+00	7.19E-17	2.39E+00	4.07E-03	6.41E-01	2.02E-01	7.79E-01	1.15E-01	6.46E-02	0.00E+00	1.32E-03	0.00E+00	0.00E+00	5.18E-01	3.61E-01	7.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.78E-01	1.15E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.04E-02	6.75E-01	7.19E-17	2.39E+00	4.07E-03	6.41E-01	2.02E-01	7.41E-04	0.00E+00
2002	11	14	7.93E-02	0.00E+00	7.01E-04	0.00E+00	0.00E+00	4.93E-01	3.41E-01	1.39E+00	3.40E-15	3.32E+00	3.53E-03	4.28E-01	2.86E-01	7.41E-01	1.17E-01	7.93E-02	0.00E+00	7.01E-04	0.00E+00	0.00E+00	4.93E-01	3.01E-01	7.87E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.41E-01	1.17E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.08E-02	6.00E-01	3.40E-15	3.32E+00	3.53E-03	4.28E-01	2.86E-01	0.00E+00	0.00E+00
2002	11	15	1.35E-01	0.00E+00	9.28E-03	0.00E+00	2.11E-06	7.94E-01	5.23E-01	2.15E+00	5.86E-03	3.62E+00	4.45E-02	5.58E-01	2.53E-01	1.12E+00	1.92E-01	1.35E-01	0.00E+00	9.28E-03	0.00E+00	6.61E-08	7.94E-01	4.86E-01	1.43E+00	5.86E-03	8.95E-04	2.05E-05	2.15E-03	1.92E-03	1.10E+00	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-06	0.00E+00	3.61E-02	7.18E-01	2.16E-17	3.62E+00	4.44E-02	5.55E-01	2.51E-01	2.08E-02	0.00E+00
2002	11	16	1.01E-01	0.00E+00	1.32E-02	0.00E+00	6.63E-05	7.32E-01	2.83E-01	9.75E-01	9.77E-03	1.52E+00	7.41E-02	3.76E-01	2.46E-01	6.20E-01	2.26E-01	1.01E-01	0.00E+00	1.32E-02	0.00E+00	0.00E+00	7.32E-01	2.72E-01	6.76E-01	9.77E-03	1.30E-03	7.79E-06	4.85E-03	2.90E-03	6.20E-01	2.26E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-05	0.00E+00	1.10E-02	3.00E-01	8.51E-21	1.52E+00	7.41E-02	3.71E-01	2.43E-01	4.30E-04	0.00E+00
2002	11	17	1.04E-02	0.00E+00	5.52E-03	0.00E+00	0.00E+00	3.95E-01	1.76E-01	5.53E-01	1.33E-18	7.57E-01	2.14E-02	1.81E-01	1.68E-01	3.41E-01	1.58E-02	1.04E-02	0.00E+00	5.52E-03	0.00E+00	0.00E+00	3.95E-01	1.75E-01	5.00E-01	0.00E+00	0.00E+00	0.00E+00	6.15E-05	0.00E+00	3.41E-01	1.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.90E-04	5.35E-02	1.33E-18	7.57E-01	2.14E-02	1.81E-01	1.68E-01	0.00E+00	0.00E+00
2002	11	18	1.21E-02	0.00E+00	7.25E-03	0.00E+00	0.00E+00	4.89E-01	1.53E-01	5.71E-01	1.16E-32	5.78E-01	4.06E-02	9.01E-02	1.62E-01	3.59E-01	4.62E-02	1.21E-02	0.00E+00	7.25E-03	0.00E+00	0.00E+00	4.89E-01	1.52E-01	5.11E-01	0.00E+00	0.00E+00	0.00E+00	8.40E-04	4.47E-06	3.59E-01	4.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.97E-04	5.95E-02	1.16E-32	5.78E-01	4.06E-02	8.92E-02	1.62E-01	0.00E+00	0.00E+00
2002	11	19	5.56E-02	0.00E+00	2.55E-03	0.00E+00	0.00E+00	3.64E-01	3.51E-01	9.34E-01	7.46E-18	1.37E+00	2.24E-02	5.43E-01	2.12E-01	6.08E-01	9.44E-02	5.56E-02	0.00E+00	2.55E-03	0.00E+00	0.00E+00	3.64E-01	3.31E-01	5.43E-01	0.00E+00	0.00E+00	0.00E+00	4.29E-05	0.00E+00	6.08E-01	9.44E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-02	3.92E-01	7.46E-18	1.37E+00	2.24E-02	5.43E-01	2.12E-01	0.00E+00	0.00E+00
2002	11	20	9.40E-02	0.00E+00	1.65E-03	0.00E+00	0.00E+00	4.51E-01	5.02E-01	1.15E+00	2.26E-17	2.35E+00	4.60E-02	7.42E-01	2.49E-01	8.85E-01	1.50E-01	9.40E-02	0.00E+00	1.65E-03	0.00E+00	0.00E+00	4.51E-01	4.54E-01	7.22E-01	0.00E+00	0.00E+00	0.00E+00	3.40E-05	1.24E-08	8.74E-01	1.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.79E-02	4.25E-01	2.26E-17	2.35E+00	4.60E-02	7.42E-01	2.49E-01	1.05E-02	0.00E+00
2002	11	21	7.23E-02	0.00E+00	1.43E-03	0.00E+00	0.00E+00	4.34E-01	4.53E-01	1.21E+00	1.42E-16	3.23E+00	1.10E-02	7.34E-01	2.39E-01	7.95E-01	1.05E-01	7.23E-02	0.00E+00	1.43E-03	0.00E+00	0.00E+00	4.34E-01	4.14E-01	7.62E-01	0.00E+00	0.00E+00	0.00E+00	6.12E-05	0.00E+00	7.44E-01	1.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-02	4.44E-01	1.42E-16	3.23E+00	1.10E-02	7.34E-01	2.39E-01	5.09E-02	0.00E+00
2002	11	22	1.42E+00	5.64E-03	9.45E-01	4.07E-06	4.34E-05	2.07E+00	7.48E-01	2.78E+00	3.63E+00	4.52E+00	3.98E-02	5.94E-01	7.52E-01	3.07E+00	1.84E+00	1.37E+00	6.17E-05	7.66E-01	1.44E-06	8.16E-06	1.90E+00	6.61E-01	2.38E+00	8.07E-03	8.49E-04	2.15E-04	2.19E-03	1.34E-03	3.01E+00	1.79E+00	4.86E-02	5.58E-03	1.79E-01	2.63E-06	3.52E-05	1.75E-01	8.76E-02	4.00E-01	3.62E+00	4.52E+00	3.95E-02	5.92E-01	7.50E-01	5.16E-02	5.23E-02
2002	11	23	2.32E+00	3.02E-04	1.29E+00	4.24E-06	2.08E-05	2.14E+00	4.58E-01	2.33E+00	3.23E+00	8.89E-03	1.45E-03	1.43E-02	8.93E-03	3.37E+00	2.90E+00	2.25E+00	2.62E-04	1.21E+00	4.18E-06	1.99E-05	2.08E+00	4.56E-01	2.26E+00	3.28E-02	3.23E-03	7.79E-04	9.43E-03	5.43E-03	3.36E+00	2.76E+00	7.05E-02	4.02E-05	7.99E-02	5.49E-08	9.46E-07	6.70E-02	1.53E-03	6.99E-02	3.19E+00	5.67E-03	6.76E-04	4.83E-03	3.49E-03	9.86E-03	1.39E-01
2002	11	24	1.20E+00	5.51E-02	6.41E-01	1.00E-02	1.86E-02	4.03E+00	2.85E+00	6.92E+00	8.91E-01	1.18E+01	1.86E-01	1.46E+00	1.38E+00	5.79E+00	1.66E+00	1.13E+00	9.88E-03	6.07E-01	3.22E-03	5.95E-03	3.98E+00	2.71E+00	5.71E+00	1.32E-01	4.39E-02	2.11E-02	9.11E-02	6.23E-02	5.67E+00	1.49E+00	6.54E-02	4.52E-02	3.43E-02	6.82E-03	1.27E-02	4.92E-02	1.36E-01	1.21E+00	7.59E-01	1.17E+01	1.65E-01	1.36E+00	1.32E+00	1.27E-01	1.69E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	11	25	8.70E-01	6.51E-05	3.58E-01	9.15E-07	5.36E-06	1.81E+00	8.34E-01	3.17E+00	8.34E-03	5.31E+00	2.40E-04	1.09E+00	1.19E+00	2.18E+00	1.13E+00
2002	11	26	7.11E-02	0.00E+00	6.61E-04	0.00E+00	0.00E+00	4.71E-01	5.76E-01	1.65E+00	1.96E-14	9.96E+00	2.32E-15	8.58E-01	1.79E+00	9.92E-01	1.13E-01
2002	11	27	1.27E-01	0.00E+00	3.84E-02	0.00E+00	0.00E+00	5.61E-01	6.68E-01	1.38E+00	4.08E-03	7.87E+00	2.79E-04	9.12E-01	7.08E-01	9.40E-01	2.71E-01
2002	11	28	6.36E-01	5.61E-06	2.01E-01	3.61E-08	1.66E-06	1.14E+00	6.24E-01	2.49E+00	3.17E-02	4.53E+00	5.50E-03	4.94E-01	4.22E-01	1.60E+00	8.37E-01
2002	11	29	2.32E+00	4.81E-01	1.15E+00	9.37E-02	1.82E-01	5.29E+00	2.05E+00	8.39E+00	3.11E+00	7.54E+00	1.62E+00	1.60E+00	1.53E+00	7.06E+00	3.37E+00
2002	11	30	5.86E-01	5.43E-04	5.52E-01	4.32E-05	1.42E-04	5.56E+00	2.59E+00	7.27E+00	7.32E-02	1.04E+01	2.29E-03	3.50E+00	3.37E+00	7.34E+00	8.62E-01
2002	12	1	3.38E-01	8.73E-05	4.19E-01	3.66E-06	1.62E-05	4.35E+00	1.71E+00	6.89E+00	8.35E-02	9.19E+00	7.39E-04	1.53E+00	2.29E-01	4.67E+00	6.87E-01
2002	12	2	1.01E+00	4.23E-01	5.67E-01	3.67E-02	4.00E-02	2.37E+00	2.17E+00	6.26E+00	1.10E+00	1.19E+01	3.82E-01	1.54E+00	1.68E+00	5.45E+00	1.25E+00
2002	12	3	2.30E+00	1.46E-01	1.26E+00	4.53E-04	1.38E-03	2.72E+00	1.01E+00	4.42E+00	3.08E+00	4.42E-01	2.63E-01	1.38E-01	1.69E-01	3.66E+00	3.29E+00
2002	12	4	1.71E+00	2.25E-01	1.42E+00	1.73E-02	2.91E-02	5.26E+00	3.02E+00	8.34E+00	1.10E+00	1.43E+01	6.34E-01	3.79E+00	6.22E+00	6.74E+00	2.59E+00
2002	12	5	7.68E-02	0.00E+00	3.65E-03	0.00E+00	0.00E+00	3.83E-01	3.25E-01	1.15E+00	9.77E-05	4.07E+00	4.88E-04	3.60E-01	2.44E-01	6.74E-01	1.30E-01
2002	12	6	6.95E-02	0.00E+00	1.70E-04	0.00E+00	0.00E+00	3.87E-01	3.34E-01	1.40E+00	1.48E-13	6.50E+00	1.38E-13	2.92E-01	5.09E-01	7.42E-01	1.09E-01
2002	12	7	8.08E-02	0.00E+00	2.40E-04	0.00E+00	0.00E+00	4.80E-01	5.22E-01	1.67E+00	5.02E-17	7.66E+00	1.47E-08	4.26E-01	3.72E-01	9.53E-01	1.32E-01
2002	12	8	1.34E-01	0.00E+00	2.60E-03	0.00E+00	0.00E+00	6.70E-01	6.32E-01	1.97E+00	7.24E-17	5.14E+00	1.86E-03	9.48E-01	2.07E-01	1.05E+00	2.00E-01
2002	12	9	4.60E-01	0.00E+00	1.93E-01	0.00E+00	0.00E+00	1.39E+00	7.21E-01	3.18E+00	1.24E-02	3.23E+00	2.27E-02	6.63E-01	3.63E-01	1.78E+00	6.87E-01
2002	12	10	7.92E-02	0.00E+00	1.52E-02	0.00E+00	1.13E-08	6.14E-01	2.92E-01	1.29E+00	6.59E-04	1.11E+00	7.73E-02	2.36E-01	2.86E-01	5.86E-01	1.26E-01
2002	12	11	8.56E-02	0.00E+00	1.04E-02	0.00E+00	0.00E+00	5.37E-01	4.61E-01	1.55E+00	9.09E-17	1.29E+00	3.07E-02	6.81E-01	2.26E-01	9.06E-01	1.17E-01
2002	12	12	4.61E-02	0.00E+00	9.87E-03	0.00E+00	1.54E-04	3.98E-01	3.44E-01	1.04E+00	5.68E-04	9.43E-01	8.52E-02	4.38E-01	2.64E-01	6.08E-01	8.79E-02
2002	12	13	6.18E-02	0.00E+00	3.29E-02	0.00E+00	2.26E-02	7.32E-01	6.11E-01	1.86E+00	4.99E-03	1.76E+00	3.56E-01	5.62E-01	5.55E-01	9.29E-01	1.99E-01
2002	12	14	2.55E-01	1.54E-07	5.50E-02	1.79E-05	1.73E-01	1.77E+00	4.44E-01	1.89E+00	2.81E-02	1.07E+00	4.98E-01	2.92E-01	3.33E-01	1.23E+00	5.08E-01
2002	12	15	8.84E-02	0.00E+00	4.54E-02	6.42E-02	1.00E-01	7.62E-01	4.99E-01	1.08E+00	1.17E-02	1.21E+00	1.81E+00	5.65E-02	6.36E-01	7.78E-01	2.98E-01
2002	12	16	1.36E+00	3.76E-01	3.68E-01	4.39E-01	3.13E-01	1.92E+00	1.19E+00	3.27E+00	1.19E-01	2.19E+00	5.59E+00	2.89E-01	5.24E-01	1.91E+00	1.73E+00
2002	12	17	1.21E-01	0.00E+00	8.95E-02	0.00E+00	0.00E+00	1.37E+00	8.16E-01	2.87E+00	4.76E-03	6.01E+00	3.38E-03	1.03E+00	2.97E-01	1.86E+00	2.48E-01
2002	12	18	3.31E-01	3.84E-04	4.62E-01	7.33E-05	1.47E-04	3.65E+00	1.73E+00	7.29E+00	7.08E-02	8.16E+00	4.53E-03	1.62E+00	2.31E-01	5.52E+00	5.34E-01
2002	12	19	5.92E-01	3.90E-02	4.38E-01	6.75E-03	1.43E-02	2.35E+00	2.33E+00	5.50E+00	4.47E-01	1.06E+01	3.58E-01	1.80E+00	1.69E+00	4.05E+00	9.42E-01
2002	12	20	6.97E+00	2.03E-01	3.71E+00	3.25E-02	5.25E-02	6.71E+00	1.21E+00	7.96E+00	7.66E+00	3.13E+00	5.35E-01	4.86E-01	5.95E-01	8.71E+00	8.84E+00
2002	12	21	6.12E+00	5.01E-01	3.48E+00	6.58E-03	1.16E-02	7.68E+00	1.89E+00	9.62E+00	7.77E+00	1.10E+00	8.29E-01	3.39E-01	3.97E-01	9.68E+00	8.23E+00
2002	12	22	6.76E-01	3.14E-01	5.35E-01	2.89E-02	5.00E-02	5.56E+00	3.10E+00	9.90E+00	6.11E-01	1.28E+01	1.27E+00	3.62E+00	4.75E+00	7.64E+00	9.20E-01
2002	12	23	4.57E-01	1.31E-05	8.39E-02	5.06E-08	4.10E-06	3.41E+00	1.45E+00	5.59E+00	3.14E-02	9.77E+00	2.41E-04	1.17E+00	1.94E+00	3.91E+00	5.56E-01
2002	12	24	1.40E-01	0.00E+00	8.04E-03	0.00E+00	0.00E+00	5.09E-01	3.49E-01	1.44E+00	8.04E-16	5.24E+00	5.77E-04	3.65E-01	4.57E-01	9.31E-01	2.66E-01
2002	12	25	6.31E-02	0.00E+00	2.36E-03	0.00E+00	0.00E+00	3.42E-01	3.27E-01	9.98E-01	2.92E-16	1.34E+00	1.97E-02	5.46E-01	1.62E-01	5.83E-01	8.66E-02
2002	12	26	1.81E-01	0.00E+00	4.04E-02	0.00E+00	2.12E-04	8.86E-01	3.49E-01	1.42E+00	7.54E-03	1.60E+00	1.22E-01	2.89E-01	2.72E-01	8.58E-01	4.17E-01
2002	12	27	1.04E+00	1.75E-01	3.53E-01	2.32E-02	3.93E-02	2.14E+00	1.14E+00	4.56E+00	9.79E-01	6.84E+00	3.40E-01	9.55E-01	8.20E-01	3.06E+00	1.47E+00
2002	12	28	6.40E-01	3.72E-02	3.00E-01	1.86E-02	3.41E-02	1.34E+00	2.72E-01	1.90E+00	1.33E+00	2.11E+00	1.93E-01	1.42E-01	3.23E-01	1.32E+00	9.05E-01
2002	12	29	1.81E+00	1.62E-03	1.08E+00	3.37E-04	9.56E-04	3.42E+00	8.05E-01	4.01E+00	9.51E-01	3.44E+00	1.60E-02	6.84E-01	3.34E-01	3.49E+00	2.27E+00
2002	12	30	1.07E-01	0.00E+00	6.45E-02	0.00E+00	2.35E-06	1.59E+00	4.89E-01	2.05E+00	9.98E-03	2.35E+00	5.02E-02	5.19E-01	2.86E-01	1.11E+00	2.22E-01
2002	12	31	3.53E+00	1.05E-03	2.60E+00	8.23E-05	6.00E-04	5.07E+00	1.23E+00	5.92E+00	3.13E+00	4.81E+00	7.31E-02	1.10E+00	1.40E+00	5.20E+00	4.55E+00
2003	1	1	7.88E-02	0.00E+00	1.82E-02	0.00E+00	3.31E-10	6.17E-01	2.93E-01	1.26E+00	4.04E-03	2.20E+00	5.42E-02	2.48E-01	2.59E-01	6.63E-01	1.70E-01
2003	1	2	2.45E-01	1.48E-07	6.55E-02	4.40E-08	6.04E-04	1.08E+00	2.77E-01	1.19E+00	3.23E-02	1.10E+00	1.75E-01	2.91E-01	3.03E-01	7.49E-01	3.95E-01
2003	1	3	1.84E-01	0.00E+00	3.62E-02	0.00E+00	1.14E-04	9.24E-01	3.05E-01	1.50E+00	9.45E-03	1.16E+00	9.80E-02	2.63E-01	2.78E-01	9.08E-01	3.26E-01
2003	1	4	4.29E-02	0.00E+00	2.01E-03	0.00E+00	0.00E+00	3.54E-01	3.63E-01	1.12E+00	1.64E-16	1.97E+00	1.86E-02	6.28E-01	2.03E-01	6.01E-01	6.60E-02
2003	1	5	6.51E-02	0.00E+00	3.09E-04	0.00E+00	0.00E+00	4.75E-01	4.33E-01	1.55E+00	1.66E-14	6.07E+00	4.19E-05	6.02E-01	1.30E+00	9.35E-01	9.99E-02
2003	1	6	5.07E-02	0.00E+00	3.45E-02	0.00E+00	0.00E+00	6.00E-01	3.68E-01	1.32E+00	1.70E-03	2.73E+00	3.87E-03	4.82E-01	2.08E-01	8.84E-01	1.54E-01
2003	1	7	4.16E-02	0.00E+00	3.43E-02	0.00E+00	0.00E+00	1.07E+00	2.87E-01	1.93E+00	1.89E-02	2.39E+00	4.87E-03	3.98E-01	1.63E-01	1.11E+00	4.92E-02
2003	1	8	5.66E-01	0.00E+00	4.67E-01	0.00E+00	0.00E+00	9.30E-01	2.53E-01	2.11E+00	1.75E+00	2.20E+00	1.18E-04	7.21E-01	5.47E-01	1.63E+00	6.64E-01
2003	1	9	4.08E+00	3.36E-01	2.55E+00	2.64E-02	4.27E-02	5.37E+00	1.66E+00	6.45E+00	3.27E+00	5.12E+00	1.24E+00	7.34E-01	1.05E+00	6.43E+00	4.91E+00
2003	1	10	2.60E+00	1.00E-01	2.47E+00	6.70E-02	1.28E-01	6.55E+00	1.81E+00	7.48E+00	4.16E+00	8.93E+00	5.86E-01	1.59E+00	1.12E+00	5.85E+00	3.40E+00
2003	1	11	1.97E-01	5.72E-05	1.78E-01	5.10E-07	1.04E-05	3.03E+00	6.78E-01	3.64E+00	3.67E-02	3.02E+00	1.06E-02	8.71E-01	2.19E-01	2.55E+00	2.95E-01
2003	1	12	1.23E+00	1.23E-03	2.48E-01	5.02E-04	7.95E-03	1.34E+00	1.61E+00	2.94E+00	9.80E-02	3.19E+00	5.43E-01	2.80E-01	3.60E-01	2.13E+00	1.82E+00
2003	1	13	1.82E+00	2.58E-03	1.29E+00	8.39E-04	1.00E-02	3.14E+00	2.41E+00	4.86E+00	9.71E-01	1.06E+01	5.33E-02	9.72E-01	9.58E-01	4.24E+00	2.37E+00
2003	1	14	3.62E+00	1.98E+00	2.18E+00	3.33E-01	4.47E-01	5.26E+00	2.76E+00	7.73E+00	4.26E+00	1.16E+01	3.23E+00	1.53E+00	1.51E+00	7.80E+00	4.45E+00
2003	1	15	5.27E-01	4.21E-05	1.74E-01	4.98E-09	1.37E-05	2.30E+00	1.29E+00	5.87E+00	7.18E-02	9.62E+00	1.23E-03	1.13E+00	1.65E+00	3.38E+00	7.57E-01
2003	1	16	6.20E-01	0.00E+00	2.49E-01	0.00E+00	0.00E+00	1.08E+00	7.37E-01	2.55E+00	3.08E-03	7.39E+00	3.27E-05	6.23E-01	1.35E+00	1.45E+00	7.53E-01
2003	1	17	1.14E+00	8.89E-05	8.22E-01	3.93E-06	2.26E-05	2.83E+00	1.09E+00	3.95E+00	1.43E-02	6.47E+00	4.79E-03	2.19E+00	2.48E+00	2.81E+00	1.61E+00
2003	1	18	3.26E-01	0.00E+00	9.24E-02	0.00E+00	0.00E+00	1.06E+00	4.74E-01	2.55E+00	1.62E-03	4.58E+00	1.31E-03	6.01E-01	2.94E-01	1.89E+00	6.04E-01
2003	1	19	5.05E-02	0.00E+00	2.58E-03	0.00E+00	0.00E+00	3.73E-01	2.94E-01	8.12E-01	1.10E-03	2.40E+00	4.40E-03	4.50E-01	2.09E-01	5.84E-01	9.44E-02
2003	1	20	5.58E-01	4.71E-01	2.75E-01	2.09E-01	4.88E-01	1.95E+00	1.19E+00	3.43E+00	1.18E-01	5.36E+00	5.23E+00	7.69E-01	3.02E-01	2.33E+00	9.03E-01
2003	1	21	9.09E-01	5.04E-02	5.30E-01	2.60E-02	1.25E-02	1.11E+00	6.26E-02	1.48E+00	1.64E+00	2.92E-03	5.84E-03	1.43E-03	1.92E-03	1.80E+00	1.15E+00
2003	1	22	4.07E+00	6.82E-01	2.14E+00	2.11E-03	2.12E-03	4.34E+00	6.11E-01	4.71E+00	4.67E+00	1.66E-01	8.91E-01	4.38E-02	5.36E-02	4.82E+00	5.55E+00
2003	1	23	3.73E-01	1.17E-01	1.67E-01	2.51E-02	4.62E-02	1.39E+00	7.21E-01	2.13E+00	1.21E-01	1.01E+00	6.83E-01	3.21E-01	4.46E-01	1.13E+00	5.29E-01
2003	1	24	3.56E-01	6.94E-05	1.01E-01	7.26E-07	2.38E-04	9.16E-01	5.28E-01	1.90E+00	2.90E-02	1.94E+00	2.72E-01	3.68E-01	2.64E-01	1.43E+00	5.41E-01
2003	1	25	8.20E-01	1.40E-01	1.46E-01	5.65E-01	1.62E+00	1.51E+00	1.31E+00	3.19E+00	1.40E-01	1.67E+00	9.37E+00	1.45E-01	2.83E-01	2.01E+00	1.24E+00
2003	1	26	6.69E-02	0.00E+00	1.69E-02	0.00E+00	0.00E+00	6.02E-01	2.13E-01	9.01E-01	9.75E-04	8.12E-01	8.42E-02	1.31E-01	3.20E-01	4.88E-01	1.49E-01
2003	1	27	2.37E-01	8.51E-04	2.98E-01	6.21E-05	2.89E-04	3.13E+00	7.64E-01	3.88E+00	8.39E-02	2.91E+00	2.15E-02	7.42E-01	4.94E-01	2.41E+00	6.82E-01
2003	1	28	1.97E+00	1.49E-03	1.15E+00	4.34E-04	1.75E-03	5.74E+00	2.51E+00	8.19E+00	2.81E-01	1.42E+01	1.58E-02	1.72E+00	7.98E-01	6.91E+00	3.03E+00
2003	1	29	1.12E-01	6.98E-08	1.36E-03	6.20E-08	3.90E-07	4.63E-01	4.38E-01	1.43E+00	2.49E-04	3.35E+00	9.31E-03	4.88E-01	2.14E-01	7.76E-01	1.80E-01
2003	1	30	4.26E-02	0.00E+00	6.46E-03	0.00E+00	5.38E-05	4.41E-01	3.23E-01	9.99E-01	2.58E-17	1.43E+00	3.83E-02	3.69E-01	2.36E-01	5.41E-01	6.48E-02
2003	1	31	7.78E-01	3.28E-07	2.05E-01	4.09E-06	2.74E-02	2.28E+00	3.85E-01	1.98E+00	8.11E-02	1.32E+00	4.27E-01	8.48E-02	4.65E-01	1.54E+00	1.30E+00
2003	2	1	4.83E-01	1.29E-02	2.05E-01	2.72E-04	6.17E-04	2.51E+00	1.13E+00	4.37E+00	3.55E-01	5.26E+00	2.59E-02	1.29E+00	8.78E-01	2.73E+00	7.72E-01
2003	2	2	1.23E+00	5.28E-01	6.79E-01	9.82E-02	1.25E-01	4.28E+00	1.86E+00	5.43E+00	3.79E-01	7.05E+00	1.63E+00	1.26E+00	9.48E-01	5.35E+00	1.73E+00
2003	2	3	2.26E+00	3.73E-04	1.68E+00	2.18E-05	8.08E-05	3.83E+00	1.14E+00	4.02E+00	2.56E+00	4.88E+00	3.51E-03	1.87E+00	1.64E+00	3.57E+00	2.77E+00
2003	2	4	1.31E+00	2.27E-03	7.33E-01	3.19E-04	1.10E-03	4.48E+00	2.25E+00	8.26E+00	1.54E-01	9.69E+00	7.61E-03	1.84E+00	2.40E+00	5.43E+00	1.75E+00
2003	2	5	2.48E+00	8.45E-04	1.69E+00	4.96E-05	1.53E-04	3.75E+00	7.63E-01	5.40E+00	4.26E+00	1.72E+00	6.51E-03	1.11E+00	7.08E-01	4.59E+00	3.23E+00
2003	2	6	1.00E+00	4.30E-05	5.08E-01	1.65E-06	7.04E-06	3.90E+00	1.14E+00	6.41E+00	3.88E-02	6.77E+00	2.13E-03	2.23E+00	2.09E+00	5.14E+00	1.48E+00
2003	2	7	1.88E+00	1.10E-01	9.03E-01	4.30E-02	9.81E-02	3.23E+00	2.72E+00	6.33E+00	1.19E+00	9.77E+00	8.91E-01	2.28E+00	2.56E+00	4.24E+00	2.55E+00
2003	2	8	2.82E+00	7.15E-02	1.17E+00	7.26E-03	3.70E-02	4.05E+00	9.29E-01	5.23E+00	3.52E+00	4.57E+00	4.81E-01	9.83E-01	7.61E-01	4.85E+00	3.51E+00
2003	2	9	1.16E-01	0.00E+00	4.46E-03	0.00E+00	0.00E+00	5.69E-01	6.83E-01	2.56E+00	4.38E-04	5.54E+00	2.16E-03	8.17E-01	7.55E-01	1.14E+00	1.76E-01
2003	2	10	6.29E-01	1.96E-03	2.43E-01	1.12E-04	1.21E-03	3.01E+00	2.50E+00	7.67E+00	5.52E-01	7.86E+00	3.24E-02	1.98E+00	1.15E+00	4.87E+00	9.62E-01
2003	2	11	9.34E-01	1.08E-04	4.33E-01	3.94E-07	7.04E-06	2.08E+00	1.19E+00	4.79E+00	6.15E-02	8.96E+00	1.65E-03	1.26E+00	4.52E-01	3.26E+00	1.35E+00
2003	2	12	7.43E-01	5.49E-05	4.54E-01	3.60E-08	2.21E-06	2.26E+00	1.04E+00	3.85E+00	2.89E-02	8.75E+00	1.07E-03	1.08E+00	3.64E-01	2.80E+00	1.46E+00
2003	2	13	2.12E+00	4.69E-02	1.68E+00	7.16E-04	4.57E-03	4.54E+00	1.24E+00	7.10E+00	1.84E+00	8.42E+00	1.51E-01	1.31E+00	7.28E-01	5.43E+00	2.75E+00
2003	2	14	9.92E-01	4.66E-01	4.50E-01	8.24E-01	9.41E-01	2.69E+00	1.20E+00	4.03E+00	4.64E-01	1.07E+00	2.61E+00	1.46E-01	3.49E-01	3.03E+00	1.64E+00

Year	Month	Day	Baseline R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	11	25	7.93E-01	6.51E-05	3.42E-01	9.15E-07	5.36E-06	1.74E+00	6.11E-01	2.75E+00	6.60E-03	1.12E-03	1.50E-04	5.29E-03	2.64E-03	2.06E+00	9.61E-01
2002	11	26	7.11E-02	0.00E+00	6.61E-04	0.00E+00	0.00E+00	4.71E-01	5.07E-01	1.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.90E-01	1.13E-01
2002	11	27	1.19E-01	0.00E+00	3.84E-02	0.00E+00	0.00E+00	5.61E-01	6.05E-01	1.02E+00	2.76E-03	1.90E-04	1.94E-07	1.49E-03	6.86E-04	9.36E-01	2.66E-01
2002	11	28	5.32E-01	4.79E-06	2.00E-01	3.61E-08	1.51E-06	1.14E+00	5.83E-01	2.13E+00	2.83E-02	2.50E-03	1.78E-04	8.54E-03	7.18E-03	1.59E+00	6.73E-01
2002	11	29	2.06E+00	1.03E-02	8.66E-01	2.08E-03	3.86E-03	5.04E+00	1.91E+00	7.02E+00	1.78E-01	4.44E-02	1.93E-02	1.07E-01	6.80E-02	6.92E+00	2.90E+00
2002	11	30	5.33E-01	5.42E-04	5.39E-01	4.32E-05	1.41E-04	5.52E+00	1.94E+00	5.59E+00	6.69E-02	8.98E-03	2.02E-03	3.04E-02	1.77E-02	7.21E+00	7.31E-01
2002	12	1	2.76E-01	1.95E-05	4.14E-01	2.51E-06	4.58E-06	4.33E+00	1.57E+00	5.50E+00	7.93E-02	5.91E-03	3.93E-04	3.25E-02	1.69E-02	4.57E+00	5.29E-01
2002	12	2	9.35E-01	4.32E-03	4.74E-01	1.00E-03	1.43E-03	2.26E+00	1.93E+00	4.84E+00	3.18E-02	9.28E-03	4.99E-03	2.68E-02	1.51E-02	5.33E+00	1.17E+00
2002	12	3	2.24E+00	3.34E-03	1.22E+00	3.59E-04	9.86E-04	2.66E+00	1.01E+00	4.30E+00	6.77E-02	1.68E-02	7.51E-03	3.44E-02	2.37E-02	3.65E+00	3.13E+00
2002	12	4	1.53E+00	1.64E-02	1.37E+00	6.09E-03	9.58E-03	5.12E+00	2.81E+00	6.92E+00	1.42E-01	5.04E-02	2.78E-02	9.26E-02	6.77E-02	6.52E+00	2.09E+00
2002	12	5	7.35E-02	0.00E+00	3.19E-03	0.00E+00	0.00E+00	3.83E-01	2.75E-01	7.96E-01	7.99E-05	3.67E-06	0.00E+00	4.90E-05	1.38E-05	6.62E-01	1.27E-01
2002	12	6	6.95E-02	0.00E+00	1.70E-04	0.00E+00	0.00E+00	3.87E-01	2.68E-01	7.75E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.42E-01	1.09E-01
2002	12	7	8.08E-02	0.00E+00	2.40E-04	0.00E+00	0.00E+00	4.80E-01	4.37E-01	9.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.51E-01	1.32E-01
2002	12	8	1.34E-01	0.00E+00	2.60E-03	0.00E+00	0.00E+00	6.70E-01	5.56E-01	1.41E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-08	0.00E+00	1.04E+00	2.00E-01
2002	12	9	4.51E-01	0.00E+00	1.93E-01	0.00E+00	0.00E+00	1.38E+00	7.03E-01	2.71E+00	1.24E-02	6.41E-04	4.22E-07	8.63E-03	4.02E-03	1.75E+00	6.60E-01
2002	12	10	7.92E-02	0.00E+00	1.52E-02	0.00E+00	0.00E+00	6.14E-01	2.84E-01	8.31E-01	6.59E-04	1.16E-05	0.00E+00	3.15E-03	7.89E-04	5.86E-01	1.26E-01
2002	12	11	8.56E-02	0.00E+00	1.04E-02	0.00E+00	0.00E+00	5.37E-01	4.34E-01	8.43E-01	0.00E+00	0.00E+00	0.00E+00	8.28E-04	0.00E+00	9.01E-01	1.17E-01
2002	12	12	4.61E-02	0.00E+00	9.87E-03	0.00E+00	0.00E+00	3.98E-01	3.30E-01	6.28E-01	5.68E-04	1.90E-04	0.00E+00	1.73E-03	1.88E-03	6.07E-01	8.79E-02
2002	12	13	6.18E-02	0.00E+00	3.29E-02	0.00E+00	3.57E-05	7.32E-01	5.88E-01	1.16E+00	4.99E-03	1.59E-03	1.11E-04	1.56E-02	9.56E-03	9.27E-01	1.99E-01
2002	12	14	2.55E-01	1.54E-07	5.50E-02	2.18E-06	1.55E-04	1.77E+00	4.42E-01	1.41E+00	2.78E-02	5.94E-03	3.97E-04	1.14E-02	1.18E-02	1.13E+00	5.08E-01
2002	12	15	8.84E-02	0.00E+00	4.54E-02	3.09E-04	1.33E-03	7.62E-01	4.95E-01	1.01E+00	8.36E-03	3.77E-03	4.33E-04	2.33E-02	1.30E-02	7.45E-01	2.98E-01
2002	12	16	1.30E+00	8.89E-03	3.61E-01	1.13E-02	1.63E-02	1.89E+00	1.18E+00	2.55E+00	1.05E-01	3.38E-02	2.14E-02	6.14E-02	4.73E-02	1.90E+00	1.63E+00
2002	12	17	1.06E-01	0.00E+00	8.93E-02	0.00E+00	0.00E+00	1.36E+00	7.50E-01	2.21E+00	4.76E-03	2.21E-04	4.00E-06	2.81E-03	1.09E-03	1.85E+00	2.02E-01
2002	12	18	2.81E-01	7.11E-05	4.55E-01	9.66E-06	2.64E-05	3.63E+00	1.63E+00	5.34E+00	6.27E-02	8.49E-03	9.96E-04	2.44E-02	1.60E-02	5.46E+00	3.87E-01
2002	12	19	5.50E-01	4.61E-03	4.27E-01	9.80E-04	1.69E-03	2.34E+00	2.15E+00	4.25E+00	8.39E-02	1.74E-02	8.19E-03	3.81E-02	2.38E-02	4.01E+00	8.59E-01
2002	12	20	6.15E+00	1.33E-02	3.54E+00	3.70E-03	6.26E-03	6.55E+00	1.18E+00	7.63E+00	1.72E-01	4.62E-02	2.33E-02	9.21E-02	6.39E-02	8.66E+00	7.43E+00
2002	12	21	5.35E+00	1.59E-02	3.24E+00	4.58E-03	7.67E-03	7.45E+00	1.87E+00	8.84E+00	2.31E-01	5.98E-02	2.91E-02	1.12E-01	8.01E-02	9.42E+00	6.78E+00
2002	12	22	6.39E-01	1.29E-02	5.22E-01	5.10E-03	7.97E-03	5.54E+00	2.92E+00	7.77E+00	1.47E-01	4.55E-02	2.35E-02	9.82E-02	6.61E-02	7.48E+00	8.30E-01
2002	12	23	4.49E-01	1.31E-05	8.39E-02	5.06E-08	4.10E-06	3.41E+00	1.28E+00	3.98E+00	3.14E-02	2.30E-03	2.41E-04	2.18E-02	7.86E-03	3.82E+00	5.33E-01
2002	12	24	1.40E-01	0.00E+00	8.04E-03	0.00E+00	0.00E+00	5.09E-01	3.03E-01	1.04E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.16E-01	2.66E-01
2002	12	25	6.31E-02	0.00E+00	2.36E-03	0.00E+00	0.00E+00	3.42E-01	3.14E-01	5.78E-01	0.00E+00	0.00E+00	0.00E+00	1.10E-04	0.00E+00	5.82E-01	8.66E-02
2002	12	26	1.81E-01	0.00E+00	4.02E-02	0.00E+00	2.66E-06	8.84E-01	3.24E-01	8.93E-01	7.54E-03	1.71E-03	1.06E-04	5.52E-03	3.01E-03	8.58E-01	4.16E-01
2002	12	27	8.67E-01	2.29E-03	2.72E-01	8.09E-04	1.36E-03	2.06E+00	1.04E+00	3.61E+00	4.80E-02	8.88E-03	3.52E-03	2.36E-02	1.99E-02	2.92E+00	1.20E+00
2002	12	28	6.40E-01	8.80E-04	2.79E-01	1.12E-04	2.07E-04	1.30E+00	2.63E-01	1.32E+00	2.43E-03	1.48E-03	1.03E-03	5.83E-03	2.86E-03	1.32E+00	9.05E-01
2002	12	29	1.46E+00	1.14E-03	9.99E-01	2.82E-04	6.48E-04	3.35E+00	7.39E-01	2.83E+00	3.56E-02	7.95E-03	3.08E-03	2.27E-02	1.32E-02	3.43E+00	1.79E+00
2002	12	30	1.07E-01	0.00E+00	6.45E-02	0.00E+00	8.37E-08	1.59E+00	4.63E-01	1.37E+00	9.98E-03	8.19E-04	6.37E-05	7.41E-03	2.28E-03	1.09E+00	2.22E-01
2002	12	31	2.70E+00	6.65E-04	1.51E+00	1.43E-05	5.30E-05	4.22E+00	1.04E+00	5.20E+00	7.15E-02	9.28E-03	1.81E-03	2.76E-02	1.71E-02	4.92E+00	3.33E+00
2003	1	1	7.53E-02	0.00E+00	1.73E-02	0.00E+00	0.00E+00	6.16E-01	2.65E-01	8.75E-01	3.98E-03	3.13E-04	4.01E-07	1.71E-03	1.11E-03	6.41E-01	1.66E-01
2003	1	2	2.45E-01	1.48E-07	6.55E-02	4.40E-08	1.02E-04	1.07E+00	2.69E-01	8.42E-01	2.89E-02	5.58E-03	1.05E-03	1.34E-02	9.99E-03	7.48E-01	3.95E-01
2003	1	3	1.84E-01	0.00E+00	3.62E-02	0.00E+00	0.00E+00	9.24E-01	2.97E-01	9.49E-01	9.45E-03	1.26E-03	2.26E-05	7.38E-03	2.81E-03	9.08E-01	3.26E-01
2003	1	4	4.29E-02	0.00E+00	2.01E-03	0.00E+00	0.00E+00	3.54E-01	3.49E-01	6.36E-01	0.00E+00	0.00E+00	0.00E+00	1.78E-04	5.64E-06	6.00E-01	6.60E-02
2003	1	5	6.51E-02	0.00E+00	3.09E-04	0.00E+00	0.00E+00	4.75E-01	3.66E-01	8.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.35E-01	9.99E-02
2003	1	6	3.46E-02	0.00E+00	3.45E-02	0.00E+00	0.00E+00	6.00E-01	3.36E-01	9.46E-01	1.70E-03	5.53E-05	0.00E+00	7.07E-04	3.21E-04	8.73E-01	9.65E-02
2003	1	7	4.16E-02	0.00E+00	3.43E-02	0.00E+00	0.00E+00	1.07E+00	2.52E-01	1.54E+00	1.89E-02	1.93E-04	0.00E+00	6.67E-03	2.42E-03	1.08E+00	4.92E-02
2003	1	8	5.22E-01	0.00E+00	3.57E-01	0.00E+00	0.00E+00	8.41E-01	1.82E-01	1.63E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E+00	6.27E-01
2003	1	9	3.52E+00	1.20E-02	2.25E+00	3.27E-03	5.68E-03	5.17E+00	1.62E+00	5.90E+00	1.80E-01	4.42E-02	2.23E-02	7.92E-02	5.80E-02	6.35E+00	3.96E+00
2003	1	10	2.00E+00	7.58E-03	1.31E+00	3.44E-03	5.92E-03	5.59E+00	1.64E+00	5.84E+00	1.72E-01	3.82E-02	1.72E-02	6.81E-02	5.28E-02	5.60E+00	2.34E+00
2003	1	11	1.77E-01	5.72E-05	1.78E-01	5.10E-07	1.04E-05	3.03E+00	6.15E-01	2.42E+00	3.67E-02	4.13E-03	5.82E-04	1.34E-02	8.20E-03	2.44E+00	2.53E-01
2003	1	12	1.22E+00	1.13E-03	2.46E-01	4.74E-04	5.14E-03	1.32E+00	1.60E+00	2.71E+00	7.90E-02	4.45E-02	2.29E-02	1.05E-02	2.68E-02	2.13E+00	1.80E+00
2003	1	13	1.59E+00	2.30E-03	1.26E+00	4.41E-04	8.51E-04	3.08E+00	2.36E+00	4.14E+00	6.47E-02	1.11E-02	4.59E-03	2.38E-02	1.71E-02	4.19E+00	1.92E+00
2003	1	14	3.53E+00	2.71E-02	2.05E+00	1.23E-02	1.67E-02	5.12E+00	2.67E+00	6.60E+00	1.43E-01	5.51E-02	3.57E-02	9.33E-02	6.86E-02	7.60E+00	4.20E+00
2003	1	15	4.93E-01	4.13E-05	1.71E-01	4.98E-09	1.36E-05	2.29E+00	1.18E+00	4.52E+00	7.05E-02	8.73E-03	1.18E-03	2.92E-02	1.67E-02	3.36E+00	6.85E-01
2003	1	16	6.15E-01	0.00E+00	2.38E-01	0.00E+00	0.00E+00	1.02E+00	6.84E-01	1.88E+00	1.07E-03	1.27E-06	3.84E-09	8.86E-05	1.91E-05	1.44E+00	7.36E-01
2003	1	17	9.31E-01	8.84E-05	7.92E-01	3.93E-06	2.24E-05	2.75E+00	8.43E-01	3.36E+00	8.61E-03	1.63E-03	4.04E-04	5.29E-03	3.03E-03	2.74E+00	1.17E+00
2003	1	18	3.05E-01	0.00E+00	9.19E-02	0.00E+00	0.00E+00	1.05E+00	4.31E-01	2.08E+00	1.57E-03	2.81E-05	0.00E+00	5.23E-04	1.17E-04	1.82E+00	5.69E-01
2003	1	19	5.05E-02	0.00E+00	2.58E-03	0.00E+00	0.00E+00	3.73E-01	2.73E-01	3.97E-01	1.10E-03	0.00E+00	0.00E+00	1.60E-03	5.88E-04	5.84E-01	9.44E-02
2003	1	20	4.85E-01	6.61E-03	2.71E-01	4.44E-03	9.60E-03	1.91E+00	1.18E+00	3.07E+00	8.83E-02	4.71E-02	2.25E-02	6.55E-02	5.26E-02	2.31E+00	7.31E-01
2003	1	21	9.06E-01	4.89E-03	4.87E-01	3.90E-03	4.18E-03	1.04E+00	6.20E-02	1.48E+00	1.36E-03	1.52E-03	2.84E-03	6.86E-04	9.60E-04	1.79E+00	1.15E+00
2003	1	22	3.86E+00	7.95E-03	2.07E+00	8.66E-04	1.24E-03	4.15E+00	6.09E-01	4.64E+00	9.09E-02	1.42E-02	7.66E-03	2.25E-02	1.70E-02	4.80E+00	5.04E+00
2003	1	23	3.64E-01	3.06E-03	1.62E-01	5.20E-04	1.23E-03	1.38E+00	6.98E-01	1.52E+00	5.55E-02	1.48E-02	6.72E-03	3.00E-02	2.21E-02	1.12E+00	5.13E-01
2003	1	24	3.56E-01	6.94E-05	1.01E-01	7.26E-07	2.38E-04	9.01E-01	5.09E-01	1.48E+00	2.26E-02	1.20E-02	9.29E-03	5.42E-03	5.81E-03	1.39E+00	5.39E-01
2003	1	25	8.14E-01	3.86E-03	1.46E-01	2.10E-02	4.65E-02	1.51E+00	1.30E+00	2.61E+00	1.20E-01	7.28E-02	4.79E-02	6.61E-02	6.41E-02	2.00E+00	1.22E+00
2003	1	26	6.69E-02	0.00E+00	1.69E-02	0.00E+00	0.00E+00	6.02E-01	2.12E-01	6.98E-01	9.75E-04	1.87E-05	0.00E+00	9.37E-03	1.76E-03	4.88E-01	1.49E-01
2003	1	27	1.77E-01	8.51E-04	2.96E-01	6.21E-05	2.89E-04	3.13E+00	7.36E-01	3.07E+00	8.25E-02	1.65E-02	4.73E-03	3.18E-02	2.47E-02	2.38E+00	4.63E-01
2003	1	28	1.79E+00	1.29E-03	1.12E+00	1.90E-04	8.15E-04	5.61E+00	2.41E+00	6.88E+00	1.55E-01	2.92E-02	8.25E-03	6.38E-02	4.47E-02	6.78E+00	2.56E+00
2003	1	29	1.12E-01	6.98E-08	1.36E-03	5.70E-08	3.70E-07	4.63E-01	3.82E-01	8.01E-01	2.49E-04	4.42E-05	1.71E-06	5.02E-04	2.29E-04	7.75E-01	1.80E-01
2003	1	30	4.26E-02	0.00E+00	6.46E-03	0.00E+00	0.00E+00	4.41E-01	3.03E-01	7.71E-01	0.00E+00	0.00E+00	0.00E+00	2.39E-04	0.00E+00	5.41E-01	6.48E-02
2003	1	31	7.43E-01	3.28E-07	2.04E-01	4.09E-06	3.02E-04	2.27E+00	3.84E-01	1.69E+00	7.64E-02	1.47E-02	2.53E-03	2.75E-02	2.09E-02	1.54E+00	1.21E+00
2003	2	1	4.38E-01	1.60E-03	1.98E-01	2.49E-04	5.24E-04	2.50E+00	1.06E+00	3.40E+00	5.34E-02	1.04E-02	3.93E-03	2.22E-02	1.55E-02	2.71E+00	6.36E-01
2003	2	2	1.16E+00	1.94E-02	6.30E-01	9.27E-03	9.14E-03	4.22E+00	1.75E+00	4.05E+00	8.86E-02	2.45E-02	1.64E-02	4.62E-02	3.22E-02	5.20E+00	1.60E+00
2003	2	3	2.07E+00	3.73E-04	1.20E+00	2.18E-05	8.08E-05	3.26E+00	1.00E+00	3.67E+00	9.32E-02	1.43E-02	2.21E-03	4.14E-02	2.81E-02	3.49E+00	2.48E+00
2003	2	4	1.26E+00	2.20E-03	7.17E-01	3.13E-04	1.08E-03	4.43E+00	2.14E+00	6.98E+00	1.17E-01	1.77E-02	6.28E-03	4.61E-02	2.90E-02	5.32E+00	1.60E+00
2003	2	5	2.07E+00	6.97E-04	1.06E+00	4.56E-05	1.35E-04	3.17E+00	5.37E-01	4.38E+00	3.49E-02	6.13E-03	1.92E-03	2.05E-02	1.12E-02	4.19E+00	2.71E+00
2003	2	6	9.46E-01	4.22E-05	4.87E-01	1.51E-06	6.27E-06	3.81E+00	1.04E+00	5.17E+00	3.70E-02	4.10E-03	6.54E-04	2.44E-02	1.06E-02	5.11E+00	1.32E+00
2003	2	7	1.37E+00	7.71E-03	7.01E-01	2.71E-03	5.56E-03	2.95E+00	2.22E+00	4.86E+00	1.04E-01	3.48E-02	1.67E-02	7.92E-02	5.20E-02	3.74E+00	1.80E+00
2003	2	8	2.29E+00	2.50E-03	9.84E-01	5.51E-04	1.16E-03	3.91E+00	8.13E-01	4.22E+00	7.86E-02	1.59E-02	6.09E-03	3.48E-02	2.39E-02	4.73E+00	2.64E+00
2003	2	9	1.11E-01	0.00E+00	4.39E-03	0.00E+00	0.00E+00	5.68E-01	6.02E-01	1.20E+00	3.50E-05	5.84E-08	0.00E+00	2.37E-05	1.01E-06	1.14E+00	1.70E-01
2003	2	10	5.16E-01	2.04E-04	2.25E-01	2.38E-05	1.41E-04	2.97E+00	2.14E+00	5.61E+00	5.70E-02	1.11E-02	2.38E-03	4.22E-02	2.35E-02	4.67E+00	7.91E-01
2003	2	11	8.15E-01	1.02E-04	4.25E-01	3.94E-07	6.84E-06	2.06E+00	1.11E+00	3.32E+00	5.55E-02	7.45E-03	1.04E-03	2.58E-02	1.38E-02	3.23E+00	1.08E+00
2003	2	12	6.34E-01	5.42E-05	4.47E-01	3.60E-08	2.21E-06	2.21E+00	9.53E-01	2.89E+00	2.57E-02	4.09E-03	7.60E-04	1.18E-02	7.17E-03	2.78E+00	1.20E+00
2003	2	13	1.80E+00	2.99E-04	1.42E+00	6.52E-06	3.50E-05	4.31E+00	1.11E+00	5.95E+00	8.21E-02	7.80E-03	1.28E-03	2.89E-02	1.68E-02	5.27E+00	2.06E+00
2003	2	14	8.88E-01	8.23E-03	4.28E-01	7.30E-03	1.08E-02	2.65E+00	1.20E+00	3.71E+00	1.22E-01	4.24E-02	1.96E-02	6.24E-02	5.70E-02	3.01E+00	1.39E+00

Year	Month	Day	Project R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2002	11	25	7.70E-02	0.00E+00	1.56E-02	0.00E+00	0.00E+00	6.95E-02	2.23E-01	4.20E-01	1.74E-03	5.31E+00	8.91E-05	1.08E+00	1.18E+00	1.24E-01	1.69E-01
2002	11	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E-02	6.07E-01	1.96E-14	9.96E+00	2.32E-15	8.58E-01	1.79E+00	2.33E-03	0.00E+00
2002	11	27	7.63E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.27E-02	3.64E-01	1.32E-03	7.87E+00	2.79E-04	9.10E-01	7.07E-01	4.62E-03	5.14E-03
2002	11	28	1.04E-01	8.21E-07	1.04E-03	0.00E+00	1.51E-07	3.29E-03	4.15E-02	3.59E-01	3.45E-03	4.52E+00	5.32E-03	4.86E-01	4.15E-01	1.05E-02	1.64E-01
2002	11	29	2.62E-01	4.71E-01	2.82E-01	9.17E-02	1.78E-01	2.54E-01	1.35E-01	1.37E+00	2.94E+00	7.49E+00	1.60E+00	1.49E+00	1.46E+00	1.37E-01	4.74E-01
2002	11	30	5.29E-02	8.62E-07	1.26E-02	0.00E+00	7.37E-07	3.33E-02	6.49E-01	1.67E+00	6.32E-03	1.04E+01	2.69E-04	3.47E+00	3.35E+00	1.28E-01	1.31E-01
2002	12	1	6.25E-02	6.78E-05	5.17E-03	1.15E-06	1.16E-05	1.73E-02	1.35E-01	1.39E+00	4.17E-03	9.18E+00	3.45E-04	1.50E+00	2.12E-01	1.02E-01	1.57E-01
2002	12	2	7.16E-02	4.19E-01	9.37E-02	3.57E-02	3.86E-02	1.04E-01	2.43E-01	1.42E+00	1.06E+00	1.19E+01	3.77E-01	1.51E+00	1.67E+00	1.27E-01	7.81E-02
2002	12	3	6.02E-02	1.43E-01	3.63E-02	9.40E-05	3.90E-04	6.29E-02	3.29E-03	1.20E-01	3.01E+00	4.25E-01	2.56E-01	1.04E-01	1.45E-01	8.93E-03	1.62E-01
2002	12	4	1.78E-01	2.08E-01	5.22E-02	1.13E-02	1.96E-02	1.44E-01	2.04E-01	1.41E+00	9.63E-01	1.43E+01	6.06E-01	3.69E+00	6.15E+00	2.19E-01	5.04E-01
2002	12	5	3.24E-03	0.00E+00	4.56E-04	0.00E+00	0.00E+00	5.86E-04	5.00E-02	3.51E-01	1.78E-05	4.07E+00	4.88E-04	3.60E-01	2.44E-01	1.16E-02	3.16E-03
2002	12	6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.60E-02	6.22E-01	1.48E-13	6.50E+00	1.38E-13	2.92E-01	5.09E-01	0.00E+00	0.00E+00
2002	12	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E-02	7.40E-01	5.02E-17	7.66E+00	1.47E-08	4.26E-01	3.72E-01	1.26E-03	0.00E+00
2002	12	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.53E-02	5.65E-01	7.24E-17	5.14E+00	1.86E-03	9.48E-01	2.07E-01	6.16E-03	0.00E+00
2002	12	9	9.49E-03	0.00E+00	3.59E-05	0.00E+00	0.00E+00	7.32E-03	1.89E-02	4.76E-01	1.13E-06	3.23E+00	2.27E-02	6.54E-01	3.59E-01	3.53E-02	2.66E-02
2002	12	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E-08	0.00E+00	7.59E-03	4.61E-01	9.95E-21	1.11E+00	7.73E-02	2.33E-01	2.85E-01	7.61E-05	0.00E+00
2002	12	11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E-02	7.02E-01	9.09E-17	1.29E+00	3.07E-02	6.81E-01	2.26E-01	5.67E-03	0.00E+00
2002	12	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-04	0.00E+00	1.30E-02	4.12E-01	1.71E-17	9.43E-01	8.52E-02	4.36E-01	2.62E-01	9.05E-04	0.00E+00
2002	12	13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-02	0.00E+00	2.30E-02	7.01E-01	3.87E-18	1.76E+00	3.55E-01	5.46E-01	5.46E-01	2.12E-03	0.00E+00
2002	12	14	0.00E+00	0.00E+00	0.00E+00	1.57E-05	1.73E-01	0.00E+00	2.20E-03	4.79E-01	3.11E-04	1.07E+00	4.97E-01	2.80E-01	3.21E-01	1.05E-01	0.00E+00
2002	12	15	0.00E+00	0.00E+00	0.00E+00	6.39E-02	9.92E-02	0.00E+00	4.09E-03	6.51E-02	3.31E-03	1.21E+00	1.81E+00	3.32E-02	6.23E-01	3.32E-02	0.00E+00
2002	12	16	6.00E-02	3.67E-01	6.71E-03	4.28E-01	2.97E-01	2.76E-02	1.30E-02	7.20E-01	1.41E-02	2.16E+00	5.57E+00	2.27E-01	4.76E-01	1.39E-02	1.00E-01
2002	12	17	1.48E-02	0.00E+00	1.94E-04	0.00E+00	0.00E+00	3.35E-03	6.59E-02	6.61E-01	5.37E-18	6.01E+00	3.37E-03	1.03E+00	2.96E-01	8.14E-03	4.65E-02
2002	12	18	4.99E-02	3.13E-04	7.51E-03	6.36E-05	1.21E-04	1.72E-02	9.38E-02	1.95E+00	8.14E-03	8.15E+00	3.53E-03	1.59E+00	2.15E-01	6.31E-02	1.48E-01
2002	12	19	4.23E-02	3.44E-02	1.08E-02	5.77E-03	1.26E-02	1.61E-02	1.79E-01	1.25E+00	3.63E-01	1.06E+01	3.50E-01	1.76E+00	1.66E+00	3.75E-02	8.29E-02
2002	12	20	8.23E-01	1.90E-01	1.76E-01	2.88E-02	4.62E-02	1.58E-01	3.04E-02	3.25E-01	7.49E+00	3.08E+00	5.12E-01	3.94E-01	5.32E-01	5.60E-02	1.41E+00
2002	12	21	7.65E-01	4.85E-01	2.36E-01	2.00E-03	3.94E-03	2.23E-01	1.63E-02	7.82E-01	7.54E+00	1.04E+00	8.00E-01	2.28E-01	3.17E-01	2.63E-01	1.46E+00
2002	12	22	3.77E-02	3.01E-01	1.26E-02	2.38E-02	4.20E-02	1.35E-02	1.81E-01	2.14E+00	4.64E-01	1.27E+01	1.24E+00	3.52E+00	4.69E+00	1.51E-01	9.07E-02
2002	12	23	8.17E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-01	1.61E+00	0.00E+00	9.77E+00	0.00E+00	1.15E+00	1.93E+00	8.33E-02	2.32E-02
2002	12	24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.68E-02	4.08E-01	8.04E-16	5.24E+00	5.77E-04	3.65E-01	4.57E-01	1.44E-02	0.00E+00
2002	12	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-02	4.19E-01	2.92E-16	1.34E+00	1.97E-02	5.46E-01	1.62E-01	1.10E-03	0.00E+00
2002	12	26	2.80E-04	0.00E+00	2.27E-04	0.00E+00	2.10E-04	1.91E-03	2.54E-02	5.26E-01	3.40E-06	1.59E+00	1.22E-01	2.84E-01	2.69E-01	7.81E-05	3.59E-04
2002	12	27	1.73E-01	1.73E-01	8.08E-02	2.24E-02	3.79E-02	8.35E-02	1.07E-01	9.53E-01	9.31E-01	6.83E+00	3.37E-01	9.31E-01	8.00E-01	1.34E-01	2.73E-01
2002	12	28	6.28E-05	3.63E-02	2.14E-02	1.84E-02	3.39E-02	4.48E-02	8.48E-03	5.76E-01	1.33E+00	2.11E+00	1.92E-01	1.36E-01	3.20E-01	2.04E-04	8.67E-05
2002	12	29	3.49E-01	4.78E-04	7.81E-02	5.42E-05	3.08E-04	7.30E-02	6.57E-02	1.18E+00	9.15E-01	3.43E+00	1.29E-02	6.61E-01	3.21E-01	6.76E-02	4.80E-01
2002	12	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-06	0.00E+00	2.59E-02	6.82E-01	1.23E-16	2.35E+00	5.02E-02	5.12E-01	2.84E-01	2.16E-02	0.00E+00
2002	12	31	8.28E-01	3.87E-04	1.09E+00	6.79E-05	5.47E-04	8.49E-01	1.91E-01	7.25E-01	3.06E+00	4.80E+00	7.13E-02	1.07E+00	1.39E+00	2.71E-01	1.23E+00
2003	1	1	3.51E-03	0.00E+00	9.69E-04	0.00E+00	3.31E-10	1.38E-03	2.73E-02	3.83E-01	6.38E-05	2.20E+00	5.42E-02	2.46E-01	2.58E-01	2.13E-02	4.31E-03
2003	1	2	0.00E+00	0.00E+00	7.31E-06	0.00E+00	5.02E-04	4.42E-03	8.37E-03	3.51E-01	3.38E-03	1.09E+00	1.74E-01	2.77E-01	2.93E-01	2.21E-04	0.00E+00
2003	1	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-04	0.00E+00	8.58E-03	5.54E-01	1.77E-17	1.16E+00	9.80E-02	2.56E-01	2.75E-01	3.72E-04	0.00E+00
2003	1	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-02	4.83E-01	1.64E-16	1.97E+00	1.86E-02	6.28E-01	2.03E-01	6.83E-04	0.00E+00
2003	1	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.69E-02	6.66E-01	1.66E-14	6.07E+00	4.19E-05	6.02E-01	1.30E+00	0.00E+00	0.00E+00
2003	1	6	1.61E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-02	3.70E-01	4.12E-15	2.73E+00	3.87E-03	4.82E-01	2.07E-01	1.06E-02	5.73E-02
2003	1	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.46E-02	3.91E-01	5.49E-16	2.39E+00	4.87E-03	3.91E-01	1.61E-01	3.00E-02	9.01E-06
2003	1	8	4.43E-02	0.00E+00	1.09E-01	0.00E+00	0.00E+00	8.89E-02	7.18E-02	4.79E-01	1.75E+00	2.20E+00	1.18E-04	7.21E-01	5.47E-01	9.74E-02	3.70E-02
2003	1	9	5.60E-01	3.24E-01	2.98E-01	2.31E-02	3.70E-02	2.01E-01	4.04E-02	5.48E-01	3.09E+00	5.07E+00	1.22E+00	6.55E-01	9.90E-01	7.95E-02	9.52E-01
2003	1	10	6.03E-01	9.27E-02	1.16E+00	6.36E-02	1.22E-01	9.65E-01	1.67E-01	1.64E+00	3.98E+00	8.90E+00	5.69E-01	1.52E+00	1.06E+00	2.46E-01	1.06E+00
2003	1	11	2.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.25E-08	6.27E-02	1.22E+00	2.77E-16	3.02E+00	1.01E-02	8.58E-01	2.11E-01	1.08E-01	4.16E-02
2003	1	12	1.02E-02	1.01E-04	1.35E-03	2.80E-05	2.80E-03	1.93E-02	8.46E-03	2.31E-01	1.90E-02	3.14E+00	5.20E-01	2.70E-01	3.33E-01	2.83E-04	1.69E-02
2003	1	13	2.23E-01	2.82E-04	2.19E-02	3.98E-04	9.19E-03	6.46E-02	5.18E-02	7.19E-01	9.06E-01	1.06E+01	4.87E-02	9.48E-01	9.41E-01	4.46E-02	4.52E-01
2003	1	14	9.78E-02	1.96E+00	1.33E-01	3.21E-01	4.31E-01	1.34E-01	9.14E-02	1.14E+00	4.12E+00	1.15E+01	3.19E+00	1.43E+00	1.44E+00	1.96E-01	2.51E-01
2003	1	15	3.38E-02	7.66E-07	3.02E-03	0.00E+00	4.14E-08	7.06E-03	1.15E-01	1.36E+00	1.31E-03	9.61E+00	5.78E-05	1.10E+00	1.63E+00	2.74E-02	7.30E-02
2003	1	16	4.49E-03	0.00E+00	1.09E-02	0.00E+00	0.00E+00	6.76E-02	5.33E-02	6.66E-01	2.01E-03	7.39E+00	3.27E-05	6.23E-01	1.35E+00	2.69E-03	1.79E-02
2003	1	17	2.10E-01	4.64E-07	2.94E-02	0.00E+00	1.94E-07	8.30E-02	2.49E-01	5.93E-01	5.66E-03	6.47E+00	4.38E-03	2.19E+00	2.48E+00	7.21E-02	4.42E-01
2003	1	18	2.05E-02	0.00E+00	4.71E-04	0.00E+00	0.00E+00	1.09E-02	4.30E-02	4.75E-01	4.88E-05	4.58E+00	1.31E-03	6.01E-01	2.94E-01	7.07E-02	3.56E-02
2003	1	19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E-02	4.15E-01	1.08E-15	2.40E+00	4.40E-03	4.48E-01	2.09E-01	0.00E+00	0.00E+00
2003	1	20	7.36E-02	4.64E-01	4.50E-03	2.05E-01	4.79E-01	3.99E-02	1.61E-02	3.60E-01	2.93E-02	5.32E+00	5.21E+00	7.03E-01	2.49E-01	1.60E-02	1.72E-01
2003	1	21	2.99E-03	4.55E-02	4.26E-02	2.21E-02	8.34E-03	6.30E-02	6.39E-04	1.65E-03	1.64E+00	1.40E-03	2.99E-03	7.48E-04	9.58E-04	1.74E-03	2.72E-03
2003	1	22	2.07E-01	6.74E-01	7.41E-02	1.24E-03	8.77E-04	1.89E-01	2.04E-03	7.11E-02	4.58E+00	1.52E-01	8.83E-01	2.12E-02	3.66E-02	1.93E-02	5.04E-01
2003	1	23	9.30E-03	1.14E-01	5.74E-03	2.46E-02	4.50E-02	1.30E-02	2.30E-02	6.15E-01	6.55E-02	9.95E-01	6.77E-01	2.91E-01	4.24E-01	5.60E-03	1.58E-02
2003	1	24	2.72E-04	0.00E+00	5.28E-06	0.00E+00	4.67E-07	1.50E-02	1.97E-02	4.11E-01	6.48E-03	1.93E+00	2.63E-01	3.62E-01	2.58E-01	3.40E-02	1.88E-03
2003	1	25	5.81E-03	1.36E-01	3.47E-06	5.44E-01	1.58E+00	1.60E-04	6.60E-03	5.79E-01	1.97E-02	1.59E+00	9.32E+00	7.85E-02	2.19E-01	1.55E-02	1.63E-02
2003	1	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.09E-04	2.03E-01	3.87E-18	8.12E-01	8.42E-02	1.21E-01	3.18E-01	0.00E+00	0.00E+00
2003	1	27	6.07E-02	0.00E+00	1.52E-03	0.00E+00	0.00E+00	2.35E-03	2.79E-02	8.12E-01	1.42E-03	2.89E+00	1.67E-02	7.10E-01	4.70E-01	2.91E-02	2.19E-01
2003	1	28	1.81E-01	2.05E-04	3.46E-02	2.44E-04	9.35E-04	1.27E-01	1.00E-01	1.31E+00	1.25E-01	1.42E+01	7.51E-03	1.66E+00	7.54E-01	1.38E-01	4.73E-01
2003	1	29	8.84E-09	0.00E+00	0.00E+00	4.95E-09	2.03E-08	0.00E+00	5.59E-02	6.29E-01	9.22E-09	3.35E+00	9.31E-03	4.88E-01	2.14E-01	1.22E-03	1.01E-08
2003	1	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.38E-05	0.00E+00	1.99E-02	2.28E-01	2.58E-17	1.43E+00	3.83E-02	3.69E-01	2.36E-01	0.00E+00	0.00E+00
2003	1	31	3.50E-02	0.00E+00	5.82E-04	0.00E+00	2.71E-02	3.92E-03	1.06E-03	2.86E-01	4.72E-03	1.31E+00	4.24E-01	5.73E-02	4.44E-01	9.85E-05	9.09E-02
2003	2	1	4.47E-02	1.13E-02	7.44E-03	2.29E-05	9.25E-05	9.83E-03	7.17E-02	9.75E-01	3.02E-01	5.25E+00	2.19E-02	1.27E+00	8.63E-01	1.57E-02	1.36E-01
2003	2	2	6.40E-02	5.08E-01	4.97E-02	8.89E-02	1.16E-01	6.52E-02	1.14E-01	1.38E+00	2.90E-01	7.02E+00	1.61E+00	1.22E+00	9.16E-01	1.47E-01	1.29E-01
2003	2	3	1.89E-01	0.00E+00	4.80E-01	0.00E+00	0.00E+00	5.69E-01	1.42E-01	3.55E-01	2.46E+00	4.86E+00	1.31E-03	1.83E+00	1.61E+00	7.98E-02	2.96E-01
2003	2	4	4.77E-02	7.02E-05	1.58E-02	6.04E-06	2.02E-05	5.64E-02	1.10E-01	1.27E+00	3.77E-02	9.68E+00	1.33E-03	1.79E+00	2.37E+00	1.11E-01	1.43E-01
2003	2	5	4.09E-01	1.48E-04	6.34E-01	3.98E-06	1.82E-05	5.83E-01	2.26E-01	1.02E+00	4.23E+00	1.72E+00	4.59E-03	1.09E+00	6.97E-01	3.93E-01	5.15E-01
2003	2	6	5.45E-02	7.44E-07	2.09E-02	1.40E-07	7.70E-07	8.75E-02	1.05E-01	1.25E+00	1.76E-03	6.77E+00	1.47E-03	2.20E+00	2.08E+00	3.90E-02	1.62E-01
2003	2	7	5.14E-01	1.02E-01	2.02E-01	4.03E-02	9.26E-02	2.79E-01	5.04E-01	1.48E+00	1.09E+00	9.74E+00	8.74E-01	2.21E+00	2.50E+00	4.97E-01	7.48E-01
2003	2	8	5.30E-01	6.90E-02	1.91E-01	6.71E-03	3.59E-02	1.37E-01	1.16E-01	1.02E+00	3.44E+00	4.56E+00	4.75E-01	9.49E-01	7.37E-01	1.17E-01	8.66E-01
2003	2	9	5.70E-03	0.00E+00	7.35E-05	0.00E+00	0.00E+00	8.08E-04	8.17E-02	1.35E+00	4.03E-04	5.54E+00	2.16E-03	8.17E-01	7.55E-01	6.26E-03	6.66E-03
2003	2	10	1.13E-01	1.75E-03	1.85E-02	8.80E-05	1.07E-03	4.74E-02	3.52E-01	2.07E+00	4.95E-01	7.85E+00	3.00E-02	1.93E+00	1.13E+00	2.01E-01	1.71E-01
2003	2	11	1.19E-01	5.77E-06	8.54E-03	0.00E+00	2.01E-07	1.91E-02	8.59E-02	1.47E+00	6.07E-03	8.95E+00	6.04E-04	1.23E+00	4.38E-01	2.86E-02	2.67E-01
2003	2	12	1.09E-01	6.75E-07	7.52E-03	0.00E+00	0.00E+00	5.50E-02	8.55E-02	9.63E-01	3.28E-03	8.75E+00	3.13E-04	1.07E+00	3.57E-01	1.84E-02	2.58E-01
2003	2	13	3.22E-01	4.66E-02	2.64E-01	7.09E-04	4.53E-03	2.32E-01	1.25E-01	1.15E+00	1.76E+00	8.41E+00	1.49E-01	1.28E+00	7.11E-01	1.65E-01	6.89E-01
2003	2	14	1.04E-01	4.58E-01	2.21E-02	8.16E-01	9.31E-01	4.20E-02	6.28E-03	3.19E-01	3.41E-01	1.02E+00	2.59E+00	8.38E-02	2.91E-01	2.22E-02	2.52E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	2	15	1.41E-01	2.02E-05	4.69E-02	0.00E+00	5.34E-07	1.04E+00	6.05E-01	2.69E+00	1.53E-02	3.33E+00	2.31E-02	8.62E-01	2.93E-01	1.35E+00	1.91E-01	1.40E-01	1.92E-05	4.62E-02	0.00E+00	2.63E-07	1.04E+00	5.60E-01	1.65E+00	1.47E-02	1.02E-03	1.93E-04	6.24E-03	2.63E-03	1.33E+00	1.90E-01	7.75E-04	9.67E-07	6.55E-04	0.00E+00	2.70E-07	1.19E-03	4.49E-02	1.04E+00	6.00E-04	3.33E+00	2.29E-02	8.55E-01	2.91E-01	2.06E-02	8.75E-04
2003	2	16	6.93E-01	2.68E-04	1.38E-01	7.82E-02	5.04E-01	1.91E+00	5.96E-01	2.58E+00	8.13E-02	2.77E+00	1.86E+00	2.07E-01	8.02E-01	1.84E+00	1.22E+00	6.87E-01	2.68E-04	1.37E-01	2.06E-03	3.53E-03	1.91E+00	5.88E-01	2.03E+00	7.50E-02	2.77E-02	5.85E-03	3.36E-02	3.65E-02	1.81E+00	1.20E+00	5.94E-03	0.00E+00	1.08E-03	7.61E-02	5.00E-01	5.84E-03	8.51E-03	5.50E-01	6.27E-03	2.74E+00	1.85E+00	1.73E-01	7.65E-01	2.38E-02	1.77E-02
2003	2	17	1.53E-01	0.00E+00	6.44E-03	0.00E+00	0.00E+00	6.66E-01	5.86E-01	2.18E+00	1.02E-17	3.56E+00	2.14E-02	8.41E-01	5.81E-01	1.04E+00	2.22E-01	1.53E-01	0.00E+00	6.44E-03	0.00E+00	0.00E+00	6.66E-01	5.40E-01	1.21E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-04	2.86E-06	1.04E+00	2.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E-02	9.63E-01	1.02E-17	3.56E+00	2.14E-02	8.41E-01	5.81E-01	0.00E+00	0.00E+00
2003	2	18	1.10E-01	0.00E+00	1.67E-03	0.00E+00	0.00E+00	6.19E-01	6.46E-01	2.06E+00	3.01E-18	5.07E+00	5.31E-03	7.94E-01	5.38E-01	1.22E+00	1.62E-01	1.10E-01	0.00E+00	1.67E-03	0.00E+00	0.00E+00	6.19E-01	5.78E-01	1.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+00	1.62E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.84E-02	7.70E-01	3.01E-18	5.07E+00	5.31E-03	7.94E-01	5.38E-01	3.70E-02	0.00E+00
2003	2	19	8.11E-03	0.00E+00	1.56E-02	0.00E+00	0.00E+00	4.55E-01	2.37E-01	7.61E-01	7.62E-18	9.93E-01	5.37E-02	1.98E-01	2.65E-01	4.40E-01	1.51E-02	8.11E-03	0.00E+00	1.56E-02	0.00E+00	0.00E+00	4.55E-01	2.36E-01	5.61E-01	0.00E+00	0.00E+00	0.00E+00	1.11E-04	0.00E+00	4.40E-01	1.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.74E-04	2.00E-01	7.62E-18	9.93E-01	5.37E-02	1.98E-01	2.65E-01	0.00E+00	0.00E+00
2003	2	20	3.40E-01	1.28E-01	8.67E-02	1.16E-01	2.73E-01	1.11E+00	3.57E-01	2.20E+00	3.21E-02	9.92E-01	1.57E+00	1.33E-01	2.69E-01	1.12E+00	5.83E-01	3.06E-01	4.44E-03	8.39E-02	3.96E-03	7.07E-03	1.11E+00	3.54E-01	1.93E+00	2.56E-02	5.98E-03	1.14E-02	7.92E-03	5.27E-03	1.12E+00	5.11E-01	3.39E-02	1.24E-01	2.81E-03	1.12E-01	2.66E-01	6.44E-03	3.06E-03	2.75E-01	6.53E-03	9.86E-01	1.56E+00	1.25E-01	2.64E-01	5.70E-03	7.23E-02
2003	2	21	1.66E+00	2.75E+00	4.58E-01	4.20E-01	4.64E-01	1.69E+00	1.23E+00	2.98E+00	3.61E-01	1.72E+00	3.53E+00	7.65E-02	3.67E-01	2.77E+00	2.21E+00	1.66E+00	2.09E-02	4.47E-01	7.71E-03	1.13E-02	1.61E+00	1.23E+00	2.98E+00	1.51E-01	6.72E-02	3.64E-02	6.30E-02	6.65E-02	2.77E+00	2.21E+00	6.33E-04	2.73E+00	1.09E-02	4.12E-01	4.52E-01	8.15E-02	3.18E-04	7.42E-04	2.10E-01	1.66E+00	3.49E+00	1.35E-02	3.00E-01	4.27E-04	2.02E-03
2003	2	22	1.00E+00	1.15E+00	9.90E-01	2.94E-01	2.21E-01	1.35E+00	1.58E-01	1.15E+00	1.61E+00	3.44E-01	3.81E-01	1.97E-01	2.48E-01	2.21E+00	1.25E+00	8.92E-01	7.98E-03	5.11E-01	8.16E-03	1.18E-02	1.04E+00	7.03E-02	1.03E+00	3.42E-02	1.81E-02	1.43E-02	2.00E-02	2.01E-02	2.12E+00	1.09E+00	1.09E-01	1.14E+00	4.79E-01	2.86E-01	2.09E-01	3.10E-01	8.79E-02	1.24E-01	1.57E+00	3.26E-01	3.67E-01	1.77E-01	2.28E-01	9.05E-02	1.61E-01
2003	2	23	3.80E+00	7.77E-03	1.94E+00	1.98E-04	2.93E-03	5.09E+00	1.12E+00	5.75E+00	6.61E+00	3.52E+00	2.51E-01	6.98E-01	4.54E-01	4.68E+00	4.54E+00	2.69E+00	7.58E-04	1.45E+00	1.12E-05	1.57E-04	4.54E+00	1.04E+00	4.68E+00	9.32E-02	1.39E-02	3.73E-03	3.43E-02	2.24E-02	4.39E+00	3.26E+00	1.11E+00	7.02E-03	4.88E-01	1.87E-04	2.77E-03	5.49E-01	8.09E-02	1.08E+00	6.52E+00	3.51E+00	2.48E-01	6.64E-01	4.32E-01	2.85E-01	1.28E+00
2003	2	24	4.55E-01	0.00E+00	1.38E-01	0.00E+00	0.00E+00	2.46E+00	1.01E+00	4.62E+00	1.37E-02	6.49E+00	5.07E-04	9.89E-01	3.82E-01	3.52E+00	6.91E-01	4.19E-01	0.00E+00	1.30E-01	0.00E+00	0.00E+00	2.41E+00	9.02E-01	3.22E+00	1.26E-02	5.99E-04	4.07E-05	1.06E-02	2.66E-03	3.50E+00	6.06E-01	3.64E-02	0.00E+00	7.81E-03	0.00E+00	0.00E+00	4.65E-02	1.04E-01	1.40E+00	1.08E-03	6.49E+00	4.67E-04	9.78E-01	3.79E-01	2.10E-02	8.56E-02
2003	2	25	5.85E-01	1.90E-05	2.63E-01	0.00E+00	9.66E-07	1.67E+00	6.81E-01	3.30E+00	3.68E-02	4.36E+00	2.20E-03	1.01E+00	2.07E-01	3.35E+00	9.50E-01	5.28E-01	1.90E-05	2.54E-01	0.00E+00	9.66E-07	1.61E+00	6.48E-01	2.76E+00	3.28E-02	1.63E-03	1.03E-04	1.41E-02	6.08E-03	3.34E+00	8.04E-01	5.71E-02	0.00E+00	9.35E-03	0.00E+00	0.00E+00	5.88E-02	3.23E-02	5.33E-01	4.04E-03	4.36E+00	2.10E-03	9.96E-01	2.00E-01	5.98E-03	1.46E-01
2003	2	26	7.52E-01	8.28E-05	3.71E-01	1.59E-06	3.97E-05	2.90E+00	1.64E+00	4.27E+00	6.30E-02	6.54E+00	2.81E-02	9.94E-01	5.90E-01	3.87E+00	1.08E+00	7.17E-01	4.50E-05	3.66E-01	8.91E-07	2.70E-05	2.88E+00	1.58E+00	3.23E+00	4.68E-02	1.72E-02	2.96E-03	3.10E-02	2.19E-02	3.81E+00	9.72E-01	3.45E-02	3.78E-05	5.61E-03	7.01E-07	1.27E-05	2.06E-02	5.99E-02	1.04E+00	1.62E-02	6.52E+00	2.52E-02	9.63E-01	5.68E-01	6.30E-02	1.11E-01
2003	2	27	1.68E+00	6.89E-01	9.88E-01	4.48E-02	6.98E-02	2.25E+00	1.24E+00	3.63E+00	2.66E+00	2.66E+00	3.39E+00	4.97E-01	6.85E-01	3.46E+00	2.45E+00	1.62E+00	1.33E-02	8.56E-01	1.93E-03	3.37E-03	2.10E+00	1.19E+00	3.48E+00	1.41E-01	4.39E-02	2.36E-02	6.44E-02	5.08E-02	3.42E+00	2.37E+00	6.20E-02	6.76E-01	1.32E-01	4.29E-02	6.65E-02	1.52E-01	4.38E-02	1.49E-01	2.51E+00	2.61E+00	3.37E+00	4.32E-01	6.34E-01	4.69E-02	8.01E-02
2003	2	28	5.81E-01	1.23E-03	4.95E-01	2.38E-08	5.18E-06	9.43E-01	4.44E-01	1.26E+00	2.12E+00	1.93E+00	7.19E-02	5.28E-01	3.03E-01	1.51E+00	7.90E-01	5.58E-01	7.28E-06	3.34E-01	0.00E+00	0.00E+00	8.14E-01	4.16E-01	9.44E-01	6.62E-03	3.56E-04	3.27E-05	1.56E-03	7.26E-04	1.49E+00	7.67E-01	2.29E-02	1.22E-03	1.60E-01	2.38E-08	5.18E-06	1.28E-01	2.81E-02	3.15E-01	2.12E+00	1.93E+00	7.19E-02	5.26E-01	3.02E-01	1.67E-02	2.30E-02
2003	3	1	7.72E-01	2.07E-01	3.37E-01	1.58E-01	1.61E-01	1.21E+00	5.65E-01	2.37E+00	5.05E-01	7.03E-01	4.94E-01	2.91E-01	1.17E-01	2.48E+00	1.08E+00	7.68E-01	4.37E-03	3.28E-01	3.54E-03	5.13E-03	1.19E+00	5.60E-01	2.13E+00	1.88E-02	7.28E-03	6.56E-03	8.16E-03	7.49E-03	2.48E+00	1.06E+00	4.05E-03	2.03E-01	8.76E-03	1.55E-01	1.55E-01	2.38E-02	4.80E-03	2.43E-01	4.86E-01	6.96E-01	4.87E-01	2.83E-01	1.09E-01	8.29E-05	2.33E-02
2003	3	2	7.33E-01	1.24E-03	4.05E-01	4.17E-04	3.62E-03	1.21E+00	7.05E-01	2.13E+00	6.64E-01	2.70E+00	1.77E-02	8.00E-01	4.43E-01	1.43E+00	8.72E-01	5.28E-01	1.36E-07	2.70E-01	0.00E+00	1.37E-07	1.13E+00	5.50E-01	1.46E+00	9.30E-05	4.37E-05	9.53E-06	1.94E-04	1.04E-04	1.33E+00	5.98E-01	2.04E-01	1.24E-03	1.36E-01	4.17E-04	3.62E-03	7.77E-02	1.55E-01	6.73E-01	6.64E-01	2.70E+00	1.77E-02	8.00E-01	4.43E-01	1.06E-01	2.74E-01
2003	3	3	8.10E-01	1.15E-01	7.53E-01	3.55E-02	4.13E-02	1.26E+00	1.84E-01	1.98E+00	1.03E+00	6.14E-02	6.53E-02	4.70E-02	5.24E-02	1.97E+00	1.08E+00	7.47E-01	4.40E-03	4.13E-01	2.19E-03	2.96E-03	1.03E+00	1.53E-01	1.93E+00	1.01E-02	4.55E-03	4.51E-03	3.56E-03	3.95E-03	1.93E+00	1.01E+00	6.37E-02	1.10E-01	3.40E-01	3.33E-02	3.84E-02	2.37E-01	3.11E-02	4.50E-02	1.02E+00	5.69E-02	6.08E-02	4.34E-02	4.85E-02	4.46E-02	6.41E-02
2003	3	4	3.68E+00	1.53E-01	2.15E+00	1.57E-01	3.33E-01	4.11E+00	7.95E-01	5.52E+00	3.67E+00	1.10E+00	4.93E-01	3.73E-01	6.10E-01	5.02E+00	4.68E+00	3.24E+00	4.28E-03	1.48E+00	3.13E-03	6.78E-03	3.55E+00	6.96E-01	5.21E+00	1.14E-01	2.78E-02	1.21E-02	4.66E-02	3.64E-02	4.90E+00	4.02E+00	4.45E-01	1.49E-01	6.77E-01	1.54E-01	3.26E-01	5.60E-01	9.96E-02	3.15E-01	3.56E+00	1.07E+00	4.81E-01	3.26E-01	5.73E-01	1.20E-01	6.62E-01
2003	3	5	1.72E-01	4.16E-02	1.18E-01	2.50E-02	2.88E-02	4.95E-01	1.23E-01	7.84E-01	3.18E-01	4.65E-01	2.21E-01	7.20E-02	1.29E-01	8.23E-01	2.28E-01	1.72E-01	5.83E-04	1.13E-01	1.16E-03	2.03E-03	4.79E-01	1.22E-01	7.11E-01	1.95E-03	2.96E-03	2.56E-03	9.09E-04	1.24E-03	8.23E-01	2.28E-01	0.00E+00	4.10E-02	4.86E-03	2.39E-02	2.68E-02	1.59E-02	1.01E-03	7.31E-02	3.16E-01	4.62E-01	2.18E-01	7.11E-02	1.28E-01	0.00E+00	0.00E+00
2003	3	6	6.10E-01	2.38E-01	4.01E-01	2.15E-01	2.41E-01	9.16E-01	2.53E-02	5.01E-01	9.38E-01	3.18E-02	1.75E-01	1.09E-02	1.15E-02	1.74E+00	7.82E-01	6.10E-01	1.05E-02	3.72E-01	1.55E-02	1.87E-02	8.58E-01	2.53E-02	5.01E-01	7.67E-03	9.28E-03	1.22E-02	9.93E-03	9.30E-03	1.74E+00	7.82E-01	0.00E+00	2.28E-01	2.85E-02	2.00E-01	2.22E-01	5.79E-02	0.00E+00	0.00E+00	9.31E-01	2.25E-02	1.63E-01	9.64E-04	2.22E-03	0.00E+00	0.00E+00
2003	3	7	1.42E+00	1.75E-02	8.80E-01	2.78E-03	1.66E-03	1.72E+00	1.78E-02	5.98E-01	2.87E+00	1.47E-03	3.07E-03	1.44E-04	3.80E-04	2.06E+00	1.68E+00	1.36E+00	9.59E-03	8.13E-01	2.42E-03	1.56E-03	1.59E+00	1.78E-02	5.98E-01	1.13E-03	1.06E-03	2.71E-03	1.43E-04	3.78E-04	2.06E+00	1.59E+00	6.28E-02	7.87E-03	6.64E-02	3.64E-04	9.88E-05	1.32E-01	0.00E+00	0.00E+00	2.87E+00	4.12E-04	3.67E-04	1.03E-07	2.05E-06	0.00E+00	9.24E-02
2003	3	8	1.24E+00	3.70E-01	6.49E-01	4.42E-01	5.41E-01	1.39E+00	2.23E-01	2.27E+00	1.81E+00	1.59E-01	7.38E-01	2.33E-02	5.04E-02	2.46E+00	1.67E+00	1.22E+00	6.12E-03	6.14E-01	5.33E-03	8.19E-03	1.35E+00	2.23E-01	2.27E+00	1.45E-02	8.91E-03	7.77E-03	1.37E-02	1.05E-02	2.46E+00	1.62E+00	2.59E-02	3.64E-01	3.53E-02	4.37E-01	5.32E-01	3.50E-02	2.17E-05	1.60E-03	1.79E+00	1.50E-01	7.30E-01	9.56E-03	3.99E-02	3.23E-04	5.32E-02
2003	3	9	3.13E+00	4.33E-01	1.86E+00	1.19E-01	1.26E-01	4.05E+00	4.16E-01	3.97E+00	2.98E+00	4.75E-01	8.24E-01	5.75E-02	1.43E-01	4.16E+00	3.79E+00	2.68E+00	1.09E-02	1.80E+00	1.10E-02	1.17E-02	3.99E+00	4.13E-01	3.68E+00	1.03E-01	2.77E-02	1.63E-02	3.77E-02	3.28E-02	4.12E+00	2.96E+00	4.52E-01	4.22E-01	6.40E-02	1.08E-01	1.14E-01	6.37E-02	3.44E-03	2.95E-01	2.88E+00	4.47E-01	8.07E-01	1.98E-02	1.10E-01	3.98E-02	8.37E-01
2003	3	10	6.65E-02	5.75E-07	1.95E-02	9.67E-05	2.32E-03	5.46E-01	2.02E-01	5.10E-01	1.71E-02	9.33E-01	1.81E-01	6.64E-02	1.99E-01	4.72E-01	1.23E-01	6.65E-02	5.75E-07	1.95E-02	5.90E-05	4.99E-04	5.46E-01	2.02E-01	5.08E-01	1.52E-02	4.96E-03	4.78E-03	2.18E-03	2.22E-03	4.72E-01	1.23E-01	0.00E+00	0.00E+00	0.00E+00	3.77E-05	1.82E-03	0.00E+00	5.10E-05	2.15E-03	1.88E-03	9.28E-01	1.76E-01	6.42E-02	1.97E-01	0.00E+00	0.00E+00
2003	3	11	4.10E-01	4.63E-01	7.97E-02	3.67E-01	4.22E-01	6.63E-01	3.78E-01	1.29E+00	7.05E-02	9.50E-01	1.17E+00	2.27E-02	1.35E-01	1.33E+00	6.64E-01	4.10E-01	1.89E-03	7.97E-02	8.86E-03	1.87E-02	6.63E-01	3.78E-01	1.29E+00	5.84E-02	2.87E-02	2.07E-02	1.75E-02	2.47E-02	1.33E+00	6.64E-01	0.00E+00	4.61E-01	0.00E+00	3.58E-01	4.04E-01	0.00E+00	0.00E+00	0.00E+00	1.20E-02	9.21E-01	1.15E+00	5.24E-03	1.10E-01	0.00E+00	0.00E+00
2003	3	12	2.75E-01	0.00E+00	4.73E-02	0.00E+00	2.00E-03	7.79E-01	1.62E-01	6.90E-01	2.13E-02	8.28E-01	1.66E-01	4.74E-02	3.28E-01	6.34E-01	4.20E-01	2.75E-01	0.00E+00	4.72E-02	0.00E+00	0.00E+00	7.62E-01	1.62E-01	6.85E-01	1.76E-02	4.92E-03	1.70E-04	8.24E-03	6.19E-03	6.34E-01	4.20E-01	2.71E-06	0.00E+00	1.18E-04	0.00E+00	2.00E-03	1.69E-02	1.09E-04	4.28E-03	3.66E-03	8.23E-01	1.66E-01	3.91E-02	3.22E-01	0.00E+00	1.76E-05
2003	3	13	8.75E-02	0.00E+00	1.46E-02	0.00E+00	2.03E-03	6.77E-01	1.41E-01	3.71E-01	1.12E-03	6.68E-01	1.99E-01	7.40E-02	2.30E-01	4.42E-01	2.28E-01	8.75E-02	0.00E+00	1.46E-02	0.00E+00	3.34E-06	6.77E-01	1.39E-01	3.41E-01	1.12E-03	4.59E-04	9.71E-05	6.52E-03	3.99E-03	4.42E-01	2.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-03	0.00E+00	2.16E-03	2.94E-02	0.00E+00	6.68E-01	1.99E-01	6.75E-02	2.26E-01	0.00E+00	0.00E+00
2003	3	14	7.68E-02	0.00E+00	4.07E-02	0.00E+00	2.77E-02	5.97E-01	4.57E-01	1.57E+00	1.62E-04	1.16E+00	2.22E-01	5.89E-01	4.59E-01	9.59E-01	1.82E-01	7.68E-02	0.00E+00	4.07E-02	0.00E+00	0.00E+00	5.97E-01	4.39E-01	1.15E+00	1.62E-04	4.72E-05	0.00E+00	1.54E-02	3.83E-03	8.89E-01	1.82E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.77E-02	0.00E+00	1.80E-02	4.27E-01	3.88E-35	1.16E+00	2.22E-01	5.74E-01	4.55E-01	7.08E-02	0.00E+00
2003	3	15	1.77E+00	4.83E-01	8.12E-01	1.28E-01	1.47E-01	4.62E+00	2.09E+00	6.96E+00	1.49E+00	4.91E+00	3.50E+00	8.67E-01	8.67E-01	5.64E+00	2.50E+00	1.63E+00	1.88E-02	8.02E-01	3.61E-03	7.32E-03	4.60E+00	2.04E+00	5.64E+00	2.36E-01	7.36E-02	3.64E-02	1.17E-01	9.31E-02	5.48E+00	2.12E+00	1.38E-01	4.65E-01	1.05E-02	1.24E-01	1.40E-01	2.33E-02	5.18E-02	1.33E+00	1.26E+00	4.83E+00	3.46E+00	7.50E-01	7.74E-01	1.61E-01	3.78E-01
2003	3	16	6.00E-01	8.33E-04	3.80E-01	5.14E-04	6.80E-03	4.10E+00	1.97E+00	5.51E+00	1.41E-01	5.17E+00	3.92E-02	1.58E+00	6.02E-01	4.45E+00	8.26E-01	6.00E-01	8.33E-04	3.80E-01	1.36E-04	5.28E-04	4.10E+00	1.89E+00	4.11E+00	1.38E-01	2.51E-02	5.05E-03	7.83E-02	5.05E-02	4.38E+00	8.26E-01	1.69E-10	0.00E+00	0.00E+00	3.78E-04	6.27E-03	2.47E-04	8.69E-02	1.40E+00	2.71E-03	5.15E+00	3.42E-02	1.50E+00	5.52E-01	7.29E-02	7.28E-06
2003	3	17	4.23E-01	9.61E-05	4.16E-01	2.37E-06	7.06E-05	3.87E+00	1.98E+00	6.05E+00	1.06E-01	7.31E+00	2.64E-02	1.78E+00	8.98E-01	3.96E+00	5.84E-01	3.89E-01	9.61E-05	4.16E-01	2.37E-06	7.06E-05	3.87E+00	1.89E+00	4.15E+00	1.06E-01	1.60E-02	2.29E-03	5.19E-02	3.37E-02	3.88E+00	4.88E-01	3.32E-02	0.00E+00	3.88E-04	0.00E+00	0.00E+00	2.70E-03	9.48E-02	1.91E+00	8.40E-06	7.29E+00	2.41E-02	1.73E+00	8.65E-01	7.82E-02	9.65E-02
2003	3	18	4.00E-01	8.46E-04	2.94E-01	1.73E-04	5.97E-04	3.02E+00	1.69E+00	4.97E+00	9.95E-02	5.27E+00	7.68E-02	1.39E+00	7.25E-01	3.45E+00	6.89E-01	3.82E-01	8.46E-04	2.94E-01	1.73E-04	5.97E-04	3.02E+00	1.59E+00	3.58E+00	9.80E-02	1.92E-02	4.26E-03	7.13E-02	4.05E-02	3.38E+00	6.42E-01	1.85E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-01	1.39E+00	1.54E-03	5.25E+00	7.25E-02	1.32E+00	6.84E-01	6.18E-02	4.70E-02
2003	3	19	7.18E-01	2.15E-01	2.24E-01	7.86E-02	1.47E-01	2.08E+00	1.06E+00	3.30E+00	1.54E-01	3.46E+00	4.94E+00	6.82E-01	5.67E-01	1.74E+00	1.09E+00	6.90E-01	1.42E-02	2.23E-01	2.83E-03	4.36E-03	2.08E+00	1.03E+00	2.48E+00	1.33E-01	4.07E-02	2.22E-02	5.29E-02	4.56E-02	1.73E+00	1.01E+00	2.79E-02	2.00E-01	1.52E-03	7.58E-02	1.42E-01	5.80E-03	2.69E-02	8.25E-01	2.11E-02	3.42E+00	4.92E+00	6.29E-01	5.22E-01	9.76E-03	7.90E-02
2003	3	20	5.13E-01	4.05E-02	1.58E-01	6.96E-02	1.26E-01	2.42E+00	8.92E-01	4.32E+00	1.08E-01	1.61E+00	1.66E+00	2.44E-01	4.84E-01	2.10E+00	6.45E-01	5.01E-01	5.32E-03	1.57E-01	4.15E-03	5.98E-03	2.42E+00	8.56E-01	2.98E+00	1.00E-01	3.45E-02	1.49E-02	5.80E-02	4.92E-02	2.02E+00	5.96E-01	1.14E-02	3.52E-02	3.67E-04	6.54E-02	1.21E-01	1.96E-03	3.61E-02	1.34E+00	8.11E-03	1.57E+00	1.64E+00	1.86E-01	4.35E-01	7.55E-02	4.87E-02
2003	3	21	8.04E-02	0.00E+00	1.33E-02	0.00E+00	2.94E-09	6.27E-01	2.59E-01	1.23E+00	2.38E-04	9.09E-01	9.21E-02	1.65E-01	2.79E-01	6.27E-01	1.54E-01	8.04E-02	0.00E+00	1.33E-02	0.00E+00	0.00E+00	6.27E-01	2.57E-01	7.90E-01	2.38E-04	8.37E-07	0.00E+00	8.21E-04	5.19E-04	6.27E-01	1.54E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.94E-09	0.00E+00	1.46E-03	4.44E-01	1.57E-34	9.09E-01	9.21E-02	1.64E-01	2.79E-01	0.00E+00	0.00E+00
2003	3	22	2.89E-01	1.12E-08	4.12E-02	1.60E-08	5.83E-03	1.09E+00	2.05E-01	8.06E-01	2.08E-02	1.04E+00	3.25E-01	3.98E-02	3.13E-01	8.12E-01	5.51E-01	2.89E-01	1.12E-08	4.12E-02	1.60E-08	3.06E-05	1.09E+00	2.05E-01	7.11E-01	2.08E-02	2.79E-03	3.40E-04	5.53E-03	5.27E-03	8.12E-01	5.51E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.80E-03	0.00E+00	1.61E-04	9.50E-02	2.80E-39	1.04E+00	3.25E-01	3.43E-02	3.08E-01	0.00E+00	3.53E-04
2003	3	23	3.89E-02	0.00E+00	1.45E-02	0.00E+00	0.00E+00	6.53E-01	2.41E-01	8.54E-01	4.04E-05	8.90E-01	6.27E-02	1.80E-01	2.69E-01	5.55E-01	1.12E-01	3.89E-02	0.00E+00	1.45E-02	0.00E+00	0.00E+00	6.53E-01	2.39E-01	5.44E-01	4.04E-05	0.00E+00	0.00E+00	4.47E-03	2.47E-04	5.55E-01	1.12E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-03	3.10E-01	1.63E-25	8.90E-01	6.27E-02	1.75E-01	2.69E-01	0.00E+00	0.00E+00
2003	3	24	8.50E-01	5.85E-05	3.66E-01	0.00E+00	1.39E-05	2.52E+00	1.27E+00	3.56E+00	8.11E-02	5.86E+00	3.38E-02	1.22E+00	9.98E-01	2.52E+00	1.18E+00	8.34E-01	5.85E-05	3.65E-01	0.00E+00	1.39E-05	2.51E+00	1.23E+00	2.98E+00	6.39E-02	8.42E-03	1.25E-03	3.49E-02	1.86E-02	2.52E+00	1.14E+00	1.61E-02	0.00E+00	1.15E-03	0.00E+00	2.51E-11	9.32E-03	4.14E-02	5.81E-01	1.72E-02	5.85E+00	3.25E-02	1.18E+00	9.79E-01	6.28E-03	3.60E-02
2003	3	25	1.43E-01	7.98E-06	9.60E-02	3.18E-08	1.06E-06	1.52E+00	5.28E-01	2.19E+00	9.55E-03	1.52E+00	8.50E-02	6.81E-01	3.10E-01	1.20E+00	3.09E-01	1.41E-01	7.98E-06	9.60E-02	3.18E-08	1.06E-06	1.52E+00	5.01E-01	1.41E+00	9.55E-03	1.42E-03	1.57E-04	6.12E-03	3.20E-03	1.18E+00	2.98E-01	2.39E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-02	7.79E-01	1.29E-18	1.52E+00	8.48E-02	6.75E-01	3.07E-01	1.92E-02	1.17E-02
2003	3	26	3.33E+00	9.12E-03	1.72E+00	5.69E-04	8.31E-04	4.20E+00	1.32E+00	5.92E+00	5.40E+00	7.44E+00	1.55E-02	1.19E+00	1.42E+00	5.42E+00	4.17E+00	3.10E+00	6.46E-04	1.63E+00	3.37E-06	1.99E-05	4.08E+00	1.15E+00	5.20E+00	1.04E-01	1.20E-02	3.05E-03	3.17E-02	1.93E-02	5.24E+00	3.80E+00	2.27E-01	8.47E-03	8.35E-02	5.65E-04	8.11E-04	1.20E-01	1.69E-01	7.14E-01	5.29E+00	7.43E+00	1.25E-02	1.16E+00	1.40E+00	1.78E-01	3.67E-01
2003	3	27	4.59E+00	3.42E-01	2.77E+00	2.31E-02	3.70E-02	5.69E+00	2.20E+00	7.70E+00	1.05E+01	1.54E+00	8.42E-01	6.02E-01	5.97E-01	7.49E+00	6.27E+00	4.04E+00	2.86E-02	2.56E+00	7.24E-03	1.11E-02	5.46E+00	2.11E+00	7.21E+00	3.25E-01	8.09E-02	4.33E-02	1.39E-01	1.04E-01	7.34E+00	5.17E+00	5.47E-01	3.13E-01	2.10E-01	1.59E-02	2.58E-02	2.30E-01	8.94E-02	4.96E-01	1.01E+01	1.46E+00	7.99E-01	4.63E-01	4.93E-01	1.46E-01	1.10E+00
2003	3	28	1.38E+00	3.06E-01	5.21E-01	4.08E-02	5.39E-02	4.22E+00	1.55E+00	6.84E+00	4.48E-01	2.77E+00	1.49E+00	6.61E-01	5.17E-01	3.82E+00	2.01E+00	1.34E+00	1.08E-02	5.14E-01	3.40E-03	6.07E-03	4.20E+00	1.51E+00	5.38E+00	1.52E-01	4.38E-02	2.18E-02	9.91E-02	6.65E-02	3.72E+00	1.90E+00	4.47E-02	2.95E-01	6.79E-03	3.74E-02	4.78E-02	2.20E-02	4.33E-02	1.46E+00	2.95E-01	2.73E+00	1.47E+00	5.62E-01	4.51E-01	9.70E-02	1.13E-01
2003	3	29	3.33E-01	1.99E-04	1.56E-01	2.14E-05	1.34E-04	1.62E+00	5.77E-01	2.98E+00	4.29E-02	1.41E+00	4.52E-02	3.63E-01	3.61E-01	1.56E+00	4.47E-01	2.33E-01	1.99E-04	1.56E-01	2.14E-05	1.34E-04	1.62E+00	5.37E-01	2.16E+00	4.29E-02	6.86E-03	1.47E-03	2.16E-02	1.39E-02	1.53E+00	2.96E-01	1.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E-05	3.93E-02	8.15E-01	5.00E-05	1.41E+00	4.38E-02	3.42E-01	3.47E-01	2.55E-02	1.51E-01
2003	3	30	7.59E-02	0.00E+00	1.93E-02	0.00E+00	0.00E+00	1.03E+00	2.38E-01	7.42E-01	7.61E-03	7.68E-01	5.02E-02	2.81E-01	2.37E-01	5.98E-01	1.46E-01	7.59E-02	0.00E+00	1.93E-02	0.00E+00	0.00E+00	1.03E+00	2.32E-01	5.49E-01	7.61E-03	2.12E-04	2.52E-07	5.36E-03	2.04E-03	5.97E-01	1.46E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E-03	1.93E-01	2.04E-18	7.68E-01	5.02E-02	2.76E-01	2.35E-01	8.15E-04	0.00E+00
2003	3	31	5.38E-01	4.28E-07	1.12E-01	6.17E-09	1.35E-04	2.18E+00	3.79E-01	1.94E+00	8.50E-02	1.32E+00	1.21E-01	1.25E-01	6.45E-01	1.70E+00	1.03E+00	5.38E-01	4.28E-07	1.12E-01	6.17E-09	6.92E-06	2.18E+00	3.72E-01	1.85E+00	7.86E-02	1.30E-02	7.19E-04	3.15E-02	2.47E-02	1.69E+00	1.03E+00	1.86E-04	0.00E+00	0.00E+00	0.00E+00	1.28E-04	7.24E-06	6.95E-03	9.41E-02	6.37E-03	1.31E+00	1.20E-01	9.33E-02	6.20E-01	4.44E-03	7.35E-03
2003	4	1	9.33E-01	7.47E-03	4.47E-01	9.32E-02	1.87E-01	4.14E+00	1.25E+00	5.11E+00	1.95E-01	4.83E+00	1.59E+00	4.88E-01	6.93E-01	4.06E+00	1.37E+00	8.69E-01	5.58E-03	4.46E-01	2.82E-03	5.24E-03	4.14E+00	1.20E+00	4.31E+00	1.44E-01	3.55E-02	1.93E-02	6.38E-02	4.83E-02	3.98E+00	1.24E+00	6.38E-02	1.88E-03	2.02E-04	9.03E-02	1.82E-01	2.30E-03	5.08E-02	8.01E-01	5.15E-02	4.80E+00	1.57E+00	4.24E-01	6.44E-01	8.47E-02	1.37E-01
2003	4	2	5.30E-01	1.10E-01	3.62E-01	1.53E-02	4.08E-02	5.85E-01	4.83E-02	1.49E+00	1.55E+00	2.35E-02	1.44E-01	1.56E-03	1.67E-03	1.79E+00	6.42E-01	5.30E-01	4.42E-03	3.40E-01	1.66E-03	2.34E-03	5.53E-01	4.83E-02	1.49E+00	1.81E-03	9.52E-04	2.23E-03	1.45E-03	1.23E-03	1.79E+00	6.42E-01	2.48E-06	1.06E-01	2.25E-02	1.36E-02	3.84E-02	3.17E-02	2.71E-06	2.85E-06	1.55E+00	2.26E-02	1.42E-01	1.09E-04	4.42E-04	2.35E-06	8.97E-04
2003	4	3	1.05E+00	4.92E-01	2.72E-01	6.09E-02	6.40E-02	2.32E+00	8.78E-01	2.47E+00	1.48E-01	1.91E+00	1.47E+00	6.04E-02	3.89E-01	2.03E+00	1.62E+00	1.04E+00	6.26E-03	2.69E-01	2.80E-03	5.09E-03	2.29E+00	8.76E-01	2.27E+00	1.22E-01	2.74E-02	1.87E-02	3.33E-02	2.93E-02	2.02E+00	1.55E+00	1.71E-02	4.86E-01	3.28E-03	5.81E-02	5.89E-02	2.66E-02	2.66E-03	1.99E-01	2.67E-02	1.88E+00	1.45E+00	2.71E-02	3.60E-01	7.37E-03	7.41E-02
2003	4	4	1.08E+00	3.02E-03	3.22E-01	6.91E-02	1.78E-01	3.30E+00	5.12E-01	4.07E+00	1.43E-01	2.40E+00	1.62E+00	1.09E-01	4.82E-01	3.13E+00	1.66E+00	1.04E+00	2.64E-03	3.14E-01	1.87E-03	4.76E-03	3.26E+00	5.06E-01	3.70E+00	1.17E-01	3.19E-02	1.78E-02	3.01E-02	3.08E-02	3.12E+00	1.56E+00	4.02E-02	3.82E-04	8.35E-03	6.72E-02	1.73E-01	3.67E-02	5.19E-03	3.73E-01	2.56E-02	2.36E+00	1.60E+00	7.92E-02	4.51E-01	5.98E-03	1.03E-01
2003	4	5	8.66E-01	1.95E-03	2.87E-01	9.64E-04	5.00E-02	2.82E+00	4.90E-01	3.28E+00	1.38E-01	2.04E+00	7.25E-01	5.81E-02	6.07E-01	2.38E+00	1.45E+00	7.91E-01	1.74E-03	2.81E-01	9.13E-04	3.42E-03	2.81E+00	4.82E-01	2.67E+00	1.20E-01	2.94E-02	1.18E-02	3.83E-02	3.50E-02	2.34E+00	1.29E+00	7.44E-02	2.14E-04	6.41E-03	5.10E-05	4.66E-02	1.25E-02	8.00E-03	6.08E-01	1.88E-02	2.01E+00	7.13E-01	1.97E-02	5.72E-01	4.64E-02	1.57E-01
2003	4	6	3.44E-01	2.52E-04	1.95E-01	2.44E-05	3.28E-04	3.76E+00	7.17E-01	4.84E+00	1.88E-01	2.63E+00	1.39E-01	3.26E-01	9.72E-01	2.91E+00	8.41E-01	3.44E-01	2.52E-04	1.95E-01	2.44E-05	3.09E-04	3.76E+00	6.97E-01	3.88E+00	1.87E-01	3.11E-02	5.89E-03	5.96E-02	5.32E-02	2.85E+00	8.41E-01	5.51E-11	0.00E+00	0.00E+00	0.00E+00	1.81E-05	0.00E+00	2.08E-02	9.66E-01	7.91E-04	2.60E+00	1.33E-01	2.66E-01	9.19E-01	5.37E-02	3.45E-06
2003	4	7	1.82E-01	4.41E-05	5.49E-02	3.43E-06	1.05E-04	1.05E+00	2.32E-01	1.30E+00	3.16E-02	9.56E-01	1.04E-01	8.03E-02	3.38E-01	6.37E-01	2.84E-01	1.79E-01	4.41E-05	5.48E-02	3.43E-06	4.79E-05	1.05E+00	2.28E-01	8.67E-01	3.16E-02	7.25E-03	1.19E-03	1.90E-02	1.32E-02	6.33E-01	2.70E-01	2.09E-03	0.00E+00	4.77E-05	0.00E+00	5.70E-05	1.35E-03	3.69E-03	4.36E-01	9.90E-06	9.48E-01	1.03E-01	6.13E-02	3.24E-01	3.88E-03	1.39E-02
2003	4	8	5.27E-01	7.36E-04	1.24E-01	1.08E-03	1.01E-01	1.28E+00	2.96E-01	1.37E+00	2.82E-02	1.10E+00	7.01E-01	8.91E-02	2.13E-01	9.28E-01	7.65E-01	4.95E-01	6.37E-04	1.16E-01	9.52E-04	2.57E-03	1.25E+00	2.95E-01	1.20E+00	2.38E-02	6.24E-03	5.31E-03	5.89E-03	6.68E-03	9.28E-01	6.70E-01	3.22E-02	9.86E-05	7.55E-03	1.26E-04	9.85E-02	3.08E-02	1.26E-03	1.73E-01	4.39E-03	1.10E+00	6.95E-01	8.32E-02	2.06E-01	1.59E-04	9.49E-02
2003	4	9	3.25E-01	1.22E-04	1.18E-01	1.61E-05	6.17E-04	1.51E+00	4.92E-01	1.83E+00	6.25E-02	9.98E-01	9.26E-02	1.57E-01	7.80E-01	1.25E+00	6.56E-01	3.16E-01	1.08E-04	1.18E-01	1.57E-05	2.64E-04	1.51E+00	4.83E-01	1.61E+00	5.69E-02	1.23E-02	3.03E-03	2.87E-02	2.03E-02	1.24E+00	6.14E-01	9.94E-03	1.37E-05	2.27E-04	3.62E-07	3.53E-04	1.59E-03	8.66E-03	2.26E-01	5.52E-03	9.85E-01	8.96E-02	1.29E-01	7.59E-01	1.38E-02	4.16E-02
2003	4	10	9.51E-01	4.04E-01	3.65E-01	6.35E-02	1.26E-01	3.39E+00	1.32E+00	5.53E+00	3.23E-01	2.71E+00	2.00E+00	3.66E-01	7.56E-01	2.80E+00	1.58E+00	9.46E-01	1.21E-02	3.64E-01	3.40E-03	4.97E-03	3.39E+00	1.28E+00	4.12E+00	2.24E-01	5.55E-02	2.18E-02	1.05E-01	8.14E-02	2.76E+00	1.56E+00	5.01E-03	3.92E-01	6.60E-04	6.02E-02	1.21E-01	1.99E-03	3.64E-02	1.41E+00	9.93E-02	2.66E+00	1.98E+00	2.61E-01	6.74E-01	4.20E-02	1.79E-02
2003	4	11	9.49E-01	8.54E-04	3.88E-01	6.85E-04	2.43E-03	3.25E+00	1.18E+00	4.76E+00	2.14E-01	3.21E+00	1.97E-01	6.99E-01	8.86E-01	3.07E+00	1.59E+00	9.27E-01	7.70E-04	3.84E-01	3.09E-04	2.02E-03	3.23E+00	1.14E+00	4.03E+00	1.93E-01	4.69E-02	1.57E-02	6.46E-02	5.74E-02	3.03E+00	1.55E+00	2.23E-02	8.32E-05	4.33E-03	3.76E-04	4.15E-04	1.84E-02	3.68E-02	7.30E-01	2.14E-02	3.16E+00	1.81E-01	6.35E-01	8.28E-01	3.78E-02	3.85E-02
2003	4	12	1.48E+00	1.06E-03	8.16E-01	5.80E-07	9.92E-06	3.33E+00	3.84E-01	3.50E+00	1.92E+00	1.27E+00	4.94E-04	4.36E-01	2.88E-01	3.72E+00	2.05E+00	1.38E+00	2.60E-05	7.34E-01	5.80E-07	9.78E-06	3.17E+00	3.41E-01	3.09E+00	3.93E-02	4.94E-03	4.79E-04	2.02E-02	1.24E-02	3.66E+00	1.90E+00	1.08E-01	1.03E-03	8.15E-02	0.00E+00	1.39E-07	1.68E-01	4.32E-02	4.16E-01	1.88E+00	1.27E+00	1.50E-05	4.16E-01	2.76E-01	5.73E-02	1.48E-01
2003	4	13	2.86E+00	7.94E-02	1.32E+00	9.28E-02	2.42E-01	2.86E+00	7.52E-01	3.12E+00	1.84E+00	3.22E+00	2.85E+00	9.20E-02	3.38E-01	3.01E+00	3.49E+00	2.54E+00	3.34E-03	1.21E+00	3.00E-03	7.55E-03	2.80E+00	7.48E-01	2.89E+00	5.02E-02	2.89E-02	1.61E-02	4.52E-02	3.37E-02	2.99E+00	2.95E+00	3.20E-01	7.60E-02	1.11E-01	8.98E-02	2.34E-01	6.25E-02	3.64E-03	2.22E-01	1.79E+00	3.19E+00	2.84E+00	4.68E-02	3.04E-01	2.70E-02	5.45E-01
2003	4	14	4.78E-01	1.85E-01	2.54E-01	7.96E-02	1.58E-01	1.22E+00	1.30E-01	1.32E+00	9.94E-01	8.05E-01	8.67E-01	2.42E-02	1.62E-01	1.43E+00	6.39E-01	4.78E-01	3.33E-03	2.31E-01	3.41E-03	4.17E-03	1.19E+00	1.30E-01	1.02E+00	1.93E-02	7.67E-03	4.95E-03	1.35E-02	1.04E-02	1.43E+00	6.39E-01	1.61E-05	1.81E-01	2.34E-02	7.62E-02	1.54E-01	3.76E-02	5.79E-04	2.93E-01	9.75E-01	7.97E-01	8.62E-01	1.07E-02	1.51E-01	3.73E-03	6.84E-05
2003	4	15	2.12E-01	0.00E+00	1.19E-01	0.00E+00	6.60E-07	1.94E+00	2.95E-01	2.47E+00	5.19E-02	1.25E+00	6.53E-02	1.10E-01	4.79E-01	1.22E+00	3.88E-01	2.09E-01	0.00E+00	1.19E-01	0.00E+00	0.00E+00	1.94E+00	2.88E-01	1.95E+00	5.19E-02	2.75E-03	6.12E-05	2.01E-02	1.26E-02	1.17E+00	3.74E-01	3.05E-03	0.00E+00	0.00E+00	0.00E+00	6.60E-07	0.00E+00	7.20E-03	5.27E-01	2.89E-18	1.25E+00	6.53E-02	8.97E-02	4.66E-01	4.20E-02	1.40E-02
2003	4	16	1.21E-01	1.85E-05	2.88E-02	1.47E-07	1.31E-04	1.09E+00	2.59E-01	2.00E+00	4.54E-02	1.21E+00	1.16E-01	1.72E-01	4.08E-01	7.39E-01	2.69E-01	1.21E-01	1.85E-05	2.88E-02	1.47E-07	5.77E-06	1.09E+00	2.54E-01	1.44E+00	4.54E-02	5.41E-03	5.05E-04	1.27E-02	9.32E-03	7.34E-01	2.68E-01	1.36E-04	0.00E+00	0.00E+00	0.00E+00	1.25E-04	0.00E+00	4.81E-03	5.60E-01	4.50E-18	1.20E+00	1.15E-01	1.59E-01	3.99E-01	5.39E-03	4.11E-04
2003	4	17	1.90E-01	6.59E-07	5.01E-02	1.35E-02	6.36E-02	1.51E+00	3.96E-01	2.26E+00	1.87E-02	1.81E+00	5.01E-01	2.70E-01	4.22E-01	1.17E+00	3.13E-01	1.90E-01	6.59E-07	5.01E-02	1.03E-05	5.05E-05	1.51E+00	3.79E-01	1.56E+00	1.87E-02	1.95E-03	1.26E-04	1.09E-02	5.34E-03	1.15E+00	3.13E-01	3.53E-05	0.00E+00	0.00E+00	1.35E-02	6.36E-02	0.00E+00	1.63E-02	6.98E-01	5.33E-17	1.80E+00	5.01E-01	2.59E-01	4.16E-01	1.31E-02	6.34E-05
2003	4	18	5.08E-01	2.18E-04	2.75E-01	4.95E-06	8.35E-05	2.51E+00	7.83E-01	4.04E+00	2.03E-01	3.76E+00	2.69E-02	8.12E-01	5.99E-01	2.36E+00	8.46E-01	4.95E-01	2.18E-04	2.67E-01	4.95E-06	8.35E-05	2.47E+00	7.59E-01	3.07E+00	8.49E-02	1.53E-02	3.11E-03	3.58E-02	2.66E-02	2.32E+00	8.09E-01	1.31E-02	0.00E+00	7.81E-03	0.00E+00	0.00E+00	3.81E-02	2.34E-02	9.69E-01	1.18E-01	3.75E+00	2.38E-02	7.76E-01	5.73E-01	4.36E-02	3.71E-02
2003	4	19	1.66E+00	3.16E-01	1.03E+00	1.52E-02	3.74E-02	4.00E+00	1.28E+00	5.49E+00	1.04E+00	3.17E+00	1.62E+00	3.67E-01	8.70E-01	3.18E+00	2.27E+00	1.58E+00	5.78E-03	1.01E+00	1.68E-03	2.99E-03	3.97E+00	1.26E+00	4.47E+00	1.41E-01	2.91E-02	1.18E-02	6.54E-02	4.48E-02	3.15E+00	2.11E+00	7.82E-02	3.10E-01	1.64E-02	1.35E-02	3.44E-02	3.40E-02	2.75E-02	1.03E+00	8.94E-01	3.14E+00	1.61E+00	3.02E-01	8.25E-01	3.66E-02	1.60E-01
2003	4	20	1.78E+00	8.66E-02	7.31E-01	3.47E-02	9.31E-02	4.39E+00	7.57E-01	4.80E+00	1.24E+00	3.53E+00	7.16E-01	3.89E-01	5.03E-01	4.24E+00	2.82E+00	1.73E+00	7.39E-03	7.21E-01	2.96E-03	4.32E-03	4.38E+00	7.12E-01	3.85E+00	1.40E-01	2.98E-02	1.34E-02	5.69E-02	4.27E-02	4.16E+00	2.69E+00	4.29E-02	7.92E-02	1.00E-02	3.17E-02	8.87E-02	1.90E-02	4.52E-02	9.45E-01	1.10E+00	3.50E+00	7.02E-01	3.32E-01	4.61E-01	8.41E-02	1.23E-01
2003	4	21	3.68E+00	4.94E-01	1.41E+00	1.15E-02	1.93E-02	5.00E+00	1.29E+00	5.84E+00	3.27E+00	2.85E+00	1.13E+00	3.06E-01	4.54E-01	6.02E+00	5.21E+00	3.37E+00	1.43E-02	1.38E+00	3.86E-03	6.18E-03	4.96E+00	1.28E+00	5.63E+00	1.80E-01	4.44E-02	2.26E-02	7.79E-02	5.84E-02	5.99E+00	4.60E+00	3.10E-01	4.80E-01	2.83E-02	7.62E-03	1.31E-02	4.68E-02	6.53E-03	2.07E-01	3.09E+00	2.80E+00	1.11E+00	2.28E-01	3.96E-01	2.97E-02	6.15E-01
2003	4	22	1.89E+00	5.36E-01	8.98E-01	9.60E-02	1.46E-01	5.47E+00	2.54E+00	8.86E+00	1.98E+00	1.03E+01	2.96E+00	1.64E+00	2.22E+00	6.88E+00	2.60E+00	1.71E+00	2.26E-02	8.13E-01	8.17E-03	1.07E-02	5.35E+00	2.40E+00	7.57E+00	2.23E-01	6.60E-02	3.53E-02	1.15E-01	8.65E-02	6.64E+00	2.30E+00	1.82E-01	5.13E-01	8.47E-02	8.79E-02	1.35E-01	1.21E-01	1.40E-01	1.29E+00	1.76E+00	1.02E+01	2.92E+00	1.53E+00	2.14E+00	2.40E-01	2.94E-01
2003	4	23	5.56E-01	4.73E-02	3.91E-01	5.34E-02	1.12E-01	4.80E+00	1.51E+00	5.82E+00	2.01E-01	8.22E+00	9.47E-01	1.50E+00	1.28E+00	4.08E+00	8.12E-01	5.42E-01	3.03E-03	3.84E-01	1.83E-03	2.85E-03	4.79E+00	1.39E+00	4.28E+00	1.58E-01	3.93E-02	1.11E-02	8.75E-02	6.29E-02	3.96E+00	7.95E-01	1.39E-02	4.43E-02	6.65E-03	5.16E-02	1.09E-01	1.01E-02	1.14E-01	1.54E+00	4.30E-02	8.18E+00	9.36E-01	1.41E+00	1.22E+00	1.18E-01	1.78E-02
2003	4	24	2.14E+00	8.03E-02	9.84E-01	5.48E-05	6.35E-05	4.14E+00	6.28E-01	5.99E+00	2.62E+00	1.54E+00	7.42E-04	5.79E-01	3.92E-01	4.25E+00	2.82E+00	1.79E+00	2.40E-04	7.91E-01	5.47E-05	6.31E-05	3.83E+00	5.35E-01	4.99E+00	1.18E-01	5.08E-03	5.30E-04	2.65E-02	1.27E-02	4.10E+00	2.43E+00	3.46E-01	8.00E-02	1.93E-01	1.08E-07	3.41E-07	3.13E-01	9.30E-02	9.92E-01	2.51E+00	1.54E+00	2.12E-04	5.52E-01	3.79E-01	1.55E-01	3.83E-01
2003	4	25	1.07E+00	1.71E-01	5.03E-01	2.26E-02	4.54E-02	1.31E+00	5.86E-01	2.42E+00	8.70E-01	1.45E+00	4.41E-01	5.14E-01	2.99E-01	1.50E+00	1.37E+00	9.93E-01	4.31E-03	4.88E-01	1.12E-03	1.65E-03	1.30E+00	5.70E-01	1.97E+00	9.03E-02	1.52E-02	6.99E-03	2.14E-02	1.78E-02	1.49E+00	1.24E+00	8.12E-02	1.66E-01	1.41E-02	2.15E-02	4.38E-02	1.84E-02	1.63E-02	4.48E-01	7.79E-01	1.44E+00	4.34E-01	4.93E-01	2.81E-01	4.63E-03	1.26E-01
2003	4	26	1.59E+00	4.86E-01	7.77E-01	4.38E-03	1.86E-02	2.03E+00	3.35E-01	2.82E+00	2.78E+00	2.40E+00	4.66E-01	4.00E-01	3.06E-01	3.06E+00	2.09E+00	1.28E+00	3.28E-03	7.63E-01	4.82E-04	1.86E-03	2.02E+00	2.94E-01	2.63E+00	3.40E-02	1.80E-02	9.57E-03	1.63E-02	1.92E-02	3.04E+00	1.50E+00	3.15E-01	4.83E-01	1.41E-02	3.89E-03	1.68E-02	1.44E-02	4.08E-02	1.91E-01	2.75E+00	2.39E+00	4.56E-01	3.83E-01	2.87E-01	1.86E-02	5.95E-01
2003	4	27	1.26E+00	4.14E-01	4.61E-01	2.44E-01	7.37E-01	2.85E+00	6.47E-01	2.54E+00	1.21E+00	2.07E+00	3.79E+00	1.17E-01	3.11E-01	2.54E+00	1.67E+00	1.20E+00	2.13E-02	4.46E-01	1.37E-02	2.71E-02	2.83E+00	6.42E-01	2.45E+00	1.65E-01	6.62E-02	4.43E-02	1.01E-01	8.05E-02	2.53E+00	1.57E+00	5.38E-02	3.92E-01	1.48E-02	2.30E-01	7.10E-01	1.99E-02	4.61E-03	8.43E-02	1.05E+00	2.01E+00	3.74E+00	1.61E-02	2.30E-01	1.25E-02	1.03E-01
2003	4	28	1.30E+00	0.00E+00	6.54E-01	0.00E+00	0.00E+00	1.35E+00	6.57E-03	1.29E+00	3.57E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E+00	1.57E+00	1.22E+00	0.00E+00	6.09E-01	0.00E+00	0.00E+00	1.28E+00	6.57E-03	1.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E+00	1.44E+00	8.27E-02	0.00E+00	4.55E-02	0.00E+00	0.00E+00	7.23E-02	0.00E+00	0.00E+00	3.57E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-01
2003	4	29	4.34E+00	1.32E-03	2.26E+00	7.10E-05	1.25E-04	3.66E+00	2.54E-02	3.31E+00	8.04E+00	5.62E-03	2.02E-03	9.43E-03	7.27E-03	4.53E+00	5.15E+00	3.77E+00	1.29E-03	2.14E+00	7.10E-05	1.25E-04	3.55E+00	2.45E-02	3.28E+00	4.65E-02	5.37E-03	1.95E-03	8.85E-03	6.89E-03	4.51E+00	4.07E+00	5.77E-01	3.72E-05	1.18E-01	4.00E-09	7.00E-08	1.11E-01	9.69E-04	3.16E-02	8.00E+00	2.53E-04	6.74E-05	5.82E-04	3.75E-04	1.38E-02	1.08E+00
2003	4	30	4.16E+00	1.57E+00	2.28E+00	3.00E-01	4.25E-01	5.51E+00	1.59E+00	7.47E+00	4.54E+00	5.11E+00	3.59E+00	4.57E-01	8.88E-01	7.92E+00	6.14E+00	3.71E+00	3.72E-02	2.23E+00	8.09E-03	1.17E-02	5.44E+00	1.56E+00	7.12E+00	3.17E-01	8.92E-02	4.96E-02	1.42E-01	1.09E-01	7.82E+00	5.06E+00	4.52E-01	1.54E+00	4.88E-02	2.92E-01	4.14E-01	7.34E-02	3.37E-02	3.51E-01	4.22E+00	5.02E+00	3.54E+00	3.14E-01	7.79E-01	9.61E-02	1.07E+00
2003	5	1	1.81E+00	2.89E-01	1.07E+00	4.19E-02	9.04E-02	2.18E+01	5.47E+00	1.97E+01	6.90E-01	9.42E+00	2.32E+00	8.97E-01	1.59E+00	1.43E+01	3.73E+00	1.80E+00	2.50E-02	1.07E+00	8.37E-03	1.27E-02	2.18E+01	5.41E+00	1.83E+01	6.67E-01	1.33E-01	4.88E-02	2.73E-01	2.13E-01	1.42E+01	3.70E+00	1.11E-02	2.64E-01	1.35E-03	3.35E-02	7.77E-02	3.59E-03	5.94E-02	1.38E+00	2.20E-02	9.29E+00	2.27E+00	6.24E-01	1.38E+00	1.02E-01	2.61E-02
2003	5	2	1.63E+00	1.31E-02	4.79E-01	2.73E-02	6.25E-02	1.25E+01	1.44E+00	9.40E+00	4.68E-01	2.24E+00	1.14E+00	1.92E-01	6.52E-01	6.83E+00	3.43E+00	1.63E+00	1.29E-02	4.79E-01	4.50E-03	7.21E-03	1.25E+01	1.44E+00	8.64E+00	4.65E-01	7.91E-02	2.56E-02	1.35E-01	1.28E-01	6.80E+00	3.43E+00	0.00E+00	2.24E-04	0.00E+00	2.28E-02	5.53E-02	0.00E+00	3.32E-03	7.65E-01	3.20E-03	2.16E+00	1.12E+00	5.71E-02	5.23E-01	2.88E-02	0.00E+00
2003	5	3	8.88E+00	1.80E-01	5.25E+00	2.50E-01	1.25E+00	1.02E+01	7.92E-01	9.95E+00	5.50E+00	4.66E-01	5.51E+00	3.99E-02	2.60E-02	1.29E+01	9.53E+00	8.64E+00	5.11E-02	5.20E+00	4.81E-02	3.58E-02	1.01E+01	7.92E-01	9.95E+00	5.35E-02	1.89E-02	2.85E-02	3.99E-02	2.60E-02	1.29E+01	9.11E+00	2.45E-01	1.29E-01	4.51E-02	2.02E-01	1.22E+00	5.86E-02	0.00E+00	2.36E-04	5.44E+00	4.47E-01	5.48E+00	0.00E+00	0.00E+00	1.04E-04	4.20E-01
2003	5	4	5.08E+00	2.06E+00	2.32E+00	1.80E-01	1.66E-01	6.67E+00	1.55E+00	9.52E+00	3.53E+00	5.66E-01	2.75E+00	7.34E-02	1.66E-01	1.60E+01	7.36E+00	5.08E+00	4.28E-02	2.30E+00	1.10E-02	1.34E-02	6.63E+00	1.55E+00	9.52E+00	2.16E-01	8.15E-02	5.11E-02	7.23E-02	8.01E-02	1.60E+01	7.36E+00	0.00E+00	2.02E+00	2.02E-02	1.69E-01	1.53E-01	4.76E-02	0.00E+00	0.00E+00	3.31E+00	4.85E-01	2.70E+00	1.11E-03	8.60E-02	0.00E+00	0.00E+00
2003	5	5	5.01E+00	1.39E+00	1.68E+00	4.53E-01	6.22E-01	1.03E+01	5.39E+00	1.68E+01	7.02E-01	6.76E+00	5.77E+00	6.87E-01	8.69E-01	1.48E+01	7.81E+00	4.95E+00	5.01E-02	1.68E+00	3.03E-02	4.50E-02	1.03E+01	5.37E+00	1.63E+01	4.08E-01	1.38E-01	8.62E-02	2.13E-01	1.71E-01	1.48E+01	7.67E+00	5.95E-02	1.34E+00	1.48E-03	4.23E-01	5.77E-01	4.37E-03	1.92E-02	4.85E-01	2.94E-01	6.62E+00	5.68E+00	4.74E-01	6.99E-01	4.28E-02	1.47E-01
2003	5	6	3.33E+00	8.95E-01	5.32E-01	4.41E-01	1.02E+00	4.70E+00	1.63E+00	1.11E+01	2.28E-01	1.78E+00	2.37E+00	4.38E-02	8.77E-02	9.44E+00	4.38E+00	3.28E+00	4.77E-02	5.28E-01	4.50E-02	6.49E-02	4.69E+00	1.63E+00	1.11E+01	1.72E-01	9.40E-02	8.00E-02	4.00E-02	4.54E-02	9.44E+00	4.21E+00	4.17E-02	8.47E-01	4.03E-03	3.96E-01	9.51E-01	1.75E-02	1.29E-03	3.66E-02	5.66E-02	1.69E+00	2.29E+00	3.80E-03	4.23E-02	2.46E-03	1.70E-01
2003	5	7	6.39E+00	2.24E-01	1.67E+00	4.16E-01	2.74E-01	9.02E+00	3.13E+00	1.59E+01	6.62E-01	6.89E+00	4.52E+00	2.30E+00	3.34E+00	1.16E+01	8.56E+00	6.36E+00	5.62E-02	1.66E+00	3.12E-02	3.77E-02	8.97E+00	3.08E+00	1.58E+01	1.60E-01	5.20E-02	4.60E-02	6.57E-02	5.36E-02	1.15E+01	8.48E+00	3.29E-02	1.68E-01	1.51E-02	3.85E-01	2.37E-01	4.87E-02	5.09E-02	9.05E-02	5.02E-01	6.84E+00	4.48E+00	2.23E+00	3.29E+00	4.02E-02	7.09E-02

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	5	8	1.06E+01	1.85E-03	8.04E+00	4.52E-04	6.49E-04	1.38E+01	1.07E+00	1.11E+01	4.87E+00	2.88E-03	1.88E-03	4.08E-03	3.03E-03	1.74E+01	1.17E+01
2003	5	9	8.78E+00	2.32E-05	6.69E+00	0.00E+00	2.35E-07	1.12E+01	7.24E-03	1.37E+01	3.95E+00	1.63E-04	3.08E-05	3.41E-04	1.84E-04	1.44E+01	9.74E+00
2003	5	10	1.06E+01	9.24E-01	5.99E+00	1.26E-01	1.94E-01	1.88E+01	8.35E+00	2.50E+01	4.89E+00	1.50E+01	3.39E+00	4.47E+00	6.10E+00	2.63E+01	1.39E+01
2003	5	11	1.53E+00	9.51E-03	1.03E+00	4.91E-02	6.70E-02	2.58E+01	6.01E+00	1.89E+01	5.43E-01	5.22E+00	4.29E-01	6.24E-01	2.22E+00	1.65E+01	4.15E+00
2003	5	12	1.10E+00	2.35E-05	4.46E-01	7.84E-07	4.32E-04	1.48E+01	3.69E+00	1.46E+01	3.08E-01	4.93E+00	1.71E-01	5.61E-01	1.15E+00	9.45E+00	1.80E+00
2003	5	13	6.17E-01	0.00E+00	1.82E-01	0.00E+00	6.91E-11	6.74E+00	1.44E+00	6.25E+00	9.39E-02	2.61E+00	2.15E-01	3.29E-01	6.47E-01	4.60E+00	1.44E+00
2003	5	14	6.16E-01	2.65E-06	5.95E-02	7.02E-06	1.64E-02	3.74E+00	9.84E-01	2.27E+00	8.88E-03	2.16E+00	4.94E-01	1.80E-01	4.59E-01	2.59E+00	1.34E+00
2003	5	15	4.91E-01	6.27E-07	6.99E-02	9.04E-07	1.68E-03	4.43E+00	8.31E-01	2.26E+00	1.75E-02	2.18E+00	4.06E-01	8.04E-02	5.44E-01	2.48E+00	1.18E+00
2003	5	16	1.85E-01	0.00E+00	6.88E-02	0.00E+00	7.48E-07	4.28E+00	9.64E-01	4.52E+00	4.28E-04	1.85E+00	2.24E-01	2.21E-01	4.95E-01	2.92E+00	5.49E-01
2003	5	17	6.83E-01	0.00E+00	1.01E-01	0.00E+00	0.00E+00	4.73E+00	1.94E+00	6.63E+00	1.98E-05	5.36E+00	6.66E-02	5.93E-01	8.47E-01	4.42E+00	1.01E+00
2003	5	18	8.21E+00	4.85E-01	3.43E+00	2.72E-03	1.58E-02	1.65E+01	2.00E+00	1.40E+01	6.35E+00	4.51E-01	1.83E+00	6.25E-02	7.10E-02	1.45E+01	9.83E+00
2003	5	19	4.18E+00	7.81E-01	1.68E+00	2.09E-01	3.46E-01	2.38E+01	7.11E+00	2.41E+01	1.45E+00	9.82E+00	3.93E+00	1.60E+00	2.06E+00	1.67E+01	7.36E+00
2003	5	20	1.03E+00	1.11E-03	3.72E-01	6.17E-04	1.76E-02	1.47E+01	3.40E+00	1.21E+01	2.95E-01	2.95E+00	4.27E-01	4.21E-01	9.10E-01	8.56E+00	2.19E+00
2003	5	21	2.57E+00	4.85E-05	9.48E-01	1.22E-07	8.02E-05	1.27E+01	1.99E+00	1.20E+01	3.26E-01	2.79E+00	2.27E-01	2.04E-01	9.12E-01	8.95E+00	5.90E+00
2003	5	22	1.33E+00	3.11E-06	4.20E-01	5.98E-06	9.07E-04	6.80E+00	1.57E+00	7.05E+00	2.08E-01	2.21E+00	2.38E-01	3.69E-01	6.57E-01	5.17E+00	2.28E+00
2003	5	23	3.98E+00	5.49E-01	1.76E+00	8.44E-02	1.44E-01	1.71E+01	5.39E+00	1.86E+01	9.07E-01	9.03E+00	1.38E+00	9.80E-01	1.76E+00	1.29E+01	6.09E+00
2003	5	24	6.55E+00	3.66E-01	3.60E+00	8.83E-02	1.40E-01	2.34E+01	4.84E+00	2.34E+01	1.92E+00	5.78E+00	8.65E-01	6.83E-01	1.17E+00	2.56E+01	8.94E+00
2003	5	25	2.42E+00	1.40E-01	8.80E-01	9.51E-02	2.50E-01	1.01E+01	2.06E+00	7.89E+00	3.22E-01	3.97E+00	1.34E+00	3.97E-01	5.86E-01	6.11E+00	3.55E+00
2003	5	26	1.37E-01	0.00E+00	3.52E-02	0.00E+00	0.00E+00	3.37E+00	1.09E+00	3.28E+00	7.79E-05	2.03E+00	2.21E-01	2.77E-01	4.77E-01	2.28E+00	1.91E-01
2003	5	27	2.37E+00	1.04E-03	7.42E-01	9.16E-04	7.44E-03	1.46E+01	4.83E+00	1.19E+01	3.81E-01	3.08E+00	2.74E-01	5.48E-01	1.35E+00	9.08E+00	3.89E+00
2003	5	28	2.91E+00	3.01E-01	1.24E+00	1.16E-01	3.54E-01	1.41E+01	5.08E+00	1.43E+01	8.42E-01	5.95E+00	2.75E+00	3.94E-01	1.10E+00	1.09E+01	4.73E+00
2003	5	29	1.30E+00	0.00E+00	3.47E-01	0.00E+00	0.00E+00	8.19E+00	2.40E+00	8.69E+00	7.84E-01	7.28E+00	2.16E-02	1.14E+00	1.45E+00	6.19E+00	2.48E+00
2003	5	30	1.04E+01	5.72E-04	4.72E+00	0.00E+00	0.00E+00	1.37E+01	3.50E-01	8.84E+00	1.70E+00	9.31E-02	8.42E-03	6.20E-03	4.79E-03	1.26E+01	1.24E+01
2003	5	31	9.50E+00	1.37E-01	2.86E+00	6.13E-02	9.75E-02	1.35E+01	1.19E+00	1.21E+01	5.32E+00	1.82E+00	6.75E-01	2.15E-01	3.90E-01	2.19E+01	1.46E+01
2003	6	1	1.03E+00	0.00E+00	2.25E-01	0.00E+00	0.00E+00	6.40E+00	1.25E+00	4.36E+00	6.57E-02	2.18E+00	7.87E-02	4.05E-01	5.79E-01	4.04E+00	1.68E+00
2003	6	2	7.26E-01	0.00E+00	2.95E-01	0.00E+00	2.46E-10	7.48E+00	2.33E+00	1.06E+01	4.73E-02	7.31E+00	8.99E-02	9.08E-01	1.61E+00	6.99E+00	1.40E+00
2003	6	3	9.76E-01	1.43E-05	2.88E-01	7.67E-07	2.88E-06	1.61E+01	3.43E+00	2.33E+01	1.87E-01	1.26E+01	6.64E-03	2.20E+00	3.61E+00	1.46E+01	2.40E+00
2003	6	4	8.32E+00	1.21E-03	3.60E+00	9.37E-05	5.75E-04	2.12E+01	3.52E+00	2.74E+01	4.30E+00	2.57E+00	2.09E-02	1.74E+00	1.53E+00	2.29E+01	1.14E+01
2003	6	5	8.16E+00	7.93E-01	3.49E+00	1.96E-01	3.92E-01	2.03E+01	5.33E+00	1.96E+01	5.02E+00	9.27E+00	7.08E+00	1.24E+00	2.16E+00	1.99E+01	1.09E+01
2003	6	6	1.10E+01	3.65E-02	4.77E+00	1.07E-04	3.50E-04	1.53E+01	6.66E-01	1.21E+01	5.15E+00	6.17E-02	2.99E-02	1.05E-01	7.39E-02	1.71E+01	1.38E+01
2003	6	7	3.77E+00	8.03E-01	1.28E+00	2.76E-01	2.47E-01	1.91E+01	5.01E+00	1.38E+01	9.57E-01	3.82E+00	7.41E+00	5.77E-01	1.19E+00	1.09E+01	5.46E+00
2003	6	8	4.86E+00	2.69E-04	2.65E+00	1.85E-05	1.04E-04	1.77E+01	1.25E+00	9.47E+00	1.95E+00	2.28E+00	2.39E-01	2.14E-01	6.22E-01	8.10E+00	6.08E+00
2003	6	9	9.06E+00	1.02E-03	8.32E+00	1.02E-06	5.33E-06	1.25E+01	4.10E-02	9.79E+00	4.27E+00	1.79E-02	2.38E-03	9.45E-03	8.16E-03	1.42E+01	9.96E+00
2003	6	10	1.03E+01	5.87E-01	4.71E+00	7.36E-02	1.62E-01	1.89E+01	3.76E+00	1.51E+01	4.34E+00	6.38E+00	1.87E+00	5.63E-01	8.15E-01	1.63E+01	1.32E+01
2003	6	11	1.05E+00	3.58E-04	7.06E-01	3.54E-05	2.17E-04	1.82E+01	4.04E+00	1.91E+01	1.64E-01	1.41E+01	2.34E-02	1.72E+00	2.29E+00	1.77E+01	1.77E+00
2003	6	12	1.30E+00	5.15E-04	6.89E-01	4.21E-05	1.86E-03	1.71E+01	4.85E+00	1.83E+01	4.70E-01	8.47E+00	3.75E-01	1.01E+00	1.07E+00	1.47E+01	2.28E+00
2003	6	13	1.40E+00	9.16E-03	3.40E-01	1.06E-01	3.46E-01	1.16E+01	3.32E+00	1.11E+01	4.42E-01	3.77E+00	2.94E+00	2.73E-01	7.32E-01	8.26E+00	2.57E+00
2003	6	14	7.53E-01	0.00E+00	2.73E-01	0.00E+00	4.71E-07	8.56E+00	1.83E+00	7.48E+00	1.84E-01	2.26E+00	1.69E-01	3.60E-01	7.07E-01	6.24E+00	1.37E+00
2003	6	15	8.96E-01	2.38E-04	6.62E-01	2.32E-06	1.23E-04	2.04E+01	2.63E+00	1.57E+01	4.77E-01	3.42E+00	1.29E-01	5.39E-01	1.00E+00	1.00E+01	2.40E+00
2003	6	16	5.86E+00	1.51E-02	2.37E+00	5.38E-03	9.25E-03	2.40E+01	3.15E+00	2.21E+01	4.70E+00	8.80E+00	8.55E-02	1.28E+00	2.26E+00	1.88E+01	8.23E+00
2003	6	17	7.57E+00	1.59E-01	3.30E+00	3.93E-02	8.22E-02	1.79E+01	3.82E+00	1.96E+01	3.49E+00	5.29E+00	4.03E-01	1.03E+00	1.44E+00	2.00E+01	9.38E+00
2003	6	18	9.26E+00	1.46E+00	2.85E+00	5.24E-01	4.59E-01	1.97E+01	5.04E+00	1.73E+01	2.26E+00	2.09E+00	7.06E+00	2.21E-01	2.07E-01	1.90E+01	1.29E+01
2003	6	19	4.16E+00	4.28E-01	1.38E+00	3.22E-01	3.07E-01	1.03E+01	3.54E+00	1.45E+01	3.27E-01	4.71E+00	6.47E+00	4.49E-01	8.74E-01	1.51E+01	4.97E+00
2003	6	20	1.32E+00	1.77E-02	3.33E-01	1.29E-01	1.48E-01	9.83E+00	2.13E+00	8.78E+00	2.28E-01	2.30E+00	1.90E+00	2.55E-01	9.87E-01	5.77E+00	2.45E+00
2003	6	21	1.03E-01	0.00E+00	3.14E-02	0.00E+00	0.00E+00	3.10E+00	6.98E-01	2.89E+00	8.37E-15	1.21E+00	1.60E-01	1.80E-01	3.39E-01	1.98E+00	2.50E-01
2003	6	22	4.07E-01	0.00E+00	1.72E-01	0.00E+00	0.00E+00	3.93E+00	9.38E-01	4.01E+00	2.14E-02	1.69E+00	1.98E-01	2.20E-01	5.09E-01	2.86E+00	7.96E-01
2003	6	23	6.81E+00	1.53E-01	2.00E+00	4.63E-02	4.23E-02	1.19E+01	2.31E+00	1.31E+01	2.93E+00	2.56E+00	1.98E-01	3.82E-01	6.43E-01	1.70E+01	9.74E+00
2003	6	24	1.03E+01	1.73E+00	4.43E+00	5.57E-02	4.25E-02	1.64E+01	3.32E+00	2.32E+01	5.16E+00	9.15E-01	2.93E+00	3.94E-01	3.58E-01	2.18E+01	1.39E+01
2003	6	25	2.15E+00	7.37E-02	9.57E-01	1.13E-01	1.55E-01	2.05E+01	7.84E+00	2.31E+01	5.55E-01	1.27E+01	1.74E+00	2.17E+00	3.19E+00	1.72E+01	2.92E+00
2003	6	26	7.90E-01	1.30E-03	6.07E-01	3.40E-05	3.37E-04	1.26E+01	2.35E+00	1.35E+01	1.94E-01	4.84E+00	3.19E-02	8.27E-01	7.56E-01	8.50E+00	2.00E+00
2003	6	27	6.70E-01	1.67E-03	9.31E-01	2.63E-04	5.56E-04	1.53E+01	2.86E+00	2.01E+01	3.09E-01	1.39E+01	1.20E-02	1.24E+00	3.66E+00	2.03E+01	9.18E-01
2003	6	28	4.25E+00	1.68E-01	2.65E+00	4.09E-02	8.20E-02	1.67E+01	2.11E+00	1.69E+01	1.90E+00	5.66E+00	4.28E-01	7.85E-01	8.96E-01	1.48E+01	4.98E+00
2003	6	29	3.94E+00	1.03E-01	9.66E-01	5.34E-02	1.92E-01	1.56E+01	3.71E+00	1.87E+01	6.02E-01	3.48E+00	2.15E+00	3.69E-01	6.72E-01	1.57E+01	6.51E+00
2003	6	30	2.57E+00	1.27E-01	2.67E-01	1.66E-01	1.58E-01	1.37E+01	3.30E+00	9.64E+00	5.21E-01	2.32E+00	2.57E+00	3.55E-01	5.95E-01	6.06E+00	4.14E+00
2003	7	1	6.41E-01	2.03E-07	1.66E-01	0.00E+00	2.89E-05	1.01E+01	1.71E+00	9.88E+00	2.65E-01	3.12E+00	1.83E-01	4.55E-01	6.48E-01	5.83E+00	1.37E+00
2003	7	2	1.59E-01	0.00E+00	2.03E-01	0.00E+00	3.65E-09	4.85E+00	8.47E-01	2.67E+00	2.45E-02	1.66E+00	1.55E-01	1.25E-01	4.71E-01	2.04E+00	4.40E-01
2003	7	3	1.80E-01	0.00E+00	2.97E-02	0.00E+00	0.00E+00	3.75E+00	1.26E+00	4.62E+00	2.07E-15	2.16E+00	6.28E-02	4.32E-01	4.66E-01	2.67E+00	4.38E-01
2003	7	4	1.19E+00	0.00E+00	1.32E-01	0.00E+00	0.00E+00	6.06E+00	1.53E+00	7.79E+00	1.51E-01	2.52E+00	1.29E-01	3.40E-01	6.49E-01	5.62E+00	2.01E+00
2003	7	5	3.18E+00	3.79E-04	6.21E-01	0.00E+00	8.99E-05	1.03E+01	2.22E+00	1.24E+01	2.49E-01	6.64E+00	8.18E-02	5.90E-01	1.19E+00	1.12E+01	5.06E+00
2003	7	6	9.38E+00	2.31E-01	3.35E+00	6.74E-02	8.51E-02	1.79E+01	4.37E+00	2.11E+01	6.76E-01	4.59E+00	4.23E-01	2.56E+00	2.92E+00	1.71E+01	1.33E+01
2003	7	7	1.07E+01	6.47E-01	3.59E+00	2.22E-01	4.81E-01	1.91E+01	3.81E+00	1.97E+01	1.23E+00	3.06E+00	5.06E+00	2.23E-01	2.39E-01	1.87E+01	1.52E+01
2003	7	8	3.51E+00	2.01E-01	1.08E+00	1.22E-01	2.17E-01	1.54E+01	4.97E+00	1.05E+01	4.19E-01	3.71E+00	3.42E+00	3.51E-01	7.91E-01	1.14E+01	6.08E+00
2003	7	9	8.32E-01	7.37E-05	3.50E-01	1.90E-06	1.03E-04	1.58E+01	2.90E+00	1.38E+01	3.06E-01	4.44E+00	1.06E-01	1.04E+00	1.05E+00	1.10E+01	1.21E+00
2003	7	10	1.28E+01	4.71E-02	5.86E+00	2.77E-02	2.01E-02	1.62E+01	5.41E-01	1.83E+01	2.01E+00	2.56E-02	1.75E-02	6.10E-02	3.47E-02	2.16E+01	1.50E+01
2003	7	11	9.23E+00	9.02E-01	4.04E+00	9.90E-02	1.87E-01	2.55E+01	5.81E+00	2.51E+01	3.10E+00	8.66E+00	2.34E+00	6.18E-01	1.44E+00	2.08E+01	1.23E+01
2003	7	12	1.05E+00	1.46E-04	6.01E-01	6.37E-03	9.97E-02	1.73E+01	2.94E+00	1.04E+01	2.91E-01	5.30E+00	8.84E-01	6.18E-01	7.42E-01	1.25E+01	1.89E+00
2003	7	13	5.48E-01	6.78E-06	3.11E-01	2.12E-07	1.35E-05	6.92E+00	1.75E+00	9.33E+00	7.79E-02	3.36E+00	1.62E-01	4.48E-01	5.40E-01	7.12E+00	1.54E+00
2003	7	14	7.67E-01	0.00E+00	4.04E-01	0.00E+00	0.00E+00	1.19E+01	2.27E+00	1.20E+01	1.54E-01	3.39E+00	1.69E-01	2.84E-01	9.39E-01	7.40E+00	2.19E+00
2003	7	15	3.63E+00	5.71E-01	1.30E+00	3.65E-02	4.96E-02	1.73E+01	2.76E+00	1.71E+01	6.56E-01	4.83E+00	4.82E-01	3.92E-01	8.55E-01	1.14E+01	5.39E+00
2003	7	16	6.78E+00	7.84E-01	2.29E+00	5.82E-01	4.48E-01	1.13E+01	4.31E+00	1.01E+01	5.60E-01	4.42E+00	8.05E+00	3.69E-01	5.58E-01	1.18E+01	8.59E+00
2003	7	17	3.64E-01	1.80E-06	3.23E-01	0.00E+00	6.28E-07	7.59E+00	1.96E+00	9.30E+00	3.71E-02	3.14E+00	1.52E-01	7.87E-01	9.43E-01	6.72E+00	1.16E+00
2003	7	18	3.15E+00	3.42E-02	1.38E+00	1.57E-02	5.27E-02	2.26E+01	6.02E+00	2.50E+01	2.65E+00	7.03E+00	4.36E-01	1.84E+00	1.99E+00	2.06E+01	4.07E+00
2003	7	19	6.09E+00	6.32E-02	2.57E+00	2.26E-02	3.57E-02	2.06E+01	2.29E+00	1.82E+01	3.68E+00	6.97E+00	5.24E-01	6.98E-01	9.70E-01	1.86E+01	8.34E+00
2003	7	20	1.02E+01	7.89E-01	3.54E+00	2.39E-01	6.38E-01	2.02E+01	3.56E+00	2.01E+01	2.37E+00	3.55E+00	4.86E+00	6.34E-01	4.77E-01	1.99E+01	1.57E+01
2003	7	21	9.28E+00	1.79E-01	3.38E+00	3.90E-02	3.63E-02	1.67E+01	2.94E+00	2.25E+01	2.82E+00	8.45E-01	1.16E-01	5.95E-01	5.18E-01	2.32E+01	1.25E+01
2003	7	22	3.06E+00	3.48E-02	1.23E+00	1.33E-02	2.33E-02	1.92E+01	3.90E+00	1.66E+01	3.61E-01	5.47E+00	2.30E-01	7.11E-01	9.93E-01	1.35E+01	4.27E+00
2003	7	23	9.04E-01	1.59E-01	5.34E-01	5.27E-02	7.48E-02	1.29E+01	4.72E+00	1.38E+01	2.53E-01	7.00E+00	1.52E+00	1.18E+00	1.19E+00	1.69E+01	1.16E+00
2003	7	24	3.26E+00	1.34E-01	1.95E+00	7.76E-02	3.11E-01	1.00E+01	1.60E+00	1.53E+01	1.12E+00	4.02E+00	2.23E+00	2.99E-01	4.97E-01	1.21E+01	5.70E+00
2003	7	25	1.92E+00	6.32E-01	1.11E+00	2.04E-01	8.85E-02	2.66E+00	8.72E-02	4.85E+00	1.12E+00	7.13E-03	2.46E-02	3.01E-03	4.27E-03	9.99E+00	2.50E+00
2003	7	26	8.70E+00	8.64E-01	3.21E+00	5.41E-02	8.66E-02	1.76E+01	3.73E+00	2.39E+01	2.22E+00	4.62E+00	9.40E-01	4.80E-01	7.10E-01	2.85E+01	1.19E+01
2003	7	27	7.08E-01	3.68E-05	7.88E-01	6.71E-08	8.98E-05	2.40E+01	5.49E+00	2.40E+01	4.16E-01	1.11E+01	7.30E-02	1.45E+00	1.18E+00	1.77E+01	1.02E+00
2003	7	28	1.81E+00	5.68E-02	9.81E-01	1.82E-02	1.18E-01	1.06E+01	2.10E+00	1.65E+01	8.22E-01	8.63E+00	1.31E+00	8.06E-01	1.67E+00	1.47E+01	2.77E+00

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	5	8	1.04E+01	9.29E-04	7.07E+00	1.49E-04	2.13E-04	1.33E+01	1.07E+00	1.11E+01	3.07E-02	1.48E-03	7.75E-04	2.61E-03	1.59E-03	1.74E+01	1.13E+01
2003	5	9	8.45E+00	1.23E-05	5.64E+00	0.00E+00	2.35E-07	1.07E+01	7.18E-03	1.37E+01	1.68E-02	7.94E-05	1.04E-05	3.21E-04	1.45E-04	1.43E+01	9.06E+00
2003	5	10	9.70E+00	5.50E-02	5.29E+00	1.28E-02	2.22E-02	1.82E+01	7.09E+00	2.35E+01	7.21E-01	2.05E-01	1.01E-01	3.94E-01	2.81E-01	2.53E+01	1.25E+01
2003	5	11	1.53E+00	9.14E-03	1.03E+00	7.93E-03	1.32E-02	2.58E+01	5.97E+00	1.78E+01	5.41E-01	1.08E-01	3.33E-02	2.95E-01	1.99E-01	1.64E+01	4.14E+00
2003	5	12	1.10E+00	2.35E-05	4.46E-01	7.84E-07	2.89E-04	1.48E+01	3.64E+00	1.35E+01	3.08E-01	4.90E-02	7.00E-03	1.21E-01	8.85E-02	9.41E+00	1.79E+00
2003	5	13	5.76E-01	0.00E+00	1.82E-01	0.00E+00	0.00E+00	6.74E+00	1.44E+00	5.98E+00	9.25E-02	4.06E-03	1.72E-05	3.38E-02	2.56E-02	4.59E+00	1.32E+00
2003	5	14	6.16E-01	2.65E-06	5.95E-02	7.02E-06	2.35E-04	3.74E+00	9.83E-01	2.08E+00	8.78E-03	2.72E-03	6.80E-04	2.96E-02	9.43E-03	2.59E+00	1.34E+00
2003	5	15	4.91E-01	6.27E-07	6.99E-02	9.04E-07	1.09E-04	4.43E+00	8.31E-01	2.23E+00	1.75E-02	2.58E-03	4.79E-04	2.71E-02	1.83E-02	2.48E+00	1.18E+00
2003	5	16	1.85E-01	0.00E+00	6.88E-02	0.00E+00	0.00E+00	4.28E+00	9.60E-01	4.38E+00	4.28E-04	2.54E-05	0.00E+00	7.42E-03	5.50E-04	2.91E+00	5.49E-01
2003	5	17	6.82E-01	0.00E+00	1.01E-01	0.00E+00	0.00E+00	4.73E+00	1.91E+00	6.30E+00	1.98E-05	0.00E+00	0.00E+00	9.84E-03	4.10E-04	4.41E+00	1.01E+00
2003	5	18	7.51E+00	5.54E-04	2.74E+00	1.16E-06	9.46E-05	1.60E+01	1.97E+00	1.36E+01	9.93E-02	1.64E-02	3.93E-03	4.12E-02	2.78E-02	1.42E+01	8.90E+00
2003	5	19	4.12E+00	5.76E-02	1.61E+00	2.38E-02	3.63E-02	2.38E+01	7.05E+00	2.32E+01	9.00E-01	2.64E-01	1.32E-01	4.34E-01	3.32E-01	1.66E+01	7.24E+00
2003	5	20	1.03E+00	1.11E-03	3.72E-01	6.12E-04	3.20E-03	1.47E+01	3.37E+00	1.11E+01	2.95E-01	5.98E-02	1.53E-02	1.48E-01	1.04E-01	8.48E+00	2.19E+00
2003	5	21	2.54E+00	2.54E-05	9.40E-01	0.00E+00	7.21E-05	1.27E+01	1.98E+00	1.18E+01	3.04E-01	6.01E-02	8.52E-03	8.72E-02	7.31E-02	8.93E+00	5.80E+00
2003	5	22	1.33E+00	2.37E-06	4.19E-01	5.98E-06	8.78E-04	6.79E+00	1.56E+00	6.75E+00	2.05E-01	3.00E-02	7.49E-03	5.77E-02	5.94E-02	5.11E+00	2.26E+00
2003	5	23	3.93E+00	3.75E-02	1.76E+00	5.20E-03	9.62E-03	1.71E+01	5.36E+00	1.77E+01	6.23E-01	1.47E-01	6.65E-02	3.02E-01	2.09E-01	1.29E+01	5.98E+00
2003	5	24	6.45E+00	2.68E-02	3.58E+00	1.37E-02	2.26E-02	2.34E+01	4.79E+00	2.25E+01	3.58E-01	1.28E-01	6.01E-02	2.34E-01	1.82E-01	2.55E+01	8.74E+00
2003	5	25	2.40E+00	3.09E-03	8.77E-01	4.25E-03	7.49E-03	1.01E+01	2.04E+00	7.66E+00	2.09E-01	3.18E-02	1.13E-02	7.76E-02	4.17E-02	6.08E+00	3.51E+00
2003	5	26	1.37E-01	0.00E+00	3.52E-02	0.00E+00	0.00E+00	3.37E+00	1.09E+00	3.13E+00	7.79E-05	2.57E-06	0.00E+00	1.13E-03	1.14E-04	2.28E+00	1.91E-01
2003	5	27	2.36E+00	1.04E-03	7.41E-01	9.09E-04	4.61E-03	1.46E+01	4.82E+00	1.10E+01	3.64E-01	8.28E-02	2.62E-02	1.65E-01	1.31E-01	9.00E+00	3.88E+00
2003	5	28	2.76E+00	2.01E-02	1.23E+00	1.13E-02	2.18E-02	1.41E+01	5.07E+00	1.38E+01	4.24E-01	1.42E-01	6.30E-02	2.39E-01	1.96E-01	1.08E+01	4.44E+00
2003	5	29	1.23E+00	0.00E+00	2.94E-01	0.00E+00	0.00E+00	8.15E+00	2.31E+00	8.42E+00	6.17E-02	4.04E-03	0.00E+00	3.31E-02	1.38E-02	6.10E+00	2.40E+00
2003	5	30	1.02E+01	4.38E-04	4.66E+00	0.00E+00	0.00E+00	1.37E+01	3.49E-01	8.71E+00	6.95E-02	3.86E-03	7.79E-04	6.19E-03	4.66E-03	1.26E+01	1.19E+01
2003	5	31	9.35E+00	8.06E-03	2.74E+00	4.42E-03	5.71E-03	1.34E+01	1.18E+00	1.19E+01	3.51E-01	3.20E-02	1.34E-02	4.62E-02	3.63E-02	2.18E+01	1.42E+01
2003	6	1	1.03E+00	0.00E+00	2.24E-01	0.00E+00	0.00E+00	6.39E+00	1.24E+00	4.06E+00	6.32E-02	3.66E-03	3.39E-05	2.47E-02	1.32E-02	4.04E+00	1.67E+00
2003	6	2	7.23E-01	0.00E+00	2.95E-01	0.00E+00	0.00E+00	7.47E+00	2.30E+00	1.01E+01	4.59E-02	2.15E-03	1.96E-05	1.18E-02	7.26E-03	6.98E+00	1.38E+00
2003	6	3	9.62E-01	3.12E-07	2.87E-01	0.00E+00	0.00E+00	1.61E+01	3.08E+00	2.19E+01	1.67E-01	1.41E-02	1.06E-03	1.00E-01	4.59E-02	1.44E+01	2.38E+00
2003	6	4	7.91E+00	1.21E-03	3.21E+00	9.37E-05	5.75E-04	2.09E+01	3.27E+00	2.66E+01	3.27E-01	5.06E-02	1.20E-02	1.36E-01	8.36E-02	2.26E+01	1.07E+01
2003	6	5	7.93E+00	6.50E-02	3.13E+00	2.45E-02	4.36E-02	2.01E+01	5.22E+00	1.88E+01	7.48E-01	2.50E-01	1.32E-01	4.21E-01	3.29E-01	1.97E+01	1.05E+01
2003	6	6	1.04E+01	1.11E-02	3.98E+00	1.07E-04	3.50E-04	1.46E+01	6.65E-01	1.21E+01	4.08E-01	5.70E-02	2.07E-02	1.03E-01	7.19E-02	1.71E+01	1.28E+01
2003	6	7	3.70E+00	8.33E-02	1.27E+00	3.01E-02	4.28E-02	1.91E+01	4.99E+00	1.30E+01	9.42E-01	2.79E-01	1.41E-01	4.66E-01	3.74E-01	1.08E+01	5.26E+00
2003	6	8	4.43E+00	2.69E-04	2.46E+00	1.85E-05	1.04E-04	1.70E+01	1.22E+00	8.93E+00	2.18E-01	2.40E-02	3.68E-03	6.69E-02	4.97E-02	8.03E+00	5.36E+00
2003	6	9	8.61E+00	9.07E-04	6.89E+00	0.00E+00	9.70E-08	1.12E+01	4.07E-02	9.78E+00	1.05E-01	6.80E-03	2.14E-03	8.86E-03	7.48E-03	1.42E+01	9.10E+00
2003	6	10	1.02E+01	1.19E-02	4.69E+00	2.70E-03	4.94E-03	1.88E+01	3.74E+00	1.48E+01	1.65E-01	3.43E-02	1.82E-02	7.45E-02	5.09E-02	1.63E+01	1.29E+01
2003	6	11	1.02E+00	3.58E-04	7.06E-01	3.54E-05	2.17E-04	1.82E+01	3.99E+00	1.80E+01	1.63E-01	1.71E-02	3.42E-03	6.33E-02	3.80E-02	1.75E+01	1.69E+00
2003	6	12	1.30E+00	5.15E-04	6.89E-01	4.21E-05	6.97E-04	1.71E+01	4.80E+00	1.73E+01	4.69E-01	7.64E-02	1.41E-02	1.65E-01	1.28E-01	1.47E+01	2.27E+00
2003	6	13	1.39E+00	9.13E-03	3.40E-01	7.60E-03	1.65E-02	1.16E+01	3.30E+00	1.02E+01	4.37E-01	1.03E-01	4.18E-02	1.68E-01	1.35E-01	8.18E+00	2.57E+00
2003	6	14	7.51E-01	0.00E+00	2.73E-01	0.00E+00	4.71E-07	8.56E+00	1.82E+00	7.03E+00	1.83E-01	2.22E-02	2.73E-03	5.08E-02	3.74E-02	6.23E+00	1.37E+00
2003	6	15	8.96E-01	2.38E-04	6.62E-01	2.32E-06	1.23E-04	2.04E+01	2.60E+00	1.46E+01	4.77E-01	6.47E-02	1.01E-02	1.68E-01	1.19E-01	9.96E+00	2.40E+00
2003	6	16	5.76E+00	3.39E-03	2.29E+00	2.30E-04	1.16E-03	2.39E+01	3.05E+00	2.10E+01	4.46E-01	7.48E-02	1.60E-02	1.87E-01	1.34E-01	1.86E+01	8.05E+00
2003	6	17	7.09E+00	1.64E-02	3.19E+00	4.62E-03	1.02E-02	1.77E+01	3.60E+00	1.86E+01	4.10E-01	9.79E-02	4.22E-02	1.68E-01	1.29E-01	1.97E+01	8.66E+00
2003	6	18	9.11E+00	6.57E-02	2.84E+00	3.70E-02	4.79E-02	1.96E+01	5.03E+00	1.71E+01	5.60E-01	1.66E-01	1.05E-01	2.11E-01	1.82E-01	1.89E+01	1.26E+01
2003	6	19	4.10E+00	5.87E-02	1.38E+00	3.14E-02	3.51E-02	1.03E+01	3.53E+00	1.40E+01	3.03E-01	1.25E-01	8.27E-02	1.65E-01	1.41E-01	1.51E+01	4.83E+00
2003	6	20	1.31E+00	8.15E-03	3.33E-01	7.49E-03	9.11E-03	9.83E+00	2.12E+00	8.44E+00	2.26E-01	4.65E-02	1.38E-02	1.03E-01	8.68E-02	5.76E+00	2.40E+00
2003	6	21	1.03E-01	0.00E+00	3.14E-02	0.00E+00	0.00E+00	3.10E+00	6.96E-01	2.65E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-03	1.32E-05	1.98E+00	2.50E-01
2003	6	22	4.02E-01	0.00E+00	1.72E-01	0.00E+00	0.00E+00	3.93E+00	9.35E-01	3.78E+00	2.14E-02	1.33E-03	0.00E+00	8.20E-03	8.06E-03	2.86E+00	7.59E-01
2003	6	23	6.72E+00	4.96E-02	1.94E+00	9.12E-03	1.04E-02	1.18E+01	2.30E+00	1.28E+01	4.87E-01	1.44E-01	6.94E-02	2.43E-01	1.82E-01	1.70E+01	9.53E+00
2003	6	24	1.02E+01	8.24E-02	4.34E+00	7.10E-03	1.30E-02	1.63E+01	3.31E+00	2.29E+01	8.11E-01	2.48E-01	1.26E-01	3.57E-01	2.89E-01	2.17E+01	1.37E+01
2003	6	25	2.13E+00	3.98E-02	9.57E-01	3.19E-02	4.51E-02	2.05E+01	7.77E+00	2.22E+01	4.89E-01	1.43E-01	8.03E-02	2.75E-01	2.01E-01	1.71E+01	2.88E+00
2003	6	26	7.79E-01	1.30E-03	6.07E-01	3.40E-05	3.37E-04	1.26E+01	2.32E+00	1.26E+01	1.94E-01	2.84E-02	7.15E-03	8.58E-02	5.22E-02	8.47E+00	1.95E+00
2003	6	27	6.51E-01	1.61E-03	9.30E-01	2.56E-04	5.39E-04	1.53E+01	2.81E+00	1.91E+01	1.87E-01	2.26E-02	5.49E-03	7.10E-02	4.36E-02	2.02E+01	8.59E-01
2003	6	28	4.05E+00	6.82E-04	2.42E+00	1.09E-04	2.95E-04	1.65E+01	2.04E+00	1.64E+01	2.39E-01	1.99E-02	2.57E-03	8.36E-02	4.69E-02	1.47E+01	4.66E+00
2003	6	29	3.93E+00	4.99E-03	9.62E-01	2.71E-03	7.39E-03	1.56E+01	3.69E+00	1.80E+01	3.69E-01	7.92E-02	2.54E-02	1.73E-01	1.39E-01	1.55E+01	6.49E+00
2003	6	30	2.54E+00	1.90E-02	2.67E-01	2.06E-02	2.49E-02	1.37E+01	3.29E+00	9.29E+00	5.08E-01	1.28E-01	5.87E-02	1.79E-01	1.54E-01	6.05E+00	4.06E+00
2003	7	1	6.41E-01	2.03E-07	1.66E-01	0.00E+00	2.50E-05	1.01E+01	1.69E+00	8.94E+00	2.65E-01	2.66E-02	2.58E-03	7.88E-02	5.60E-02	5.81E+00	1.37E+00
2003	7	2	1.59E-01	0.00E+00	2.03E-01	0.00E+00	0.00E+00	4.85E+00	8.46E-01	2.42E+00	2.45E-02	1.22E-03	3.01E-05	9.97E-03	5.79E-03	2.03E+00	4.40E-01
2003	7	3	1.80E-01	0.00E+00	2.97E-02	0.00E+00	0.00E+00	3.75E+00	1.25E+00	4.40E+00	0.00E+00	0.00E+00	0.00E+00	3.75E-03	1.65E-04	2.67E+00	4.38E-01
2003	7	4	1.19E+00	0.00E+00	1.32E-01	0.00E+00	0.00E+00	6.06E+00	1.52E+00	7.33E+00	1.51E-01	7.89E-03	5.96E-05	5.25E-02	4.18E-02	5.61E+00	2.01E+00
2003	7	5	3.14E+00	3.79E-04	6.21E-01	0.00E+00	8.98E-05	1.03E+01	2.19E+00	1.15E+01	2.47E-01	3.41E-02	5.29E-03	6.97E-02	5.51E-02	1.12E+01	4.94E+00
2003	7	6	9.28E+00	1.72E-02	3.33E+00	5.38E-03	8.74E-03	1.79E+01	4.32E+00	2.09E+01	4.10E-01	8.10E-02	3.44E-02	1.26E-01	1.05E-01	1.71E+01	1.30E+01
2003	7	7	1.06E+01	3.49E-02	3.58E+00	1.33E-02	1.99E-02	1.91E+01	3.80E+00	1.95E+01	5.74E-01	1.11E-01	5.60E-02	2.15E-01	1.54E-01	1.86E+01	1.50E+01
2003	7	8	3.50E+00	2.37E-02	1.08E+00	9.35E-03	1.69E-02	1.54E+01	4.94E+00	1.01E+01	4.07E-01	1.11E-01	5.27E-02	2.12E-01	1.56E-01	1.14E+01	6.05E+00
2003	7	9	8.32E-01	7.37E-05	3.50E-01	1.90E-06	8.58E-05	1.58E+01	2.86E+00	1.27E+01	3.05E-01	2.40E-02	2.09E-03	1.02E-01	6.39E-02	1.09E+01	1.21E+00
2003	7	10	1.24E+01	8.62E-03	5.73E+00	3.81E-03	3.20E-03	1.61E+01	5.26E-01	1.83E+01	2.23E-01	1.89E-02	7.42E-03	4.34E-02	2.81E-02	2.15E+01	1.44E+01
2003	7	11	9.01E+00	2.73E-02	4.02E+00	7.07E-03	1.09E-02	2.54E+01	5.78E+00	2.45E+01	5.93E-01	1.13E-01	4.38E-02	2.32E-01	1.66E-01	2.07E+01	1.19E+01
2003	7	12	1.05E+00	1.46E-04	6.01E-01	1.06E-04	4.49E-04	1.73E+01	2.89E+00	9.45E+00	2.91E-01	3.40E-02	4.06E-03	1.37E-01	7.77E-02	1.25E+01	1.89E+00
2003	7	13	5.08E-01	5.40E-06	3.09E-01	0.00E+00	1.23E-05	6.92E+00	1.73E+00	9.07E+00	7.54E-02	5.81E-03	1.91E-04	3.37E-02	1.95E-02	7.09E+00	1.42E+00
2003	7	14	7.17E-01	0.00E+00	4.04E-01	0.00E+00	0.00E+00	1.19E+01	2.26E+00	1.09E+01	1.52E-01	1.09E-02	4.62E-04	9.38E-02	4.77E-02	7.37E+00	2.06E+00
2003	7	15	3.63E+00	1.10E-02	1.29E+00	2.26E-03	2.34E-03	1.73E+01	2.73E+00	1.62E+01	5.65E-01	4.44E-02	1.21E-02	1.16E-01	7.41E-02	1.13E+01	5.38E+00
2003	7	16	6.65E+00	6.31E-02	2.28E+00	3.18E-02	3.92E-02	1.12E+01	4.31E+00	1.00E+01	4.22E-01	1.45E-01	8.85E-02	2.19E-01	2.02E-01	1.18E+01	8.36E+00
2003	7	17	3.64E-01	1.80E-06	3.23E-01	0.00E+00	0.00E+00	7.59E+00	1.92E+00	8.88E+00	3.71E-02	1.43E-03	2.47E-05	3.87E-02	1.16E-02	6.72E+00	1.16E+00
2003	7	18	2.69E+00	2.24E-03	1.21E+00	3.54E-04	9.97E-04	2.23E+01	5.72E+00	2.33E+01	4.10E-01	6.15E-02	1.47E-02	1.54E-01	1.02E-01	2.02E+01	3.56E+00
2003	7	19	6.04E+00	3.29E-03	2.56E+00	1.51E-03	2.08E-03	2.06E+01	2.25E+00	1.72E+01	4.54E-01	4.81E-02	9.46E-03	1.27E-01	8.57E-02	1.85E+01	8.18E+00
2003	7	20	1.01E+01	3.51E-02	3.51E+00	1.03E-02	1.72E-02	2.02E+01	3.56E+00	1.99E+01	5.03E-01	1.20E-01	5.64E-02	2.27E-01	1.68E-01	1.99E+01	1.54E+01
2003	7	21	8.73E+00	1.35E-02	3.18E+00	5.25E-03	6.83E-03	1.65E+01	2.59E+00	2.14E+01	4.38E-01	5.53E-02	2.17E-02	1.40E-01	8.52E-02	2.27E+01	1.17E+01
2003	7	22	3.02E+00	6.15E-03	1.23E+00	2.08E-03	3.83E-03	1.92E+01	3.86E+00	1.57E+01	3.55E-01	7.04E-02	2.19E-02	1.61E-01	1.13E-01	1.34E+01	4.15E+00
2003	7	23	8.85E-01	1.01E-03	5.31E-01	7.51E-04	1.77E-03	1.29E+01	4.67E+00	1.28E+01	1.93E-01	3.23E-02	6.66E-03	1.10E-01	6.45E-02	1.68E+01	1.12E+00
2003	7	24	3.17E+00	1.18E-02	1.92E+00	4.80E-03	1.01E-02	9.97E+00	1.59E+00	1.49E+01	2.25E-01	3.02E-02	1.81E-02	6.73E-02	5.21E-02	1.21E+01	5.42E+00
2003	7	25	1.92E+00	2.16E-02	1.10E+00	1.63E-02	1.35E-02	2.64E+00	8.72E-02	4.85E+00	7.03E-03	6.96E-03	1.29E-02	3.01E-03	4.26E-03	9.99E+00	2.50E+00
2003	7	26	8.51E+00	1.29E-02	3.19E+00	4.93E-03	6.32E-03	1.75E+01	3.73E+00	2.37E+01	3.95E-01	5.73E-02	2.04E-02	1.38E-01	8.90E-02	2.84E+01	1.14E+01
2003	7	27	7.06E-01	2.57E-05	7.88E-01	0.00E+00	8.43E-05	2.40E+01	5.42E+00	2.25E+01	4.14E-01	5.61E-02	7.99E-03	1.70E-01	1.08E-01	1.76E+01	1.01E+00
2003	7	28	1.77E+00	2.65E-03	7.91E-01	5.72E-04	2.55E-03	1.05E+01	2.06E+00	1.58E+01	2.10E-01	3.55E-02	1.34E-02	8.01E-02	5.55E-02	1.46E+01	2.67E+00

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	5	8	2.23E-01	9.20E-04	9.66E-01	3.03E-04	4.36E-04	4.78E-01	1.44E-03	1.90E-03	4.84E+00	1.41E-03	1.11E-03	1.48E-03	1.44E-03	1.90E-03	4.57E-01
2003	5	9	3.32E-01	1.08E-05	1.05E+00	0.00E+00	0.00E+00	4.70E-01	5.60E-05	4.53E-03	3.94E+00	8.37E-05	2.04E-05	1.95E-05	3.89E-05	2.09E-03	6.78E-01
2003	5	10	9.44E-01	8.69E-01	6.97E-01	1.13E-01	1.72E-01	6.28E-01	1.27E+00	1.46E+00	4.17E+00	1.48E+01	3.29E+00	4.08E+00	5.82E+00	9.58E-01	1.38E+00
2003	5	11	5.88E-03	3.68E-04	3.83E-04	4.11E-02	5.38E-02	1.44E-03	4.04E-02	1.04E+00	2.14E-03	5.12E+00	3.96E-01	3.29E-01	2.02E+00	7.69E-02	8.42E-03
2003	5	12	6.96E-04	0.00E+00	0.00E+00	0.00E+00	1.43E-04	0.00E+00	4.50E-02	1.08E+00	1.28E-15	4.88E+00	1.64E-01	4.39E-01	1.07E+00	3.70E-02	4.34E-03
2003	5	13	4.08E-02	0.00E+00	6.49E-06	0.00E+00	6.91E-11	8.42E-04	5.33E-03	2.66E-01	1.45E-03	2.61E+00	2.15E-01	2.96E-01	6.22E-01	1.09E-02	1.23E-01
2003	5	14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-02	0.00E+00	1.39E-03	1.94E-01	1.01E-04	2.15E+00	4.94E-01	1.50E-01	4.49E-01	0.00E+00	0.00E+00
2003	5	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-03	0.00E+00	2.62E-04	3.10E-02	8.66E-30	2.17E+00	4.06E-01	5.34E-02	5.25E-01	0.00E+00	0.00E+00
2003	5	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E-07	0.00E+00	4.52E-03	1.40E-01	1.52E-16	1.85E+00	2.24E-01	2.14E-01	4.95E-01	6.14E-03	0.00E+00
2003	5	17	9.48E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E-02	3.30E-01	1.99E-19	5.36E+00	6.66E-02	5.83E-01	8.47E-01	8.13E-03	1.44E-03
2003	5	18	6.98E-01	4.84E-01	6.86E-01	2.72E-03	1.57E-02	4.66E-01	2.79E-02	4.23E-01	6.25E+00	4.35E-01	1.83E+00	2.14E-02	4.32E-02	2.73E-01	9.26E-01
2003	5	19	5.76E-02	7.23E-01	6.72E-02	1.86E-01	3.10E-01	4.79E-02	5.97E-02	9.11E-01	5.54E-01	9.56E+00	3.80E+00	1.17E+00	1.72E+00	1.02E-01	1.16E-01
2003	5	20	1.78E-06	1.11E-06	0.00E+00	4.72E-06	1.44E-02	4.54E-08	3.63E-02	1.05E+00	2.40E-05	2.89E+00	4.12E-01	2.72E-01	8.06E-01	7.08E-02	2.83E-06
2003	5	21	3.65E-02	2.31E-05	7.92E-03	1.22E-07	8.08E-06	2.32E-02	4.41E-03	1.45E-01	2.23E-02	2.73E+00	2.19E-01	1.17E-01	8.39E-01	2.45E-02	1.05E-01
2003	5	22	3.40E-03	7.40E-07	1.11E-03	0.00E+00	2.94E-05	6.22E-03	1.05E-02	3.00E-01	3.74E-03	2.18E+00	2.31E-01	3.12E-01	5.98E-01	6.31E-02	2.11E-02
2003	5	23	4.93E-02	5.12E-01	5.44E-03	7.92E-02	1.34E-01	9.36E-03	2.66E-02	9.05E-01	2.83E-01	8.88E+00	1.31E+00	6.78E-01	1.55E+00	2.38E-02	1.18E-01
2003	5	24	1.04E-01	3.39E-01	1.51E-02	7.46E-02	1.18E-01	2.29E-02	4.91E-02	9.19E-01	1.56E+00	5.65E+00	8.05E-01	4.49E-01	9.93E-01	1.18E-01	2.00E-01
2003	5	25	1.95E-02	1.37E-01	2.72E-03	9.09E-02	2.43E-01	8.07E-03	1.55E-02	2.35E-01	1.13E-01	3.93E+00	1.33E+00	3.20E-01	5.44E-01	2.50E-02	3.87E-02
2003	5	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.79E-03	1.47E-01	2.31E-18	2.03E+00	2.21E-01	2.76E-01	4.77E-01	0.00E+00	0.00E+00
2003	5	27	1.75E-03	5.39E-06	9.43E-04	7.47E-06	2.83E-03	1.35E-02	1.42E-02	9.41E-01	1.69E-02	2.99E+00	2.48E-01	3.83E-01	1.22E+00	7.38E-02	4.73E-03
2003	5	28	1.45E-01	2.81E-01	3.73E-03	1.05E-01	3.32E-01	7.11E-03	1.02E-02	5.73E-01	4.17E-01	5.81E+00	2.69E+00	1.55E-01	9.05E-01	5.64E-02	2.87E-01
2003	5	29	7.39E-02	0.00E+00	5.32E-02	0.00E+00	0.00E+00	3.79E-02	8.67E-02	2.67E-01	7.22E-01	7.27E+00	2.16E-02	1.10E+00	1.44E+00	8.65E-02	8.39E-02
2003	5	30	2.65E-01	1.34E-04	5.86E-02	0.00E+00	0.00E+00	5.96E-02	7.18E-05	1.31E-01	1.63E+00	8.93E-02	7.64E-03	9.29E-06	1.28E-04	6.94E-02	4.76E-01
2003	5	31	1.48E-01	1.29E-01	1.21E-01	5.69E-02	9.18E-02	1.11E-01	3.19E-03	1.73E-01	4.97E+00	1.79E+00	6.62E-01	1.69E-01	3.53E-01	2.21E-02	3.50E-01
2003	6	1	6.64E-04	0.00E+00	6.25E-04	0.00E+00	0.00E+00	1.04E-02	1.14E-02	3.04E-01	2.45E-03	2.18E+00	7.87E-02	3.80E-01	5.65E-01	1.58E-03	1.76E-03
2003	6	2	3.08E-03	0.00E+00	2.67E-04	0.00E+00	2.46E-10	5.75E-03	2.30E-02	5.53E-01	1.38E-03	7.31E+00	8.99E-02	8.96E-01	1.61E+00	3.85E-03	2.31E-02
2003	6	3	1.41E-02	1.40E-05	3.08E-04	7.67E-07	2.88E-06	7.04E-04	3.45E-01	1.43E+00	1.98E-02	1.26E+01	5.58E-03	2.10E+00	3.57E+00	1.56E-01	2.05E-02
2003	6	4	4.06E-01	1.56E-06	3.90E-01	0.00E+00	0.00E+00	3.22E-01	2.51E-01	7.88E-01	3.97E+00	2.52E+00	8.95E-03	1.60E+00	1.45E+00	2.59E-01	6.95E-01
2003	6	5	2.32E-01	7.28E-01	3.57E-01	1.71E-01	3.48E-01	2.67E-01	1.11E-01	8.03E-01	4.27E+00	9.02E+00	6.95E+00	8.23E-01	1.83E+00	1.95E-01	3.87E-01
2003	6	6	6.01E-01	2.54E-02	7.96E-01	0.00E+00	1.81E-07	7.75E-01	1.01E-03	4.48E-02	4.74E+00	4.70E-03	9.24E-03	1.46E-03	2.07E-03	2.52E-02	9.29E-01
2003	6	7	7.03E-02	7.19E-01	1.49E-03	2.46E-01	2.04E-01	5.07E-03	2.10E-02	7.98E-01	1.49E-02	3.54E+00	7.27E+00	1.11E-01	8.16E-01	6.11E-02	1.96E-01
2003	6	8	4.27E-01	8.25E-07	1.89E-01	0.00E+00	1.01E-09	6.63E-01	2.82E-02	5.31E-01	1.74E+00	2.25E+00	2.35E-01	1.47E-01	5.72E-01	6.65E-02	7.16E-01
2003	6	9	4.54E-01	1.14E-04	1.43E+00	1.02E-06	5.23E-06	1.28E+00	3.66E-04	1.31E-02	4.17E+00	1.11E-02	2.40E-04	5.87E-04	6.80E-04	5.24E-03	8.58E-01
2003	6	10	1.26E-01	5.75E-01	2.17E-02	7.09E-02	1.57E-01	5.56E-02	1.56E-02	3.43E-01	4.17E+00	6.35E+00	1.85E+00	4.89E-01	7.65E-01	4.18E-02	3.15E-01
2003	6	11	2.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.54E-02	1.12E+00	8.25E-04	1.41E+01	1.99E-02	1.66E+00	2.25E+00	1.08E-01	7.49E-02
2003	6	12	1.28E-03	0.00E+00	7.78E-05	0.00E+00	1.16E-03	1.79E-04	5.52E-02	1.06E+00	2.44E-04	8.39E+00	3.61E-01	8.43E-01	9.40E-01	8.36E-02	9.99E-03
2003	6	13	2.75E-03	2.82E-05	1.08E-04	9.80E-02	3.30E-01	6.47E-04	1.42E-02	9.16E-01	4.25E-03	3.67E+00	2.90E+00	1.04E-01	5.98E-01	7.97E-02	6.93E-03
2003	6	14	1.62E-03	0.00E+00	4.91E-06	0.00E+00	0.00E+00	1.86E-04	1.52E-02	4.57E-01	8.94E-04	2.24E+00	1.66E-01	3.09E-01	6.69E-01	7.88E-03	3.24E-03
2003	6	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E-02	1.10E+00	1.10E-26	3.36E+00	1.19E-01	3.72E-01	8.85E-01	4.29E-02	0.00E+00
2003	6	16	1.04E-01	1.17E-02	8.04E-02	5.15E-03	8.09E-03	1.01E-01	1.07E-01	1.17E+00	4.26E+00	8.73E+00	6.95E-02	1.09E+00	2.12E+00	1.49E-01	1.81E-01
2003	6	17	4.75E-01	1.42E-01	1.16E-01	3.47E-02	7.20E-02	1.83E-01	2.18E-01	9.32E-01	3.08E+00	5.19E+00	3.60E-01	8.64E-01	1.32E+00	2.95E-01	7.19E-01
2003	6	18	1.46E-01	1.39E+00	8.18E-03	4.87E-01	4.11E-01	3.11E-02	4.40E-03	1.94E-01	1.70E+00	1.93E+00	6.96E+00	1.04E-02	2.52E-02	6.40E-02	3.31E-01
2003	6	19	6.13E-02	3.69E-01	2.03E-03	2.91E-01	2.72E-01	3.36E-02	8.49E-03	5.01E-01	2.40E-02	4.58E+00	6.39E+00	2.83E-01	7.33E-01	4.07E-02	1.35E-01
2003	6	20	9.70E-03	9.55E-03	7.57E-05	1.22E-01	1.39E-01	3.30E-04	1.68E-02	3.40E-01	1.48E-03	2.26E+00	1.89E+00	1.52E-01	9.00E-01	7.02E-03	4.29E-02
2003	6	21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.67E-03	2.41E-01	8.37E-15	1.21E+00	1.60E-01	1.78E-01	3.39E-01	3.13E-07	0.00E+00
2003	6	22	4.68E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-04	3.36E-03	2.33E-01	8.69E-16	1.69E+00	1.98E-01	2.12E-01	5.00E-01	1.57E-04	3.65E-02
2003	6	23	9.82E-02	1.03E-01	5.80E-02	3.72E-02	3.19E-02	4.50E-02	1.02E-02	2.55E-01	2.45E+00	2.41E+00	1.29E-01	1.39E-01	4.61E-01	1.21E-02	2.06E-01
2003	6	24	1.12E-01	1.65E+00	9.72E-02	4.86E-02	2.95E-02	1.34E-01	6.92E-03	3.77E-01	4.35E+00	6.67E-01	2.80E+00	3.65E-02	6.87E-02	8.24E-02	2.57E-01
2003	6	25	2.10E-02	3.39E-02	3.59E-04	8.13E-02	1.10E-01	1.23E-03	7.52E-02	9.42E-01	6.60E-02	1.26E+01	1.66E+00	1.89E+00	2.99E+00	9.51E-02	4.54E-02
2003	6	26	1.14E-02	0.00E+00	6.27E-08	0.00E+00	0.00E+00	1.89E-05	3.05E-02	8.89E-01	1.51E-05	4.81E+00	2.48E-02	7.41E-01	7.03E-01	2.52E-02	4.56E-02
2003	6	27	1.89E-02	5.85E-05	1.69E-03	6.92E-06	1.64E-05	4.02E-03	5.04E-02	9.98E-01	1.22E-01	1.39E+01	6.56E-03	1.17E+00	3.62E+00	1.93E-02	5.87E-02
2003	6	28	1.95E-01	1.67E-01	2.32E-01	4.08E-02	8.17E-02	2.03E-01	6.36E-02	4.89E-01	1.66E+00	5.64E+00	4.26E-01	7.02E-01	8.49E-01	8.39E-02	3.22E-01
2003	6	29	1.08E-02	9.81E-02	3.59E-03	5.07E-02	1.85E-01	8.09E-03	2.26E-02	7.22E-01	2.33E-01	3.40E+00	2.13E+00	1.97E-01	5.33E-01	2.38E-01	2.68E-02
2003	6	30	2.93E-02	1.07E-01	3.33E-04	1.45E-01	1.33E-01	1.88E-03	5.28E-03	3.49E-01	1.32E-02	2.20E+00	2.51E+00	1.75E-01	4.41E-01	1.08E-02	7.87E-02
2003	7	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.90E-06	0.00E+00	1.77E-02	9.43E-01	3.59E-24	3.10E+00	1.80E-01	3.76E-01	5.92E-01	2.00E-02	0.00E+00
2003	7	2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.65E-09	0.00E+00	1.04E-03	2.56E-01	1.43E-21	1.66E+00	1.55E-01	1.15E-01	4.65E-01	1.01E-02	0.00E+00
2003	7	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.08E-03	2.18E-01	2.07E-15	2.16E+00	6.28E-02	4.28E-01	4.66E-01	0.00E+00	0.00E+00
2003	7	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.94E-03	4.63E-01	2.05E-19	2.51E+00	1.29E-01	2.88E-01	6.07E-01	1.20E-02	0.00E+00
2003	7	5	3.97E-02	1.79E-07	2.85E-05	0.00E+00	3.58E-08	6.31E-04	2.69E-02	8.95E-01	2.53E-03	6.61E+00	7.65E-02	5.21E-01	1.14E+00	1.34E-02	1.13E-01
2003	7	6	1.04E-01	2.14E-01	1.89E-02	6.20E-02	7.63E-02	4.60E-02	4.65E-02	2.11E-01	2.66E-01	4.51E+00	3.89E-01	2.44E+00	2.81E+00	3.79E-02	2.25E-01
2003	7	7	6.72E-02	6.12E-01	1.03E-02	2.09E-01	4.61E-01	2.82E-02	3.65E-03	2.74E-01	6.54E-01	2.95E+00	5.00E+00	8.37E-03	8.46E-02	1.07E-01	1.42E-01
2003	7	8	1.66E-02	1.77E-01	8.08E-04	1.12E-01	2.00E-01	4.54E-03	2.29E-02	3.84E-01	1.16E-02	3.60E+00	3.37E+00	1.39E-01	6.35E-01	7.21E-02	2.93E-02
2003	7	9	9.76E-05	0.00E+00	0.00E+00	0.00E+00	1.69E-05	2.24E-07	4.10E-02	1.08E+00	5.03E-04	4.42E+00	1.04E-01	9.42E-01	9.85E-01	3.43E-02	3.24E-04
2003	7	10	3.63E-01	3.85E-02	1.31E-01	2.39E-02	1.69E-02	8.55E-02	1.57E-02	7.34E-02	1.78E+00	6.67E-03	1.01E-02	1.77E-02	6.65E-03	3.17E-02	6.84E-01
2003	7	11	2.19E-01	8.74E-01	1.73E-02	9.19E-02	1.76E-01	2.73E-02	2.58E-02	5.55E-01	2.51E+00	8.55E+00	2.30E+00	3.86E-01	1.28E+00	6.15E-02	4.13E-01
2003	7	12	0.00E+00	0.00E+00	0.00E+00	6.26E-03	9.92E-02	0.00E+00	4.90E-02	9.12E-01	3.16E-05	5.27E+00	8.80E-01	4.82E-01	6.64E-01	5.98E-02	0.00E+00
2003	7	13	3.96E-02	1.39E-06	1.27E-03	2.12E-07	1.15E-06	5.09E-03	1.46E-02	2.63E-01	2.51E-03	3.36E+00	1.62E-01	4.15E-01	5.21E-01	3.09E-02	1.19E-01
2003	7	14	5.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-04	1.19E-02	1.10E+00	2.04E-03	3.38E+00	1.68E-01	1.90E-01	8.91E-01	2.12E-02	1.26E-01
2003	7	15	2.58E-03	5.60E-01	1.84E-03	3.42E-02	4.72E-02	4.62E-03	2.15E-02	8.31E-01	9.10E-02	4.79E+00	4.70E-01	2.76E-01	7.81E-01	3.93E-02	1.88E-02
2003	7	16	1.29E-01	7.21E-01	7.58E-03	5.50E-01	4.09E-01	2.41E-02	8.72E-03	9.27E-02	1.37E-01	4.27E+00	7.96E+00	1.50E-01	3.56E-01	7.08E-02	2.32E-01
2003	7	17	8.14E-06	0.00E+00	0.00E+00	0.00E+00	6.28E-07	0.00E+00	4.17E-02	4.21E-01	3.28E-05	3.14E+00	1.52E-01	7.48E-01	9.31E-01	8.63E-03	1.61E-05
2003	7	18	4.56E-01	3.20E-02	1.65E-01	1.54E-02	5.17E-02	3.17E-01	3.01E-01	1.72E+00	2.24E+00	6.97E+00	4.21E-01	1.69E+00	1.89E+00	4.10E-01	5.15E-01
2003	7	19	4.68E-02	5.99E-02	4.88E-03	2.11E-02	3.36E-02	1.09E-02	4.14E-02	9.87E-01	3.23E+00	6.92E+00	5.15E-01	5.72E-01	8.85E-01	6.29E-02	1.57E-01
2003	7	20	1.27E-01	7.54E-01	2.29E-02	2.28E-01	6.21E-01	4.82E-02	9.21E-03	2.44E-01	1.87E+00	3.43E+00	4.80E+00	4.06E-01	3.08E-01	4.09E-02	2.87E-01
2003	7	21	5.53E-01	1.65E-01	1.98E-01	3.38E-02	2.95E-02	2.67E-01	3.48E-01	1.02E+00	2.38E+00	7.89E-01	9.40E-02	4.56E-01	4.33E-01	5.58E-01	7.37E-01
2003	7	22	3.85E-02	2.87E-02	6.01E-03	1.12E-02	1.95E-02	4.56E-02	4.36E-02	9.40E-01	5.85E-03	5.40E+00	2.08E-01	5.50E-01	8.80E-01	6.48E-02	1.28E-01
2003	7	23	1.90E-02	1.58E-01	2.81E-03	5.20E-02	7.30E-02	8.12E-03	5.17E-02	1.02E+00	5.99E-02	6.96E+00	1.52E+00	1.07E+00	1.13E+00	7.95E-02	3.44E-02
2003	7	24	9.11E-02	1.22E-01	3.20E-02	7.28E-02	3.01E-01	3.84E-02	1.92E-02	4.69E-01	8.92E-01	3.99E+00	2.21E+00	2.32E-01	4.45E-01	4.53E-02	2.81E-01
2003	7	25	9.91E-05	6.10E-01	1.07E-02	1.88E-01	7.50E-02	1.52E-02	0.00E+00	0.00E+00	1.12E+00	1.67E-04	1.18E-02	1.12E-06	7.83E-06	0.00E+00	3.85E-03
2003	7	26	1.87E-01	8.51E-01	2.71E-02	4.92E-02	8.02E-02	3.03E-02	7.75E-03	1.73E-01	1.82E+00	4.56E+00	9.20E-01	3.42E-01	6.21E-01	2.50E-02	4.81E-01
2003	7	27	2.08E-03	1.10E-05	2.20E-04	6.71E-08	5.52E-06	8.15E-04	7.22E-02	1.44E+00	2.44E-03	1.10E+01	6.50E-02	1.28E+00	1.07E+00	9.58E-02	4.17E-03
2003	7	28	4.61E-02	5.41E-02	1.90E-01	1.76E-02	1.16E-01	9.68E-02	4.18E-02	6.67E-01	6.12E-01	8.59E+00	1.29E+00	7.25E-01	1.61E+00	6.72E-02	1.00E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	7	29	9.87E+00	4.63E-02	5.21E+00	1.93E-02	1.44E-02	1.53E+01	4.03E-01	1.22E+01	2.58E+00	1.07E-02	9.94E-02	1.35E-02	1.12E-02	1.54E+01	1.07E+01
2003	7	30	4.62E+00	4.84E-01	1.58E+00	1.60E-01	2.76E-01	1.73E+01	4.38E+00	2.05E+01	2.00E+00	5.09E+00	4.30E+00	4.71E-01	1.21E+00	1.93E+01	6.43E+00
2003	7	31	1.13E+01	1.55E-02	4.96E+00	3.31E-03	3.92E-03	1.65E+01	6.36E-01	1.58E+01	5.36E+00	4.98E-02	2.11E-02	8.95E-02	6.55E-02	1.44E+01	1.45E+01
2003	8	1	6.25E+00	1.02E+00	1.01E+00	4.98E-01	5.01E-01	1.64E+01	5.14E+00	1.18E+01	1.16E+00	4.61E+00	1.53E+01	4.85E-01	5.95E-01	1.08E+01	8.35E+00
2003	8	2	1.51E+00	4.31E-03	8.17E-01	1.21E-03	1.58E-02	1.32E+01	3.17E+00	1.37E+01	3.20E-01	3.77E+00	4.63E-01	5.77E-01	9.99E-01	1.16E+01	2.77E+00
2003	8	3	1.87E+00	3.72E-04	5.83E-01	3.44E-05	8.71E-04	7.80E+00	1.30E+00	6.43E+00	1.03E-01	2.61E+00	2.17E-01	3.16E-01	4.62E-01	5.85E+00	2.61E+00
2003	8	4	6.64E+00	1.78E-02	2.63E+00	2.20E-03	2.86E-03	9.79E+00	1.69E+00	1.18E+01	3.02E+00	5.32E+00	5.79E-02	7.17E-01	1.37E+00	9.76E+00	8.68E+00
2003	8	5	6.60E+00	4.45E-01	2.41E+00	6.13E-02	1.13E-01	2.47E+01	4.18E+00	2.35E+01	1.65E+00	3.03E+00	9.67E-01	3.33E-01	8.91E-01	2.12E+01	9.81E+00
2003	8	6	4.17E+00	3.58E-01	1.81E+00	1.85E-01	3.85E-01	1.63E+01	6.09E+00	2.05E+01	1.86E+00	8.28E+00	2.12E+00	1.76E+00	2.27E+00	1.61E+01	5.43E+00
2003	8	7	1.79E+00	8.20E-02	8.19E-01	5.54E-02	1.46E-01	1.28E+01	3.93E+00	2.05E+01	4.92E-01	6.49E+00	1.31E+00	9.08E-01	1.42E+00	1.64E+01	2.90E+00
2003	8	8	4.68E+00	3.63E-02	2.23E+00	6.50E-03	7.31E-03	1.74E+01	2.57E+00	1.86E+01	1.58E+00	3.35E+00	6.07E-02	1.61E+00	1.21E+00	1.89E+01	5.89E+00
2003	8	9	1.20E+01	8.20E-01	4.65E+00	7.86E-03	1.31E-02	1.83E+01	3.67E+00	2.23E+01	2.17E+00	7.08E-01	2.36E+00	2.88E-01	2.55E-01	2.12E+01	1.37E+01
2003	8	10	2.91E+00	3.67E-01	9.87E-01	1.52E-01	2.78E-01	1.61E+01	6.99E+00	1.69E+01	1.09E+00	1.65E+01	1.60E+00	2.32E+00	3.37E+00	1.80E+01	4.80E+00
2003	8	11	1.70E+00	9.81E-02	2.88E-01	3.13E-02	6.18E-02	1.11E+01	2.32E+00	1.30E+01	2.96E-01	5.38E+00	5.32E-01	7.87E-01	7.13E-01	1.41E+01	2.72E+00
2003	8	12	2.62E+00	1.13E-02	1.08E+00	2.41E-01	4.09E-01	1.45E+01	5.75E+00	1.88E+01	4.77E-01	6.59E+00	4.39E+00	8.88E-01	1.02E+00	1.66E+01	4.32E+00
2003	8	13	1.91E+00	1.38E-03	1.33E+00	1.55E-04	9.32E-04	1.26E+01	2.83E+00	1.31E+01	3.32E-01	4.33E+00	1.41E-01	4.68E-01	8.57E-01	9.99E+00	3.23E+00
2003	8	14	1.77E+00	7.15E-02	8.33E-01	2.00E-02	1.01E-01	1.80E+01	9.37E+00	2.09E+01	6.91E-01	1.57E+01	1.23E+00	1.87E+00	2.89E+00	1.68E+01	3.39E+00
2003	8	15	1.19E+01	9.88E-01	5.40E+00	7.74E-02	1.06E-01	2.14E+01	6.94E+00	2.54E+01	5.53E+00	5.85E+00	2.56E+00	1.03E+00	1.66E+00	2.95E+01	1.52E+01
2003	8	16	2.17E+00	1.23E-01	7.43E-01	9.75E-02	1.50E-01	1.12E+01	2.82E+00	1.10E+01	1.58E+00	3.20E+00	1.04E+00	4.44E-01	7.13E-01	9.20E+00	3.72E+00
2003	8	17	2.44E+00	2.07E-02	9.97E-01	1.81E-02	4.76E-02	1.43E+01	5.14E+00	1.69E+01	2.27E-01	1.12E+01	5.98E-01	1.77E+00	2.39E+00	1.18E+01	3.65E+00
2003	8	18	1.07E+00	6.88E-04	7.72E-01	1.36E-05	2.67E-04	1.68E+01	3.40E+00	2.18E+01	3.74E-01	5.49E+00	1.26E-01	9.55E-01	8.71E-01	1.38E+01	1.43E+00
2003	8	19	4.23E+00	2.00E-01	2.98E+00	4.02E-02	7.25E-02	1.41E+01	4.74E+00	1.81E+01	2.87E+00	5.71E+00	4.87E-01	1.13E+00	6.25E-01	1.91E+01	5.01E+00
2003	8	20	7.10E+00	3.63E-01	2.59E+00	4.91E-01	6.18E-01	1.81E+01	6.26E+00	2.42E+01	8.57E-01	4.63E+00	7.43E+00	1.46E+00	2.07E+00	2.27E+01	9.51E+00
2003	8	21	2.22E+00	8.24E-03	9.74E-01	4.10E-01	6.57E-01	2.14E+01	5.33E+00	1.96E+01	6.24E-01	1.04E+01	7.08E+00	9.88E-01	1.15E+00	1.97E+01	3.48E+00
2003	8	22	9.82E-01	1.67E-03	4.56E-01	1.71E-03	6.80E-02	1.18E+01	2.05E+00	1.01E+01	3.72E-01	3.04E+00	9.84E-01	2.25E-01	7.24E-01	6.55E+00	3.58E+00
2003	8	23	4.31E-01	1.46E-04	4.66E-01	6.71E-07	4.38E-05	8.10E+00	2.00E+00	7.60E+00	7.41E-02	2.90E+00	1.78E-01	3.10E-01	6.83E-01	7.78E+00	1.44E+00
2003	8	24	1.06E+00	1.14E-03	8.90E-01	6.42E-05	4.93E-04	1.54E+01	3.00E+00	1.88E+01	3.01E-01	4.28E+00	1.22E-01	5.43E-01	9.37E-01	1.09E+01	1.76E+00
2003	8	25	3.81E+00	3.36E-02	2.27E+00	5.95E-02	1.54E-01	2.07E+01	7.04E+00	2.20E+01	6.52E-01	1.10E+01	3.57E+00	1.19E+00	1.77E+00	1.79E+01	5.52E+00
2003	8	26	3.78E+00	1.26E+00	1.14E+00	2.57E-01	5.22E-01	1.60E+01	5.68E+00	2.04E+01	1.28E+00	3.43E+00	3.33E+00	4.26E-01	1.00E+00	1.59E+01	5.57E+00
2003	8	27	9.18E-01	1.12E-03	8.20E-01	1.22E-04	1.03E-03	2.03E+01	3.81E+00	1.97E+01	3.80E-01	3.46E+00	2.16E-01	8.11E-01	1.04E+00	1.41E+01	2.77E+00
2003	8	28	1.32E+01	4.11E-03	5.51E+00	2.10E-04	1.06E-03	2.02E+01	6.00E+00	2.84E+01	5.02E+00	9.02E+00	1.48E-02	1.97E+00	2.77E+00	3.15E+01	1.94E+01
2003	8	29	1.19E+01	8.02E-01	5.58E+00	8.94E-02	1.59E-01	2.81E+01	9.36E+00	3.76E+01	6.49E+00	2.29E+01	2.31E+00	3.74E+00	5.87E+00	3.41E+01	1.57E+01
2003	8	30	1.04E+01	2.08E+00	3.82E+00	2.72E-01	3.48E-01	2.73E+01	5.74E+00	2.45E+01	1.15E+00	8.80E+00	1.04E+01	8.09E-01	1.65E+00	1.66E+01	1.33E+01
2003	8	31	1.47E+00	1.25E-02	5.73E-01	3.60E-02	5.84E-02	2.22E+01	4.12E+00	2.05E+01	2.76E-01	9.46E+00	1.89E-01	1.41E+00	9.79E-01	1.66E+01	1.99E+00
2003	9	1	5.02E+00	8.52E-02	2.52E+00	5.96E-02	4.42E-02	1.66E+01	3.54E+00	1.82E+01	3.44E+00	6.84E+00	5.72E-02	1.69E+00	1.35E+00	1.81E+01	6.85E+00
2003	9	2	1.33E+01	7.48E-01	6.19E+00	8.87E-02	1.27E-01	1.95E+01	2.19E+00	1.88E+01	2.34E+00	3.32E-01	1.30E+00	2.04E-01	1.89E-01	1.77E+01	1.58E+01
2003	9	3	2.42E+00	2.75E-01	7.62E-01	1.73E-01	1.75E-01	2.37E+01	5.84E+00	1.76E+01	7.42E-01	5.55E+00	4.87E+00	5.67E-01	1.25E+00	1.26E+01	4.14E+00
2003	9	4	1.28E+00	8.05E-04	6.10E-01	1.22E-04	1.60E-03	1.98E+01	4.43E+00	2.03E+01	4.73E-01	4.50E+00	4.65E-01	3.90E-01	1.02E+00	1.35E+01	3.14E+00
2003	9	5	1.71E+00	1.37E-03	1.15E+00	2.96E-04	4.85E-03	2.10E+01	6.42E+00	2.46E+01	4.24E-01	5.90E+00	8.88E-01	8.24E-01	1.28E+00	1.96E+01	3.61E+00
2003	9	6	9.26E+00	1.80E-01	4.14E+00	6.00E-02	1.93E-01	2.90E+01	5.20E+00	2.09E+01	1.90E+00	7.67E+00	1.74E+00	8.08E-01	8.07E-01	2.69E+01	1.23E+01
2003	9	7	6.62E+00	1.37E-01	2.33E+00	1.11E-01	1.57E-01	2.01E+01	6.05E+00	1.45E+01	5.91E-01	6.13E+00	3.31E+00	6.00E-01	6.53E-01	1.10E+01	8.72E+00
2003	9	8	3.73E+00	1.25E-02	1.72E+00	6.00E-02	3.48E-01	2.01E+01	5.52E+00	2.08E+01	1.40E+00	8.68E+00	2.76E+00	1.29E+00	1.15E+00	2.13E+01	7.09E+00
2003	9	9	2.46E+00	2.29E-01	9.33E-01	7.20E-02	2.70E-01	1.55E+01	6.42E+00	2.07E+01	9.58E-01	1.03E+01	2.45E+00	2.25E+00	3.85E+00	1.44E+01	5.34E+00
2003	9	10	7.49E-01	1.35E-05	5.31E-01	0.00E+00	4.36E-07	9.42E+00	2.53E+00	1.42E+01	2.31E-01	4.91E+00	1.65E-01	7.37E-01	6.91E-01	1.35E+01	1.61E+00
2003	9	11	3.69E-01	1.70E-05	2.86E-01	2.02E-08	1.46E-06	7.58E+00	1.78E+00	8.52E+00	2.08E-02	4.35E+00	1.67E-01	5.78E-01	6.61E-01	5.54E+00	8.64E-01
2003	9	12	1.24E+00	1.88E-05	5.99E-01	0.00E+00	3.54E-05	1.37E+01	2.83E+00	1.90E+01	7.84E-02	1.24E+01	1.19E-03	9.89E-01	2.76E+00	1.53E+01	2.41E+00
2003	9	13	1.45E+00	2.40E-03	9.04E-01	3.54E-04	1.89E-03	1.97E+01	6.06E+00	2.02E+01	1.55E-01	1.14E+01	4.18E-01	1.06E+00	2.07E+00	1.83E+01	2.24E+00
2003	9	14	4.55E-01	2.97E-03	3.24E-01	1.26E-04	1.57E-03	7.49E+00	2.04E+00	6.81E+00	1.54E-01	3.52E+00	7.37E-01	3.35E-01	7.03E-01	4.68E+00	8.36E-01
2003	9	15	8.88E+00	7.76E-03	4.85E+00	2.91E-04	1.05E-03	1.06E+01	7.15E-02	1.11E+01	4.40E+00	2.58E-01	4.29E-02	1.50E-01	1.88E-01	1.63E+01	1.12E+01
2003	9	16	5.76E+00	1.47E-03	4.29E+00	3.09E-06	9.17E-06	7.91E+00	2.18E-03	1.17E+01	3.87E+00	2.46E-03	1.32E-03	8.01E-04	1.29E-03	1.24E+01	6.38E+00
2003	9	17	7.88E+00	2.21E-01	5.51E+00	3.05E-01	3.10E-01	1.43E+01	3.11E+00	1.58E+01	2.82E+00	1.46E+00	3.32E+00	1.55E-01	3.38E-01	1.93E+01	8.91E+00
2003	9	18	6.64E-01	4.85E-04	4.23E-01	5.35E-05	1.01E-03	7.45E+00	1.78E+00	7.21E+00	1.41E-01	2.22E+00	3.46E-01	1.71E-01	7.33E-01	4.44E+00	1.56E+00
2003	9	19	6.42E-01	0.00E+00	4.14E-01	0.00E+00	2.69E-05	1.16E+01	2.25E+00	9.55E+00	4.13E-02	3.99E+00	1.46E-01	6.59E-01	8.69E-01	7.97E+00	1.28E+00
2003	9	20	1.32E+00	8.90E-03	8.39E-01	2.42E-02	9.85E-02	1.84E+01	3.28E+00	2.24E+01	5.30E-01	4.90E+00	5.94E-01	7.81E-01	8.37E-01	1.52E+01	3.96E+00
2003	9	21	5.54E+00	2.74E-01	4.26E+00	1.10E-01	1.73E-01	1.44E+01	4.31E+00	2.06E+01	6.01E+00	3.08E+00	6.30E-01	8.24E-01	9.16E-01	2.35E+01	8.03E+00
2003	9	22	7.88E-02	0.00E+00	4.18E-02	0.00E+00	0.00E+00	3.34E+00	1.45E+00	3.83E+00	8.35E-16	2.69E+00	1.62E-01	4.74E-01	4.89E-01	2.76E+00	1.79E-01
2003	9	23	7.02E+00	1.50E-03	4.98E+00	3.65E-05	1.95E-04	1.18E+01	3.71E+00	1.43E+01	2.84E+00	2.08E+01	3.57E-02	1.50E+00	5.10E+00	1.69E+01	8.85E+00
2003	9	24	1.25E+01	8.71E-01	5.70E+00	1.35E-01	1.19E-01	1.98E+01	2.43E+00	1.84E+01	2.34E+00	2.64E+00	1.84E+00	1.47E-01	4.42E-01	1.56E+01	1.50E+01
2003	9	25	1.69E-01	0.00E+00	8.34E-03	0.00E+00	0.00E+00	4.23E+00	1.73E+00	5.71E+00	8.61E-04	3.24E+00	6.07E-03	8.66E-01	4.51E-01	3.42E+00	3.56E-01
2003	9	26	1.52E+00	2.08E-04	1.04E+00	7.19E-09	4.12E-06	1.32E+01	3.90E+00	2.10E+01	7.21E-01	1.18E+01	4.17E-03	2.78E+00	4.31E+00	1.76E+01	2.67E+00
2003	9	27	1.35E+01	2.52E-03	6.72E+00	1.52E-04	4.58E-04	2.17E+01	1.33E+00	1.58E+01	3.42E+00	5.84E-01	1.36E-02	4.72E-01	5.18E-01	1.97E+01	1.64E+01
2003	9	28	1.26E+01	6.53E-02	7.81E+00	1.59E-02	1.92E-02	1.94E+01	1.96E-01	1.33E+01	3.05E+00	4.36E-02	4.38E-02	3.67E-02	3.76E-02	1.87E+01	1.31E+01
2003	9	29	1.24E+01	0.00E+00	7.46E+00	0.00E+00	0.00E+00	1.52E+01	1.06E-01	1.06E+01	4.82E+00	3.00E-03	2.30E-04	1.80E-03	1.19E-03	1.52E+01	1.39E+01
2003	9	30	1.65E+01	8.42E-01	9.51E+00	1.98E-01	3.24E-01	3.46E+01	8.84E+00	3.15E+01	3.68E+00	7.47E+00	6.45E+00	1.38E+00	2.22E+00	2.99E+01	1.98E+01
2003	10	1	2.77E+00	7.96E-01	1.78E+00	2.19E-01	3.00E-01	5.99E+00	2.51E+00	7.27E+00	2.35E+00	8.92E+00	2.52E+00	9.41E-01	1.55E+00	7.39E+00	3.67E+00
2003	10	2	2.62E+00	1.35E-03	1.58E+00	1.41E-04	3.69E-04	3.13E+00	3.83E-01	3.69E+00	2.40E+00	2.86E-02	3.59E-03	4.28E-02	2.54E-02	4.27E+00	3.31E+00
2003	10	3	6.47E-01	6.96E-02	5.30E-01	4.83E-02	1.54E-01	4.70E+00	2.22E+00	6.86E+00	7.05E-01	8.48E+00	3.72E-01	1.99E+00	2.27E+00	6.68E+00	1.02E+00
2003	10	4	4.18E-01	1.95E-04	1.11E-01	4.81E-04	7.83E-03	4.40E+00	1.08E+00	6.77E+00	3.80E-02	6.99E+00	2.03E-02	1.10E+00	2.13E+00	3.98E+00	4.78E-01
2003	10	5	3.35E-01	5.18E-05	1.08E-01	1.29E-06	2.51E-05	4.44E+00	9.99E-01	6.76E+00	5.43E-02	6.51E+00	3.20E-02	1.26E+00	1.94E+00	3.77E+00	3.62E-01
2003	10	6	4.31E-01	7.36E-04	2.62E-01	3.04E-04	1.39E-02	4.70E+00	1.33E+00	6.16E+00	9.87E-02	4.11E+00	4.34E-01	7.47E-01	8.62E-01	4.54E+00	7.02E-01
2003	10	7	2.58E-01	1.16E-06	1.29E-01	2.54E-05	8.35E-04	1.55E+00	5.61E-01	3.19E+00	2.29E-02	1.16E+00	1.22E-01	2.16E-01	4.89E-01	1.47E+00	4.46E-01
2003	10	8	9.16E-02	0.00E+00	9.81E-02	6.52E-06	1.46E-02	1.44E+00	4.83E-01	3.04E+00	7.41E-03	2.46E+00	2.73E-01	2.07E-01	5.85E-01	1.28E+00	2.75E-01
2003	10	9	4.48E-02	0.00E+00	1.35E-02	0.00E+00	2.12E-09	6.17E-01	1.81E-01	7.31E-01	1.78E-04	7.98E-01	7.47E-02	1.16E-01	2.70E-01	4.18E-01	1.31E-01
2003	10	10	7.59E-02	3.18E-06	1.71E-01	0.00E+00	4.38E-07	2.52E+00	6.76E-01	3.49E+00	3.58E-02	3.74E+00	4.69E-03	9.24E-01	3.36E-01	2.76E+00	1.58E-01
2003	10	11	1.85E-01	4.87E-05	2.10E-01	1.62E-01	1.64E-01	2.32E+00	9.09E-01	4.45E+00	2.45E-02	2.21E+00	2.01E+00	3.56E-01	7.11E-01	2.73E+00	4.23E-01
2003	10	12	6.83E-02	0.00E+00	1.13E-02	0.00E+00	2.13E-06	6.19E-01	2.42E-01	1.47E+00	1.11E-03	8.29E-01	7.13E-02	2.43E-01	2.32E-01	5.67E-01	9.98E-02
2003	10	13	4.09E-01	4.10E-02	1.51E-01	1.70E-02	8.55E-02	1.94E+00	1.28E+00	4.03E+00	1.17E-01	5.77E+00	1.35E+00	1.06E+00	1.53E+00	2.49E+00	6.87E-01
2003	10	14	1.59E+00	8.03E-01	9.04E-01	1.29E-01	1.73E-01	5.12E+00	1.71E+00	7.49E+00	7.97E-01	3.01E+00	2.14E+00	9.66E-01	8.15E-01	5.64E+00	2.41E+00
2003	10	15	2.19E+00	8.83E-02	1.23E+00	9.10E-04	1.12E-03	3.69E+00	7.25E-01	4.36E+00	2.32E+00	1.23E+00	7.93E-03	4.35E-01	3.42E-01	5.12E+00	2.73E+00
2003	10	16	1.39E+00	1.31E-01	5.44E-01	2.26E-02	3.32E-02	2.87E+00	4.70E-01	2.43E+00	5.75E-01	1.08E+00	1.52E+00	6.09E-02	3.66E-01	1.94E+00	1.87E+00
2003	10	17	1.24E-01	0.00E+00	1.48E-02	0.00E+00	9.21E-05	1.51E+00	1.04E-01	3.07E-01	3.18E-02	6.50E-01	1.19E-01	1.58E-02	2.05E-01	4.22E-01	3.46E-01
2003	10	18	8.43E-02	0.00E+00	3.79E-02	0.00E+00	1.31E-02	7.68E-01	3.45E-01	1.61E+00	9.78E-03	1.05E+00	2.22E-01	1.12E-01	4.52E-01	8.35E-01	1.92E-01

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	7	29	9.41E+00	6.58E-03	5.11E+00	3.57E-03	3.17E-03	1.52E+01	4.03E-01	1.22E+01	6.51E-02	7.63E-03	4.90E-03	1.20E-02	9.20E-03	1.54E+01	9.91E+00
2003	7	30	4.58E+00	2.59E-02	1.53E+00	1.31E-02	2.28E-02	1.72E+01	4.35E+00	1.96E+01	4.80E-01	1.33E-01	5.90E-02	2.36E-01	1.85E-01	1.92E+01	6.36E+00
2003	7	31	1.05E+01	1.85E-03	4.35E+00	4.42E-04	6.53E-04	1.56E+01	5.72E-01	1.54E+01	1.67E-01	1.18E-02	3.70E-03	3.06E-02	1.86E-02	1.40E+01	1.37E+01
2003	8	1	6.22E+00	1.02E-01	1.01E+00	3.23E-02	4.22E-02	1.64E+01	5.13E+00	1.15E+01	1.13E+00	3.48E-01	1.85E-01	4.61E-01	3.95E-01	1.07E+01	8.29E+00
2003	8	2	1.49E+00	4.25E-03	8.16E-01	9.05E-04	3.65E-03	1.32E+01	3.14E+00	1.27E+01	3.18E-01	6.72E-02	2.30E-02	1.13E-01	9.65E-02	1.16E+01	2.72E+00
2003	8	3	1.87E+00	3.72E-04	5.83E-01	4.91E-06	2.72E-04	7.80E+00	1.30E+00	5.82E+00	1.03E-01	1.95E-02	4.98E-03	2.22E-02	2.11E-02	5.76E+00	2.60E+00
2003	8	4	6.39E+00	6.13E-03	2.56E+00	3.92E-04	6.25E-04	9.70E+00	1.66E+00	1.16E+01	2.34E-01	3.19E-02	1.08E-02	4.07E-02	3.59E-02	9.73E+00	8.29E+00
2003	8	5	6.53E+00	1.72E-02	2.40E+00	5.69E-03	1.12E-02	2.47E+01	4.14E+00	2.25E+01	5.07E-01	1.47E-01	5.10E-02	2.68E-01	2.25E-01	2.11E+01	9.65E+00
2003	8	6	4.10E+00	2.00E-02	1.80E+00	1.24E-02	2.20E-02	1.63E+01	6.02E+00	1.96E+01	4.99E-01	1.38E-01	5.43E-02	2.95E-01	2.22E-01	1.60E+01	5.30E+00
2003	8	7	1.78E+00	5.44E-03	8.17E-01	3.90E-03	7.81E-03	1.28E+01	3.87E+00	1.95E+01	3.43E-01	5.06E-02	1.63E-02	1.71E-01	1.09E-01	1.64E+01	2.87E+00
2003	8	8	4.59E+00	1.99E-03	2.20E+00	5.27E-04	8.37E-04	1.74E+01	2.42E+00	1.78E+01	3.45E-01	5.55E-02	1.03E-02	1.51E-01	1.06E-01	1.88E+01	5.70E+00
2003	8	9	1.15E+01	3.72E-02	4.44E+00	5.74E-03	1.09E-02	1.82E+01	3.66E+00	2.18E+01	4.78E-01	1.51E-01	6.93E-02	2.78E-01	2.06E-01	2.11E+01	1.28E+01
2003	8	10	2.82E+00	1.85E-02	9.52E-01	1.03E-02	1.66E-02	1.60E+01	6.85E+00	1.61E+01	5.51E-01	1.41E-01	5.54E-02	3.45E-01	2.27E-01	1.79E+01	4.64E+00
2003	8	11	1.68E+00	1.14E-03	2.87E-01	7.21E-04	1.30E-03	1.11E+01	2.29E+00	1.19E+01	1.80E-01	1.31E-02	2.06E-03	8.55E-02	4.37E-02	1.41E+01	2.67E+00
2003	8	12	2.60E+00	1.03E-02	1.08E+00	9.03E-03	1.21E-02	1.45E+01	5.72E+00	1.80E+01	4.70E-01	9.40E-02	2.85E-02	2.31E-01	1.59E-01	1.66E+01	4.25E+00
2003	8	13	1.80E+00	1.07E-03	1.32E+00	1.17E-04	8.47E-04	1.26E+01	2.81E+00	1.24E+01	3.27E-01	4.49E-02	1.17E-02	7.52E-02	6.63E-02	9.93E+00	2.92E+00
2003	8	14	1.74E+00	1.04E-02	8.33E-01	2.49E-03	6.18E-03	1.80E+01	9.31E+00	1.96E+01	6.79E-01	1.48E-01	4.17E-02	3.65E-01	2.44E-01	1.68E+01	3.32E+00
2003	8	15	1.17E+01	4.74E-02	5.34E+00	1.50E-02	2.36E-02	2.13E+01	6.91E+00	2.50E+01	5.16E-01	1.79E-01	8.78E-02	3.37E-01	2.43E-01	2.95E+01	1.47E+01
2003	8	16	2.12E+00	7.58E-03	6.30E-01	5.39E-03	1.28E-02	1.11E+01	2.80E+00	1.04E+01	2.83E-01	6.96E-02	2.83E-02	1.11E-01	9.03E-02	9.12E+00	3.64E+00
2003	8	17	2.37E+00	1.96E-03	9.96E-01	6.73E-05	4.71E-04	1.42E+01	4.89E+00	1.58E+01	2.15E-01	3.56E-02	1.15E-02	5.80E-02	4.33E-02	1.16E+01	3.54E+00
2003	8	18	1.07E+00	6.66E-04	7.72E-01	1.24E-05	2.58E-04	1.68E+01	3.35E+00	2.05E+01	3.73E-01	5.29E-02	1.07E-02	1.74E-01	1.17E-01	1.37E+01	1.42E+00
2003	8	19	3.99E+00	8.44E-03	2.65E+00	3.03E-03	2.58E-03	1.38E+01	4.56E+00	1.69E+01	2.29E-01	2.48E-02	6.87E-03	8.98E-02	4.76E-02	1.89E+01	4.71E+00
2003	8	20	6.92E+00	2.02E-02	2.48E+00	1.21E-02	2.40E-02	1.79E+01	6.04E+00	2.31E+01	3.46E-01	1.15E-01	6.20E-02	2.10E-01	1.50E-01	2.23E+01	9.16E+00
2003	8	21	2.18E+00	7.53E-03	9.74E-01	1.18E-02	2.34E-02	2.14E+01	5.28E+00	1.83E+01	6.19E-01	1.57E-01	5.95E-02	2.81E-01	2.16E-01	1.96E+01	3.37E+00
2003	8	22	9.67E-01	1.67E-03	4.56E-01	1.54E-03	5.45E-03	1.18E+01	2.04E+00	9.24E+00	3.72E-01	6.87E-02	1.87E-02	1.40E-01	1.20E-01	6.47E+00	3.53E+00
2003	8	23	4.03E-01	1.46E-04	4.66E-01	6.71E-07	4.38E-05	8.10E+00	1.99E+00	7.30E+00	5.24E-02	9.68E-03	2.27E-03	6.11E-02	2.05E-02	7.76E+00	1.38E+00
2003	8	24	1.04E+00	1.13E-03	8.90E-01	6.25E-05	4.86E-04	1.54E+01	2.97E+00	1.77E+01	3.01E-01	4.65E-02	1.11E-02	1.26E-01	8.44E-02	1.08E+01	1.73E+00
2003	8	25	3.71E+00	1.76E-02	2.25E+00	3.47E-03	7.42E-03	2.07E+01	6.99E+00	2.11E+01	5.91E-01	1.25E-01	4.84E-02	2.35E-01	1.77E-01	1.78E+01	5.29E+00
2003	8	26	3.68E+00	4.86E-02	1.13E+00	2.71E-02	4.19E-02	1.60E+01	5.67E+00	1.95E+01	5.32E-01	1.95E-01	1.04E-01	2.63E-01	2.40E-01	1.58E+01	5.28E+00
2003	8	27	9.14E-01	1.12E-03	8.20E-01	1.22E-04	1.03E-03	2.03E+01	3.77E+00	1.80E+01	3.79E-01	6.84E-02	1.65E-02	1.62E-01	1.18E-01	1.40E+01	2.76E+00
2003	8	28	1.26E+01	2.91E-03	4.98E+00	1.84E-04	9.42E-04	1.97E+01	5.71E+00	2.78E+01	4.37E-01	3.53E-02	9.70E-03	9.65E-02	6.02E-02	3.12E+01	1.83E+01
2003	8	29	1.10E+01	3.80E-02	4.83E+00	8.77E-03	1.54E-02	2.72E+01	8.82E+00	3.59E+01	9.88E-01	1.71E-01	7.16E-02	2.95E-01	2.21E-01	3.32E+01	1.46E+01
2003	8	30	1.02E+01	1.17E-01	3.80E+00	2.88E-02	4.34E-02	2.73E+01	5.72E+00	2.39E+01	1.05E+00	3.57E-01	1.87E-01	5.41E-01	4.44E-01	1.65E+01	1.29E+01
2003	8	31	1.46E+00	8.99E-03	5.73E-01	2.89E-03	4.87E-03	2.22E+01	4.04E+00	1.90E+01	2.75E-01	4.23E-02	1.49E-02	1.65E-01	8.10E-02	1.66E+01	1.97E+00
2003	9	1	5.01E+00	9.73E-03	2.51E+00	6.82E-03	6.63E-03	1.66E+01	3.40E+00	1.72E+01	4.80E-01	5.50E-02	1.46E-02	1.43E-01	9.32E-02	1.81E+01	6.84E+00
2003	9	2	1.28E+01	3.35E-02	6.11E+00	4.02E-03	7.77E-03	1.94E+01	2.17E+00	1.87E+01	5.35E-01	8.92E-02	4.43E-02	1.42E-01	1.08E-01	1.76E+01	1.48E+01
2003	9	3	2.41E+00	3.77E-02	7.61E-01	1.81E-02	2.95E-02	2.37E+01	5.80E+00	1.63E+01	7.31E-01	2.11E-01	8.97E-02	3.52E-01	2.95E-01	1.25E+01	4.12E+00
2003	9	4	1.28E+00	8.05E-04	6.10E-01	1.22E-04	1.30E-03	1.98E+01	4.39E+00	1.87E+01	4.73E-01	6.73E-02	1.22E-02	1.99E-01	1.32E-01	1.35E+01	3.14E+00
2003	9	5	1.70E+00	1.37E-03	1.15E+00	2.96E-04	3.09E-03	2.10E+01	6.37E+00	2.32E+01	4.24E-01	9.85E-02	2.19E-02	2.21E-01	1.70E-01	1.95E+01	3.59E+00
2003	9	6	9.13E+00	4.84E-03	4.12E+00	1.73E-03	2.64E-03	2.90E+01	5.13E+00	1.99E+01	3.52E-01	3.18E-02	9.68E-03	1.24E-01	5.95E-02	2.68E+01	1.21E+01
2003	9	7	6.49E+00	4.85E-02	2.33E+00	2.54E-02	2.48E-02	2.01E+01	6.03E+00	1.40E+01	5.41E-01	1.36E-01	8.10E-02	1.35E-01	1.17E-01	1.10E+01	8.38E+00
2003	9	8	3.66E+00	5.17E-03	1.64E+00	3.49E-03	9.12E-03	2.00E+01	5.40E+00	2.02E+01	7.22E-01	9.78E-02	3.05E-02	2.10E-01	1.50E-01	2.12E+01	6.96E+00
2003	9	9	2.42E+00	5.58E-03	9.31E-01	1.52E-03	6.61E-03	1.55E+01	6.07E+00	1.90E+01	3.96E-01	8.80E-02	3.40E-02	1.53E-01	9.98E-02	1.42E+01	5.28E+00
2003	9	10	6.94E-01	0.00E+00	5.30E-01	0.00E+00	0.00E+00	9.41E+00	2.51E+00	1.36E+01	2.28E-01	1.35E-02	5.75E-04	6.73E-02	3.84E-02	1.34E+01	1.49E+00
2003	9	11	3.69E-01	1.70E-05	2.86E-01	2.02E-08	8.82E-07	7.58E+00	1.76E+00	7.78E+00	2.08E-02	3.39E-03	7.36E-04	1.10E-02	5.82E-03	5.51E+00	8.64E-01
2003	9	12	1.23E+00	1.88E-05	5.99E-01	0.00E+00	3.54E-05	1.37E+01	2.78E+00	1.82E+01	7.72E-02	6.84E-03	1.19E-03	3.12E-02	1.56E-02	1.52E+01	2.36E+00
2003	9	13	1.44E+00	2.39E-03	9.04E-01	3.17E-04	9.70E-04	1.97E+01	6.01E+00	1.91E+01	1.46E-01	2.64E-02	8.73E-03	9.51E-02	4.97E-02	1.82E+01	2.20E+00
2003	9	14	4.55E-01	1.83E-03	3.24E-01	1.26E-04	1.55E-03	7.49E+00	2.04E+00	6.47E+00	6.10E-02	3.15E-02	2.46E-02	4.37E-02	2.62E-02	4.68E+00	8.36E-01
2003	9	15	8.80E+00	1.09E-03	4.60E+00	5.63E-05	1.53E-04	1.03E+01	2.31E-02	1.10E+01	2.85E-02	8.75E-03	3.33E-03	1.03E-02	1.00E-02	1.62E+01	1.11E+01
2003	9	16	5.64E+00	2.47E-05	3.99E+00	3.30E-12	3.93E-11	7.79E+00	2.07E-03	1.17E+01	9.73E-04	7.43E-05	2.73E-05	8.59E-05	7.99E-05	1.24E+01	6.14E+00
2003	9	17	7.76E+00	6.46E-03	4.86E+00	4.62E-03	1.13E-02	1.39E+01	3.05E+00	1.56E+01	3.78E-01	1.20E-01	5.23E-02	8.56E-02	1.01E-01	1.92E+01	8.73E+00
2003	9	18	6.60E-01	4.70E-04	4.23E-01	5.11E-05	3.93E-04	7.45E+00	1.77E+00	6.58E+00	1.40E-01	2.11E-02	4.66E-03	5.68E-02	3.58E-02	4.42E+00	1.54E+00
2003	9	19	5.74E-01	0.00E+00	4.13E-01	0.00E+00	0.00E+00	1.16E+01	2.24E+00	9.08E+00	4.09E-02	4.58E-04	4.12E-06	2.14E-02	5.09E-03	7.95E+00	1.13E+00
2003	9	20	1.25E+00	2.04E-03	8.23E-01	1.36E-04	6.79E-04	1.84E+01	3.09E+00	2.12E+01	2.73E-01	4.35E-02	9.96E-03	1.38E-01	8.50E-02	1.48E+01	3.85E+00
2003	9	21	5.49E+00	2.75E-03	3.75E+00	2.02E-04	7.47E-04	1.42E+01	4.25E+00	1.99E+01	2.13E-01	4.15E-02	1.16E-02	1.02E-01	6.75E-02	2.35E+01	7.93E+00
2003	9	22	7.88E-02	0.00E+00	4.18E-02	0.00E+00	0.00E+00	3.34E+00	1.45E+00	3.27E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-04	0.00E+00	2.76E+00	1.79E-01
2003	9	23	6.91E+00	3.80E-04	4.89E+00	1.00E-05	5.92E-05	1.17E+01	3.67E+00	1.41E+01	9.01E-02	2.02E-02	3.93E-03	3.94E-02	3.16E-02	1.69E+01	8.58E+00
2003	9	24	1.21E+01	2.05E-02	5.67E+00	8.85E-03	1.26E-02	1.97E+01	2.43E+00	1.84E+01	2.02E-01	4.19E-02	2.94E-02	4.89E-02	4.14E-02	1.56E+01	1.43E+01
2003	9	25	1.69E-01	0.00E+00	8.34E-03	0.00E+00	0.00E+00	4.23E+00	1.71E+00	5.17E+00	8.61E-04	0.00E+00	0.00E+00	4.18E-03	5.15E-04	3.42E+00	3.56E-01
2003	9	26	1.47E+00	2.07E-04	1.04E+00	0.00E+00	4.02E-06	1.32E+01	3.68E+00	2.00E+01	1.25E-01	9.84E-03	1.82E-03	5.29E-02	2.66E-02	1.75E+01	2.61E+00
2003	9	27	1.31E+01	1.98E-03	6.27E+00	1.52E-04	4.58E-04	2.13E+01	1.31E+00	1.56E+01	1.57E-01	1.50E-02	4.42E-03	4.28E-02	2.68E-02	1.97E+01	1.59E+01
2003	9	28	1.20E+01	1.14E-02	7.70E+00	3.17E-03	3.35E-03	1.93E+01	1.83E-01	1.33E+01	7.47E-02	9.13E-03	7.10E-03	1.33E-02	1.01E-02	1.86E+01	1.22E+01
2003	9	29	1.19E+01	0.00E+00	7.37E+00	0.00E+00	0.00E+00	1.52E+01	1.06E-01	1.06E+01	2.40E-02	6.63E-04	3.55E-05	1.80E-03	1.14E-03	1.52E+01	1.31E+01
2003	9	30	1.57E+01	4.42E-02	9.32E+00	1.56E-02	2.48E-02	3.43E+01	8.57E+00	3.05E+01	4.79E-01	1.44E-01	7.52E-02	2.63E-01	1.96E-01	2.95E+01	1.85E+01
2003	10	1	2.49E+00	1.37E-02	1.73E+00	4.08E-03	6.70E-03	5.95E+00	2.45E+00	6.59E+00	1.78E-01	4.72E-02	2.36E-02	9.57E-02	6.69E-02	7.28E+00	3.10E+00
2003	10	2	2.32E+00	1.35E-03	1.41E+00	1.41E-04	3.68E-04	2.98E+00	3.76E-01	3.52E+00	6.43E-02	1.12E-02	3.50E-03	2.63E-02	1.73E-02	4.22E+00	2.85E+00
2003	10	3	5.63E-01	7.27E-03	4.92E-01	2.27E-03	4.12E-03	4.67E+00	2.08E+00	5.41E+00	9.40E-02	3.04E-02	1.52E-02	6.13E-02	4.25E-02	6.53E+00	8.84E-01
2003	10	4	4.14E-01	1.95E-04	1.11E-01	1.65E-05	8.53E-05	4.40E+00	9.80E-01	5.29E+00	3.80E-02	6.69E-03	1.43E-03	2.34E-02	1.37E-02	3.90E+00	4.60E-01
2003	10	5	3.35E-01	5.18E-05	1.08E-01	1.29E-06	2.51E-05	4.44E+00	8.92E-01	5.20E+00	5.43E-02	7.13E-03	9.77E-04	2.81E-02	1.62E-02	3.68E+00	3.62E-01
2003	10	6	4.25E-01	7.36E-04	2.62E-01	3.04E-04	1.34E-03	4.70E+00	1.26E+00	4.33E+00	9.52E-02	2.14E-02	6.71E-03	5.71E-02	3.47E-02	4.44E+00	6.79E-01
2003	10	7	2.37E-01	1.16E-06	1.29E-01	2.54E-05	1.50E-04	1.55E+00	5.43E-01	2.17E+00	2.29E-02	5.51E-03	7.81E-04	2.10E-02	1.32E-02	1.46E+00	3.95E-01
2003	10	8	9.16E-02	0.00E+00	9.81E-02	0.00E+00	4.14E-07	1.44E+00	4.66E-01	2.08E+00	7.41E-03	1.10E-03	2.58E-06	2.10E-02	8.77E-03	1.28E+00	2.75E-01
2003	10	9	4.48E-02	0.00E+00	1.35E-02	0.00E+00	0.00E+00	6.17E-01	1.80E-01	6.11E-01	1.78E-04	0.00E+00	0.00E+00	4.53E-03	5.29E-04	4.18E-01	1.31E-01
2003	10	10	7.03E-02	3.18E-06	1.71E-01	0.00E+00	4.38E-07	2.52E+00	6.28E-01	2.32E+00	3.58E-02	3.18E-03	2.10E-04	1.14E-02	7.16E-03	2.67E+00	1.39E-01
2003	10	11	1.67E-01	4.87E-05	2.10E-01	7.92E-04	1.95E-03	2.32E+00	8.63E-01	3.25E+00	2.28E-02	4.07E-03	9.24E-04	2.01E-02	1.00E-02	2.64E+00	3.79E-01
2003	10	12	6.83E-02	0.00E+00	1.13E-02	0.00E+00	0.00E+00	6.19E-01	2.38E-01	8.60E-01	1.11E-03	1.52E-04	0.00E+00	3.55E-03	9.42E-04	5.67E-01	9.98E-02
2003	10	13	3.70E-01	9.72E-06	1.51E-01	9.99E-07	2.88E-05	1.94E+00	1.22E+00	3.16E+00	1.72E-02	1.80E-03	2.30E-04	1.70E-02	6.40E-03	2.45E+00	6.03E-01
2003	10	14	1.40E+00	1.24E-02	7.80E-01	3.99E-03	6.32E-03	5.07E+00	1.63E+00	6.45E+00	1.31E-01	4.26E-02	2.14E-02	8.98E-02	6.10E-02	5.58E+00	2.07E+00
2003	10	15	1.79E+00	5.89E-03	9.01E-01	9.10E-04	1.12E-03	3.45E+00	6.75E-01	3.89E+00	4.87E-02	1.37E-02	7.58E-03	2.45E-02	1.75E-02	5.08E+00	2.08E+00
2003	10	16	1.22E+00	5.13E-03	5.34E-01	1.35E-03	2.20E-03	2.85E+00	4.68E-01	2.31E+00	7.33E-02	1.93E-02	8.71E-03	3.91E-02	2.88E-02	1.93E+00	1.56E+00
2003	10	17	1.24E-01	0.00E+00	1.48E-02	0.00E+00	1.25E-06	1.51E+00	1.04E-01	3.07E-01	3.18E-02	4.24E-03	6.17E-05	3.58E-03	6.82E-03	4.22E-01	3.46E-01
2003	10	18	8.43E-02	0.00E+00	3.79E-02	0.00E+00	8.64E-06	7.68E-01	3.37E-01	1.09E+00	9.78E-03	1.54E-03	1.50E-05	7.63E-03	8.19E-03	8.33E-01	1.92E-01

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	7	29	4.60E-01	3.97E-02	9.37E-02	1.57E-02	1.12E-02	4.70E-02	5.56E-04	8.48E-03	2.52E+00	3.09E-03	9.45E-02	1.42E-03	2.03E-03	6.37E-03	8.42E-01
2003	7	30	3.98E-02	4.58E-01	4.93E-02	1.47E-01	2.54E-01	4.48E-02	2.55E-02	9.42E-01	1.52E+00	4.95E+00	4.24E+00	2.35E-01	1.03E+00	1.11E-01	7.40E-02
2003	7	31	7.69E-01	1.37E-02	6.08E-01	2.87E-03	3.27E-03	8.42E-01	6.38E-02	4.07E-01	5.19E+00	3.80E-02	1.74E-02	5.89E-02	4.68E-02	3.56E-01	8.69E-01
2003	8	1	2.38E-02	9.22E-01	9.99E-04	4.66E-01	4.59E-01	3.69E-03	2.49E-03	2.94E-01	3.08E-02	4.26E+00	1.52E+01	2.40E-02	2.01E-01	6.81E-02	6.01E-02
2003	8	2	1.58E-02	5.78E-05	9.94E-04	3.01E-04	1.21E-02	1.24E-03	2.92E-02	1.06E+00	1.36E-03	3.70E+00	4.40E-01	4.64E-01	9.03E-01	4.74E-02	4.33E-02
2003	8	3	2.50E-03	0.00E+00	0.00E+00	2.95E-05	5.98E-04	2.00E-05	8.65E-03	6.03E-01	3.34E-04	2.59E+00	2.12E-01	2.94E-01	4.41E-01	9.62E-02	9.25E-03
2003	8	4	2.56E-01	1.17E-02	7.64E-02	1.81E-03	2.24E-03	8.54E-02	3.21E-02	2.79E-01	2.79E+00	5.28E+00	4.71E-02	6.76E-01	1.33E+00	3.10E-02	3.92E-01
2003	8	5	7.57E-02	4.28E-01	7.97E-03	5.56E-02	1.01E-01	1.45E-02	4.09E-02	1.01E+00	1.14E+00	2.88E+00	9.16E-01	6.52E-02	6.66E-01	8.45E-02	1.67E-01
2003	8	6	6.48E-02	3.38E-01	7.16E-03	1.73E-01	3.63E-01	3.09E-02	6.43E-02	8.81E-01	1.36E+00	8.14E+00	2.07E+00	1.46E+00	2.05E+00	8.56E-02	1.23E-01
2003	8	7	1.28E-02	7.66E-02	1.74E-03	5.15E-02	1.38E-01	4.42E-03	5.89E-02	1.05E+00	1.49E-01	6.44E+00	1.29E+00	7.37E-01	1.31E+00	5.79E-02	3.55E-02
2003	8	8	9.87E-02	3.43E-02	3.34E-02	5.98E-03	6.47E-03	2.62E-02	1.45E-01	8.03E-01	1.23E+00	3.30E+00	5.04E-02	1.46E+00	1.11E+00	8.45E-02	1.87E-01
2003	8	9	4.95E-01	7.82E-01	2.09E-01	2.11E-03	2.22E-03	1.67E-01	9.55E-03	5.12E-01	1.69E+00	5.57E-01	2.29E+00	1.06E-02	4.82E-02	7.06E-02	8.98E-01
2003	8	10	9.56E-02	3.48E-01	3.49E-02	1.42E-01	2.61E-01	5.39E-02	1.41E-01	8.56E-01	5.37E-01	1.63E+01	1.55E+00	1.97E+00	3.15E+00	1.37E-01	1.59E-01
2003	8	11	2.04E-02	9.69E-02	1.09E-03	3.06E-02	6.05E-02	2.01E-03	3.56E-02	1.11E+00	1.17E-01	5.36E+00	5.30E-01	7.01E-01	6.69E-01	2.42E-02	5.29E-02
2003	8	12	1.91E-02	1.06E-03	7.57E-04	2.32E-01	3.97E-01	3.36E-03	3.25E-02	8.96E-01	6.44E-03	6.50E+00	4.36E+00	6.56E-01	8.63E-01	5.25E-02	6.76E-02
2003	8	13	1.12E-01	3.09E-04	4.80E-03	3.86E-05	8.46E-05	1.27E-02	2.60E-02	7.23E-01	4.91E-03	4.28E+00	1.29E-01	3.92E-01	7.91E-01	5.30E-02	3.11E-01
2003	8	14	3.26E-02	6.10E-02	8.47E-04	1.75E-02	9.48E-02	2.25E-03	6.31E-02	1.25E+00	1.22E-02	1.56E+01	1.19E+00	1.50E+00	2.65E+00	3.96E-02	7.26E-02
2003	8	15	2.22E-01	9.41E-01	6.32E-02	6.24E-02	8.20E-02	7.33E-02	2.97E-02	4.20E-01	5.02E+00	5.67E+00	2.47E+00	6.98E-01	1.42E+00	5.24E-02	5.03E-01
2003	8	16	5.87E-02	1.15E-01	1.13E-01	9.21E-02	1.37E-01	1.13E-01	2.54E-02	5.92E-01	1.30E+00	3.13E+00	1.01E+00	3.33E-01	6.22E-01	7.76E-02	8.26E-02
2003	8	17	6.62E-02	1.87E-02	1.37E-03	1.80E-02	4.71E-02	5.10E-03	2.49E-01	1.13E+00	1.18E-02	1.12E+01	5.86E-01	1.71E+00	2.35E+00	1.53E-01	1.08E-01
2003	8	18	2.22E-03	2.20E-05	2.85E-04	1.18E-06	8.70E-06	1.12E-03	5.40E-02	1.36E+00	1.16E-03	5.44E+00	1.15E-01	7.81E-01	7.54E-01	6.68E-02	1.03E-02
2003	8	19	2.40E-01	1.92E-01	3.27E-01	3.72E-02	7.00E-02	3.83E-01	1.79E-01	1.15E+00	2.64E+00	5.68E+00	4.80E-01	1.04E+00	5.78E-01	1.85E-01	3.06E-01
2003	8	20	1.87E-01	3.43E-01	1.11E-01	4.78E-01	5.94E-01	1.74E-01	2.25E-01	1.11E+00	5.10E-01	4.52E+00	7.37E+00	1.25E+00	1.92E+00	3.41E-01	3.50E-01
2003	8	21	3.63E-02	7.11E-04	1.21E-04	3.98E-01	6.34E-01	1.03E-03	4.55E-02	1.27E+00	4.94E-03	1.02E+01	7.02E+00	7.07E-01	9.34E-01	8.44E-02	1.10E-01
2003	8	22	1.53E-02	0.00E+00	1.14E-06	1.67E-04	6.26E-02	3.98E-05	6.60E-03	8.60E-01	1.57E-04	2.97E+00	9.66E-01	8.54E-02	6.05E-01	7.51E-02	5.26E-02
2003	8	23	2.77E-02	0.00E+00	4.65E-04	0.00E+00	0.00E+00	2.35E-03	9.01E-03	3.04E-01	2.17E-02	2.89E+00	1.76E-01	2.49E-01	6.63E-01	2.30E-02	6.12E-02
2003	8	24	1.63E-02	1.49E-05	4.63E-04	1.67E-06	6.54E-06	9.71E-04	3.18E-02	1.02E+00	4.43E-04	4.24E+00	1.11E-01	4.17E-01	8.53E-01	6.30E-02	3.64E-02
2003	8	25	1.09E-01	1.60E-02	1.38E-02	5.60E-02	1.47E-01	2.82E-02	4.29E-02	8.96E-01	6.09E-02	1.09E+01	3.52E+00	9.52E-01	1.60E+00	6.57E-02	2.26E-01
2003	8	26	1.03E-01	1.21E+00	5.00E-03	2.30E-01	4.80E-01	9.57E-03	1.25E-02	8.31E-01	7.49E-01	3.24E+00	3.23E+00	1.63E-01	7.59E-01	1.01E-01	2.89E-01
2003	8	27	3.96E-03	0.00E+00	1.46E-04	0.00E+00	8.59E-09	6.94E-04	4.41E-02	1.63E+00	7.52E-04	3.39E+00	1.99E-01	6.49E-01	9.25E-01	4.04E-02	1.59E-02
2003	8	28	6.09E-01	1.20E-03	5.33E-01	2.52E-05	1.17E-04	4.09E-01	2.84E-01	6.03E-01	4.59E+00	8.99E+00	5.10E-03	1.87E+00	2.71E+00	3.00E-01	1.05E+00
2003	8	29	8.87E-01	7.64E-01	7.44E-01	8.06E-02	1.44E-01	8.54E-01	5.42E-01	1.68E+00	5.51E+00	2.28E+01	2.24E+00	3.44E+00	5.65E+00	8.28E-01	1.07E+00
2003	8	30	1.79E-01	1.96E+00	1.76E-02	2.43E-01	3.05E-01	3.24E-02	1.91E-02	5.85E-01	1.05E-01	8.44E+00	1.02E+01	2.68E-01	1.21E+00	8.07E-02	3.56E-01
2003	8	31	8.59E-03	3.48E-03	4.93E-04	3.31E-02	5.35E-02	6.53E-04	7.82E-02	1.54E+00	1.33E-03	9.42E+00	1.74E-01	1.25E+00	8.98E-01	7.23E-02	1.78E-02
2003	9	1	1.18E-02	7.54E-02	1.02E-02	5.28E-02	3.76E-02	2.43E-02	1.43E-01	1.03E+00	2.96E+00	6.79E+00	4.26E-02	1.54E+00	1.26E+00	6.21E-02	1.62E-02
2003	9	2	5.34E-01	7.14E-01	8.45E-02	8.47E-02	1.19E-01	6.13E-02	2.36E-02	5.70E-02	1.81E+00	2.43E-01	1.26E+00	6.22E-02	8.03E-02	3.14E-02	9.42E-01
2003	9	3	6.90E-03	2.37E-01	1.18E-03	1.55E-01	1.45E-01	2.97E-03	3.56E-02	1.31E+00	1.13E-02	5.34E+00	4.78E+00	2.15E-01	9.58E-01	7.97E-02	1.48E-02
2003	9	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E-04	0.00E+00	3.61E-02	1.59E+00	5.54E-06	4.43E+00	4.53E-01	1.91E-01	8.92E-01	4.50E-02	0.00E+00
2003	9	5	7.48E-03	0.00E+00	2.22E-04	0.00E+00	1.76E-03	9.23E-04	5.21E-02	1.44E+00	4.67E-04	5.80E+00	8.66E-01	6.03E-01	1.11E+00	7.66E-02	1.77E-02
2003	9	6	1.28E-01	1.75E-01	1.83E-02	5.83E-02	1.90E-01	3.32E-02	7.08E-02	1.02E+00	1.55E+00	7.64E+00	1.73E+00	6.83E-01	7.48E-01	7.85E-02	2.29E-01
2003	9	7	1.27E-01	8.90E-02	8.36E-03	8.59E-02	1.33E-01	2.81E-02	2.34E-02	5.48E-01	5.01E-02	5.99E+00	3.23E+00	4.65E-01	5.36E-01	2.39E-02	3.41E-01
2003	9	8	6.90E-02	7.30E-03	7.13E-02	5.65E-02	3.39E-01	8.29E-02	1.16E-01	6.00E-01	6.77E-01	8.58E+00	2.73E+00	1.08E+00	9.98E-01	7.40E-02	1.26E-01
2003	9	9	4.11E-02	2.23E-01	1.97E-03	7.05E-02	2.64E-01	7.92E-03	3.51E-01	1.76E+00	5.62E-01	1.03E+01	2.41E+00	2.10E+00	3.75E+00	1.88E-01	5.90E-02
2003	9	10	5.46E-02	1.35E-05	1.18E-03	0.00E+00	4.36E-07	3.10E-03	2.27E-02	5.56E-01	3.03E-03	4.89E+00	1.64E-01	6.70E-01	6.52E-01	6.52E-02	1.22E-01
2003	9	11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.77E-07	0.00E+00	1.93E-02	7.43E-01	2.12E-18	4.35E+00	1.67E-01	5.67E-01	6.55E-01	2.73E-02	0.00E+00
2003	9	12	1.50E-02	0.00E+00	2.45E-05	0.00E+00	0.00E+00	4.15E-04	4.62E-02	8.10E-01	1.22E-03	1.24E+01	3.26E-07	9.58E-01	2.74E+00	3.07E-02	4.60E-02
2003	9	13	5.19E-03	1.62E-05	1.29E-06	3.73E-05	9.23E-04	1.48E-05	5.06E-02	1.14E+00	9.46E-03	1.14E+01	4.09E-01	9.65E-01	2.02E+00	1.28E-01	3.69E-02
2003	9	14	1.28E-04	1.14E-03	7.04E-05	6.52E-08	2.37E-05	9.76E-04	4.70E-03	3.33E-01	9.33E-02	3.49E+00	7.12E-01	2.91E-01	6.77E-01	1.85E-04	1.80E-04
2003	9	15	8.01E-02	6.67E-03	2.47E-01	2.34E-04	9.01E-04	2.49E-01	4.85E-02	5.57E-02	4.37E+00	2.49E-01	3.95E-02	1.40E-01	1.78E-01	5.01E-02	1.08E-01
2003	9	16	1.17E-01	1.45E-03	3.00E-01	3.09E-06	9.17E-06	1.16E-01	1.05E-04	9.33E-04	3.87E+00	2.38E-03	1.29E-03	7.15E-04	1.21E-03	8.35E-04	2.42E-01
2003	9	17	1.20E-01	2.14E-01	6.48E-01	3.00E-01	2.99E-01	3.92E-01	6.39E-02	1.79E-01	2.44E+00	1.34E+00	3.27E+00	6.93E-02	2.37E-01	8.35E-02	1.85E-01
2003	9	18	4.50E-03	1.53E-05	7.61E-05	2.43E-06	6.15E-04	1.45E-04	5.54E-03	6.28E-01	2.82E-04	2.20E+00	3.41E-01	1.14E-01	6.97E-01	1.57E-02	1.41E-02
2003	9	19	6.84E-02	0.00E+00	9.20E-04	0.00E+00	2.69E-05	2.25E-03	1.38E-02	4.64E-01	3.80E-04	3.99E+00	1.46E-01	6.37E-01	8.64E-01	2.02E-02	1.42E-01
2003	9	20	6.94E-02	6.86E-03	1.63E-02	2.40E-02	9.79E-02	2.81E-02	1.88E-01	1.20E+00	2.57E-01	4.86E+00	5.84E-01	6.42E-01	7.52E-01	4.67E-01	1.09E-01
2003	9	21	5.71E-02	2.71E-01	5.01E-01	1.09E-01	1.72E-01	2.46E-01	5.34E-02	6.52E-01	5.79E+00	3.04E+00	6.18E-01	7.21E-01	8.49E-01	3.00E-02	1.03E-01
2003	9	22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E-03	5.58E-01	8.35E-16	2.69E+00	1.62E-01	4.73E-01	4.89E-01	0.00E+00	0.00E+00
2003	9	23	1.16E-01	1.12E-03	9.18E-02	2.64E-05	1.35E-04	1.04E-01	4.71E-02	1.69E-01	2.75E+00	2.08E+01	3.18E-02	1.46E+00	5.06E+00	1.85E-02	2.73E-01
2003	9	24	3.90E-01	8.51E-01	3.03E-02	1.26E-01	1.07E-01	3.86E-02	2.98E-03	6.58E-02	2.14E+00	2.60E+00	1.82E+00	9.77E-02	4.01E-01	1.47E-02	6.93E-01
2003	9	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-02	5.31E-01	3.88E-16	3.24E+00	6.07E-03	8.62E-01	4.50E-01	4.33E-04	0.00E+00
2003	9	26	4.62E-02	8.37E-07	2.75E-03	7.19E-09	9.44E-08	8.42E-03	2.16E-01	9.82E-01	5.97E-01	1.18E+01	2.34E-03	2.73E+00	4.28E+00	1.06E-01	6.38E-02
2003	9	27	3.93E-01	5.39E-04	4.49E-01	0.00E+00	3.83E-09	4.46E-01	2.62E-02	2.06E-01	3.27E+00	5.68E-01	9.18E-03	4.30E-01	4.91E-01	6.74E-03	5.41E-01
2003	9	28	5.66E-01	5.39E-02	1.10E-01	1.27E-02	1.58E-02	9.52E-02	1.33E-02	5.52E-02	2.97E+00	3.45E-02	3.67E-02	2.33E-02	2.76E-02	3.64E-02	9.64E-01
2003	9	29	4.75E-01	0.00E+00	8.48E-02	0.00E+00	0.00E+00	6.69E-02	0.00E+00	3.35E-03	4.79E+00	2.34E-03	1.95E-04	4.48E-06	5.31E-05	1.71E-03	8.09E-01
2003	9	30	8.26E-01	7.98E-01	1.97E-01	1.83E-01	2.99E-01	2.66E-01	2.72E-01	9.97E-01	3.20E+00	7.32E+00	6.37E+00	1.11E+00	2.02E+00	4.11E-01	1.31E+00
2003	10	1	2.85E-01	7.82E-01	4.15E-02	2.15E-01	2.94E-01	4.12E-02	6.38E-02	6.84E-01	2.17E+00	8.88E+00	2.50E+00	8.45E-01	1.48E+00	1.07E-01	5.73E-01
2003	10	2	3.02E-01	7.87E-06	1.71E-01	0.00E+00	6.55E-07	1.51E-01	7.24E-03	1.68E-01	2.33E+00	1.74E-02	9.02E-05	1.65E-02	8.12E-03	5.14E-02	4.64E-01
2003	10	3	8.38E-02	6.23E-02	3.82E-02	4.60E-02	1.50E-01	3.75E-02	1.44E-01	1.45E+00	6.11E-01	8.45E+00	3.57E-01	1.93E+00	2.22E+00	1.48E-01	1.40E-01
2003	10	4	4.04E-03	0.00E+00	0.00E+00	4.64E-04	7.74E-03	0.00E+00	1.03E-01	1.48E+00	0.00E+00	6.99E+00	1.88E-02	1.08E+00	2.11E+00	8.37E-02	1.82E-02
2003	10	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-01	1.56E+00	0.00E+00	6.50E+00	3.10E-02	1.23E+00	1.92E+00	9.00E-02	3.53E-06
2003	10	6	6.18E-03	0.00E+00	0.00E+00	0.00E+00	1.26E-02	0.00E+00	7.31E-02	1.83E+00	3.54E-03	4.09E+00	4.28E-01	6.90E-01	8.27E-01	9.62E-02	2.34E-02
2003	10	7	2.09E-02	0.00E+00	0.00E+00	0.00E+00	6.84E-04	1.34E-04	1.84E-02	1.02E+00	9.88E-29	1.15E+00	1.21E-01	1.95E-01	4.76E-01	1.60E-02	5.11E-02
2003	10	8	0.00E+00	0.00E+00	0.00E+00	6.52E-06	1.46E-02	0.00E+00	1.64E-02	9.58E-01	0.00E+00	2.46E+00	2.73E-01	1.86E-01	5.76E-01	2.48E-03	0.00E+00
2003	10	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E-09	0.00E+00	5.20E-04	1.20E-01	4.26E-29	7.98E-01	7.47E-02	1.11E-01	2.70E-01	0.00E+00	0.00E+00
2003	10	10	5.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.85E-02	1.17E+00	5.50E-17	3.74E+00	4.48E-03	9.12E-01	3.29E-01	8.84E-02	1.89E-02
2003	10	11	1.80E-02	0.00E+00	0.00E+00	1.61E-01	1.62E-01	0.00E+00	4.65E-02	1.20E+00	1.64E-03	2.21E+00	2.00E+00	3.36E-01	7.00E-01	8.20E-02	4.35E-02
2003	10	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E-06	0.00E+00	4.06E-03	6.06E-01	5.81E-19	8.29E-01	7.13E-02	2.40E-01	2.31E-01	3.54E-05	0.00E+00
2003	10	13	3.82E-02	4.10E-02	1.14E-04	1.70E-02	8.55E-02	3.25E-04	6.18E-02	8.63E-01	1.00E-01	5.77E+00	1.35E+00	1.04E+00	1.52E+00	3.46E-02	8.41E-02
2003	10	14	1.91E-01	7.90E-01	1.24E-01	1.25E-01	1.67E-01	5.55E-02	8.79E-02	1.04E+00	6.66E-01	2.96E+00	2.12E+00	8.76E-01	7.54E-01	5.96E-02	3.32E-01
2003	10	15	3.96E-01	8.24E-02	3.30E-01	0.00E+00	0.00E+00	2.44E-01	4.96E-02	4.64E-01	2.27E+00	1.21E+00	3.41E-04	4.10E-01	3.24E-01	3.76E-02	6.47E-01
2003	10	16	1.76E-01	1.26E-01	9.38E-03	2.13E-02	3.10E-02	1.31E-02	2.40E-03	1.17E-01	5.02E-01	1.06E+00	1.51E+00	2.19E-02	3.37E-01	8.18E-03	3.08E-01
2003	10	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.08E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-29	6.46E-01	1.19E-01	1.22E-02	1.99E-01	0.00E+00	0.00E+00
2003	10	18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-02	0.00E+00	8.25E-03	5.13E-01	7.56E-27	1.05E+00	2.22E-01	1.04E-01	4.44E-01	1.82E-03	0.00E+00

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	10	19	2.79E-02	0.00E+00	1.96E-02	0.00E+00	3.44E-12	6.02E-01	2.31E-01	1.12E+00	8.10E-07	1.15E+00	6.17E-02	1.86E-01	2.34E-01	5.07E-01	9.50E-02
2003	10	20	5.00E-01	2.80E-03	1.73E-01	3.21E-02	2.86E-01	2.87E+00	8.50E-01	4.29E+00	1.30E-01	2.14E+00	1.34E+00	2.63E-01	1.11E+00	2.28E+00	8.86E-01
2003	10	21	2.06E-01	3.71E-06	3.47E-02	9.99E-07	6.42E-05	1.19E+00	2.86E-01	1.40E+00	6.88E-02	3.02E+00	8.89E-02	2.28E-01	4.66E-01	1.00E+00	4.24E-01
2003	10	22	2.23E+00	2.29E-01	1.05E+00	6.93E-02	1.95E-01	3.07E+00	7.82E-01	4.31E+00	8.95E-01	2.98E+00	8.31E-01	4.27E-01	7.28E-01	3.65E+00	2.82E+00
2003	10	23	4.44E-02	0.00E+00	6.31E-03	0.00E+00	3.81E-06	4.77E-01	1.67E-01	5.61E-01	2.07E-04	1.03E+00	4.01E-02	1.58E-01	2.38E-01	4.13E-01	9.94E-02
2003	10	24	3.01E-01	3.63E-06	1.30E-01	0.00E+00	0.00E+00	2.44E+00	7.58E-01	4.02E+00	1.48E-02	5.09E+00	6.75E-04	7.78E-01	9.74E-01	2.01E+00	4.06E-01
2003	10	25	2.00E-01	2.46E-04	1.29E-01	3.16E-05	6.89E-05	1.49E+00	6.15E-01	2.36E+00	9.89E-03	4.45E+00	1.13E-03	6.79E-01	2.92E-01	1.50E+00	3.26E-01
2003	10	26	4.61E-02	0.00E+00	3.34E-03	0.00E+00	0.00E+00	7.66E-01	2.41E-01	1.16E+00	1.31E-03	2.72E+00	2.57E-03	3.80E-01	4.89E-01	5.80E-01	6.33E-02
2003	10	27	3.58E-01	2.43E-05	1.67E-01	8.79E-08	2.61E-06	3.39E+00	6.13E-01	4.40E+00	8.39E-02	3.90E+00	2.71E-02	3.79E-01	4.57E-01	2.38E+00	5.80E-01
2003	10	28	5.26E-01	1.40E-03	1.50E-01	5.49E-04	2.55E-02	2.32E+00	1.36E+00	4.07E+00	8.83E-02	5.27E+00	1.50E-01	1.13E+00	7.85E-01	2.61E+00	7.04E-01
2003	10	29	1.08E+00	0.00E+00	6.31E-01	0.00E+00	0.00E+00	2.15E+00	4.61E-02	2.28E+00	1.19E+00	1.53E-01	0.00E+00	2.00E-01	1.51E-01	1.56E+00	1.35E+00
2003	10	30	1.28E+00	0.00E+00	1.05E+00	0.00E+00	0.00E+00	1.91E+00	7.00E-03	1.67E+00	1.89E+00	4.45E-09	0.00E+00	2.85E-08	7.98E-10	1.56E+00	1.56E+00
2003	10	31	2.18E+00	2.25E-01	1.04E+00	3.50E-02	6.63E-02	3.77E+00	1.23E+00	5.82E+00	1.40E+00	6.26E+00	6.82E-01	1.01E+00	5.73E-01	5.26E+00	3.10E+00
2003	11	1	4.39E-01	1.14E-04	2.30E-01	1.20E-06	7.46E-06	1.80E+00	1.42E+00	3.36E+00	7.21E-02	5.60E+00	1.21E-02	1.24E+00	3.77E-01	2.95E+00	6.63E-01
2003	11	2	4.69E+00	1.10E-01	2.47E+00	5.17E-03	1.26E-02	5.30E+00	5.41E-01	4.58E+00	8.63E+00	4.07E-01	2.46E-01	1.76E-01	2.13E-01	4.67E+00	5.69E+00
2003	11	3	2.64E+00	0.00E+00	1.82E+00	0.00E+00	0.00E+00	2.95E+00	4.19E-04	2.27E+00	3.41E+00	1.44E-05	3.63E-07	5.53E-05	3.07E-05	2.42E+00	3.05E+00
2003	11	4	2.95E+00	3.24E-03	1.63E+00	6.45E-02	2.11E-01	4.44E+00	7.45E-01	5.15E+00	2.37E+00	2.17E+00	1.89E+00	6.15E-01	3.31E-01	4.16E+00	3.41E+00
2003	11	5	1.95E-01	2.74E-05	1.99E-01	4.14E-06	1.40E-05	3.78E+00	8.90E-01	4.01E+00	3.01E-02	5.41E+00	1.44E-03	1.28E+00	2.45E-01	4.40E+00	2.73E-01
2003	11	6	4.51E-02	0.00E+00	1.48E-02	0.00E+00	0.00E+00	5.48E-01	3.61E-01	1.74E+00	2.19E-03	3.38E+00	2.32E-03	4.98E-01	2.73E-01	9.19E-01	1.51E-01
2003	11	7	1.42E+00	5.13E-04	6.79E-01	6.58E-06	8.16E-05	3.66E+00	8.32E-01	5.93E+00	9.02E-02	6.08E+00	2.10E-02	8.63E-01	4.56E-01	4.96E+00	2.42E+00
2003	11	8	3.77E-01	1.23E-05	2.48E-01	4.69E-07	5.90E-06	2.60E+00	8.42E-01	3.83E+00	4.54E-02	4.08E+00	1.42E-02	9.64E-01	4.38E-01	3.07E+00	8.15E-01
2003	11	9	2.13E-01	8.67E-05	1.10E-01	7.24E-06	4.07E-05	2.46E+00	8.16E-01	2.97E+00	1.55E-02	4.90E+00	2.05E-02	1.13E+00	2.48E-01	3.26E+00	2.58E-01
2003	11	10	2.04E-02	0.00E+00	1.57E-02	0.00E+00	0.00E+00	5.11E-01	2.06E-01	6.74E-01	3.18E-05	9.77E-01	7.36E-02	2.09E-01	2.97E-01	4.71E-01	9.35E-02
2003	11	11	5.95E-01	4.53E-06	1.01E-01	0.00E+00	1.09E-05	3.19E+00	4.27E-01	3.54E+00	3.92E-02	4.36E+00	3.05E-02	6.59E-01	9.10E-01	2.15E+00	7.96E-01
2003	11	12	2.92E-01	3.11E-04	1.61E-01	3.83E-05	9.42E-05	2.41E+00	7.11E-01	3.87E+00	2.45E-02	3.36E+00	4.33E-03	6.81E-01	2.19E-01	2.81E+00	4.73E-01
2003	11	13	1.93E-02	0.00E+00	2.61E-03	0.00E+00	0.00E+00	4.86E-01	3.40E-01	1.26E+00	1.83E-17	3.11E+00	6.87E-04	5.98E-01	2.69E-01	6.16E-01	6.14E-02
2003	11	14	2.49E-01	0.00E+00	2.23E-01	0.00E+00	0.00E+00	2.52E+00	7.41E-01	3.10E+00	9.23E-03	4.73E+00	2.68E-03	9.71E-01	2.32E-01	2.82E+00	4.18E-01
2003	11	15	4.76E-01	1.15E-03	5.19E-01	1.49E-04	4.95E-04	3.26E+00	1.38E+00	6.01E+00	1.26E-01	7.96E+00	4.37E-02	1.37E+00	5.47E-01	5.68E+00	8.28E-01
2003	11	16	3.58E-01	2.53E-04	3.55E-02	1.75E-01	2.24E-01	1.23E+00	4.85E-01	3.26E+00	6.91E-03	1.46E+00	1.73E+00	8.68E-02	4.92E-01	1.46E+00	7.11E-01
2003	11	17	3.63E-02	0.00E+00	1.25E-02	0.00E+00	0.00E+00	5.82E-01	2.95E-01	1.04E+00	6.47E-18	9.59E-01	5.14E-02	3.03E-01	2.69E-01	5.75E-01	9.45E-02
2003	11	18	3.32E-01	6.70E-01	1.50E-01	3.43E-02	3.92E-02	2.57E+00	4.05E-01	2.27E+00	9.00E-02	9.29E-01	5.64E-01	1.09E-01	4.38E-01	1.48E+00	7.90E-01
2003	11	19	2.73E-01	2.51E-02	3.24E-02	2.09E-02	9.12E-02	1.06E+00	2.79E-01	9.53E-01	3.36E-02	1.15E+00	4.59E-01	7.69E-02	3.22E-01	8.29E-01	5.10E-01
2003	11	20	8.23E-01	2.03E-01	4.06E-01	1.88E-01	4.44E-01	1.73E+00	9.07E-01	2.89E+00	5.51E-01	2.13E+00	1.27E+00	5.03E-01	1.71E-01	2.46E+00	1.16E+00
2003	11	21	2.48E+00	3.43E-01	1.29E+00	2.99E-02	5.37E-02	3.15E+00	7.17E-01	3.39E+00	4.16E+00	5.32E-01	2.35E+00	7.80E-02	1.35E-01	4.21E+00	3.15E+00
2003	11	22	2.35E-01	2.93E-03	2.75E-02	3.64E-03	6.38E-03	2.31E+00	8.83E-01	4.34E+00	4.68E-02	5.90E+00	7.30E-03	7.08E-01	9.91E-01	2.97E+00	2.75E-01
2003	11	23	5.33E-02	0.00E+00	4.14E-03	0.00E+00	1.19E-11	3.65E-01	2.99E-01	1.05E+00	1.28E-15	2.93E+00	1.80E-02	3.43E-01	2.45E-01	6.19E-01	8.52E-02
2003	11	24	2.68E-02	0.00E+00	1.91E-02	0.00E+00	9.76E-06	5.44E-01	3.23E-01	1.26E+00	1.60E-04	1.45E+00	5.80E-02	3.96E-01	2.80E-01	6.13E-01	5.47E-02
2003	11	25	4.33E-02	0.00E+00	1.85E-02	0.00E+00	2.37E-05	5.32E-01	3.02E-01	1.24E+00	2.67E-04	1.16E+00	1.05E-01	2.54E-01	3.06E-01	6.18E-01	1.14E-01
2003	11	26	6.78E-02	1.34E-06	5.44E-02	0.00E+00	1.18E-07	1.82E+00	7.45E-01	3.37E+00	2.08E-02	5.01E+00	2.51E-03	1.23E+00	2.93E-01	1.67E+00	1.09E-01
2003	11	27	3.71E-01	2.64E-04	2.12E-01	3.75E-05	5.96E-03	2.26E+00	7.79E-01	3.85E+00	7.15E-02	4.63E+00	1.34E-01	9.98E-01	3.66E-01	2.50E+00	6.71E-01
2003	11	28	2.05E-02	0.00E+00	1.94E-02	0.00E+00	7.11E-04	5.00E-01	1.80E-01	6.20E-01	1.46E-03	7.23E-01	1.33E-01	1.28E-01	3.11E-01	4.95E-01	1.02E-01
2003	11	29	6.44E-02	0.00E+00	3.14E-02	0.00E+00	4.47E-11	1.10E+00	1.84E-01	1.01E+00	2.34E-02	7.83E-01	7.27E-02	7.65E-02	3.32E-01	4.91E-01	1.89E-01
2003	11	30	1.78E-01	1.45E-03	3.07E-01	2.50E-04	1.34E-03	3.79E+00	2.19E+00	4.61E+00	6.71E-02	1.05E+01	1.95E-02	1.44E+00	1.05E+00	6.01E+00	2.30E-01
2003	12	1	1.14E+00	3.22E-01	3.51E-01	4.22E-01	4.30E-01	3.69E+00	1.45E+00	5.06E+00	1.57E-01	5.70E+00	7.11E+00	6.56E-01	5.63E-01	2.80E+00	1.53E+00
2003	12	2	3.63E-01	5.95E-05	1.61E-01	3.41E-05	3.26E-04	2.29E+00	6.37E-01	3.62E+00	2.08E-02	3.72E+00	6.25E-02	6.82E-01	3.06E-01	2.32E+00	4.88E-01
2003	12	3	1.12E+00	7.99E-07	4.74E-01	1.83E-07	3.57E-03	1.94E+00	1.19E+00	2.43E+00	1.95E+00	3.71E+00	1.17E-01	7.50E-01	8.34E-01	2.19E+00	1.79E+00
2003	12	4	5.06E+00	9.08E-01	2.38E+00	1.34E-02	2.27E-02	4.81E+00	2.19E+00	9.05E+00	5.33E+00	1.48E+00	2.08E+00	5.42E-01	6.70E-01	8.38E+00	6.27E+00
2003	12	5	1.21E+00	1.57E-01	3.17E-01	2.10E-02	1.03E-01	2.44E+00	1.05E+00	4.92E+00	2.59E-01	1.55E+00	1.80E+00	2.96E-01	4.98E-01	2.67E+00	1.60E+00
2003	12	6	5.93E-01	2.91E-05	1.36E-01	2.26E-03	1.90E-01	1.75E+00	6.81E-01	2.12E+00	1.67E-02	2.44E+00	8.37E-01	3.41E-01	5.83E-01	1.85E+00	8.82E-01
2003	12	7	1.87E-01	9.63E-04	1.97E-01	1.33E-04	3.74E-04	3.45E+00	1.92E+00	6.73E+00	4.39E-02	1.25E+01	3.08E-03	1.73E+00	1.32E+00	4.30E+00	2.56E-01
2003	12	8	7.35E-01	1.00E-03	6.37E-01	1.08E-04	3.54E-04	5.71E+00	2.19E+00	7.92E+00	5.71E-01	1.18E+01	5.34E-03	1.70E+00	2.18E+00	5.73E+00	1.17E+00
2003	12	9	2.88E+00	1.17E-02	1.84E+00	4.44E-04	1.33E-03	4.73E+00	1.75E+00	6.38E+00	2.32E+00	1.46E+01	4.72E-02	1.31E+00	1.41E+00	6.25E+00	3.73E+00
2003	12	10	4.80E+00	1.25E-01	3.02E+00	1.90E-02	4.00E-02	6.82E+00	1.87E+00	8.38E+00	3.55E+00	6.04E+00	5.71E-01	1.03E+00	1.56E+00	7.98E+00	6.03E+00
2003	12	11	2.40E-01	8.91E-04	3.21E-02	4.18E-04	7.87E-04	2.19E+00	4.60E-01	3.62E+00	1.21E-02	3.98E+00	5.76E-03	9.71E-01	1.26E+00	1.91E+00	2.62E-01
2003	12	12	4.99E-02	0.00E+00	8.79E-03	0.00E+00	1.26E-11	6.16E-01	3.99E-01	1.77E+00	1.44E-04	1.49E+00	5.06E-02	5.26E-01	2.43E-01	7.56E-01	9.00E-02
2003	12	13	1.56E-01	0.00E+00	5.13E-02	2.00E-07	3.30E-04	1.85E+00	6.95E-01	2.73E+00	5.66E-03	2.96E+00	5.78E-02	6.98E-01	7.10E-01	1.27E+00	3.33E-01
2003	12	14	1.86E-01	7.71E-04	1.02E-01	3.81E-05	1.60E-04	1.71E+00	5.56E-01	2.78E+00	3.44E-02	1.33E+00	3.15E-02	7.26E-01	3.54E-01	1.22E+00	3.44E-01
2003	12	15	1.02E-01	0.00E+00	6.89E-03	0.00E+00	0.00E+00	1.02E+00	5.99E-01	2.73E+00	1.19E-02	3.33E+00	1.27E-02	9.34E-01	2.45E-01	1.09E+00	2.04E-01
2003	12	16	2.49E-02	0.00E+00	1.31E-02	0.00E+00	6.67E-05	4.18E-01	1.63E-01	6.43E-01	1.08E-03	6.46E-01	8.11E-02	1.12E-01	2.40E-01	3.65E-01	7.47E-02
2003	12	17	9.07E-02	9.74E-08	4.48E-02	0.00E+00	5.85E-08	1.39E+00	4.79E-01	2.83E+00	3.03E-03	2.10E+00	1.69E-02	5.57E-01	2.18E-01	1.34E+00	1.36E-01
2003	12	18	4.92E-01	6.97E-07	2.40E-01	0.00E+00	5.31E-07	1.71E+00	7.93E-01	3.27E+00	3.69E-02	4.55E+00	2.76E-02	7.94E-01	3.18E-01	2.15E+00	8.54E-01
2003	12	19	2.31E-01	1.01E-08	9.16E-02	0.00E+00	5.60E-08	1.09E+00	4.30E-01	1.92E+00	8.07E-03	1.67E+00	1.94E-02	3.71E-01	2.37E-01	2.33E+00	4.77E-01
2003	12	20	1.34E-01	0.00E+00	1.18E-02	0.00E+00	2.45E-12	6.60E-01	5.48E-01	1.52E+00	3.22E-16	3.03E+00	2.01E-02	6.57E-01	2.70E-01	1.10E+00	2.12E-01
2003	12	21	1.16E-01	0.00E+00	7.07E-04	0.00E+00	0.00E+00	5.87E-01	6.34E-01	2.17E+00	2.40E-16	6.47E+00	1.87E-03	7.34E-01	3.70E-01	1.09E+00	1.72E-01
2003	12	22	5.04E-02	0.00E+00	5.31E-03	0.00E+00	0.00E+00	4.21E-01	4.31E-01	1.16E+00	5.80E-17	4.86E+00	2.16E-03	4.98E-01	3.30E-01	7.33E-01	8.30E-02
2003	12	23	1.22E-01	0.00E+00	4.40E-02	1.73E-06	3.37E-03	8.85E-01	4.53E-01	1.93E+00	1.57E-02	1.66E+00	1.07E-01	2.73E-01	5.93E-01	1.04E+00	1.76E-01
2003	12	24	5.80E-01	1.95E-03	2.56E-01	1.14E-03	2.02E-01	2.92E+00	1.06E+00	5.65E+00	9.67E-02	1.73E+00	1.92E+00	3.09E-01	2.60E-01	2.82E+00	9.34E-01
2003	12	25	2.33E-01	3.14E-04	2.08E-01	1.29E-05	8.64E-05	3.01E+00	9.31E-01	4.88E+00	5.10E-02	1.90E+00	5.16E-02	9.29E-01	4.16E-01	2.39E+00	3.16E-01
2003	12	26	1.44E+00	3.17E-03	9.72E-01	4.64E-04	1.45E-03	6.43E+00	2.85E+00	8.07E+00	3.89E-01	1.80E+01	1.80E-02	2.77E+00	2.93E+00	8.22E+00	2.26E+00
2003	12	27	1.67E+00	3.37E-02	1.35E+00	5.06E-03	1.21E-02	4.22E+00	2.28E+00	5.73E+00	3.84E+00	8.85E+00	1.50E-01	1.80E+00	1.26E+00	6.21E+00	2.27E+00
2003	12	28	3.44E+00	7.73E-01	2.18E+00	3.47E-01	5.75E-01	4.26E+00	1.96E+00	4.89E+00	7.76E+00	6.49E+00	5.35E+00	8.75E-01	1.68E+00	4.52E+00	4.52E+00
2003	12	29	5.19E+00	2.84E-03	3.71E+00	1.13E-03	1.97E-03	6.28E+00	7.98E-01	5.92E+00	4.24E+00	7.97E-01	6.59E-03	4.42E-01	5.61E-01	6.49E+00	6.39E+00
2003	12	30	1.37E-01	8.06E-04	1.24E-01	2.16E-04	4.37E-04	1.96E+00	6.77E-01	2.41E+00	1.53E-02	3.69E+00	5.88E-03	8.04E-01	4.88E-01	2.11E+00	1.92E-01
2003	12	31	7.50E-02	0.00E+00	3.62E-03	0.00E+00	0.00E+00	4.68E-01	7.94E-01	1.85E+00	3.54E-17	6.51E+00	3.78E-03	1.09E+00	2.52E-01	1.07E+00	1.28E-01
2004	1	1	8.46E-01	8.55E-04	5.22E-01	2.58E-05	1.36E-04	2.13E+00	1.61E+00	3.94E+00	1.03E+00	8.50E+00	1.15E-02	1.46E+00	6.23E-01	4.51E+00	1.27E+00
2004	1	2	9.72E-01	8.80E-01	5.09E-01	1.98E-02	5.89E-03	1.17E+00	3.44E-01	1.94E+00	1.90E+00	7.48E-03	7.76E-03	3.80E-03	5.23E-03	2.07E+00	1.30E+00
2004	1	3	3.17E+00	5.67E-02	1.63E+00	1.51E-03	5.65E-03	3.95E+00	9.33E-01	3.46E+00	4.49E+00	3.20E+00	4.70E-01	3.10E-01	3.87E-01	4.68E+00	3.92E+00
2004	1	4	1.84E+00	2.23E-01	9.30E-01	4.90E-02	1.20E-01	6.70E+00	5.20E+00	1.22E+01	9.76E-01	1.68E+01	1.40E+00	5.98E+00	6.02E+00	1.10E+01	2.63E+00
2004	1	5	6.40E-01	0.00E+00	2.45E-01	0.00E+00	5.11E-07	3.15E+00	2.92E+00	7.03E+00	3.69E-02	1.14E+01	2.49E-03	1.44E+00	7.89E-01	5.94E+00	7.76E-01
2004	1	6	3.10E-01	0.00E+00	9.17E-02	0.00E+00	0.00E+00	1.18E+00	7.63E-01	2.25E+00	9.29E-04	4.63E+00	8.98E-03	9.51E-01	1.99E-01	1.85E+00	5.06E-01
2004	1	7	3.48E-01	0.00E+00	1.02E-01	0.00E+00	6.56E-06	9.88E-01	8.96E-01	2.03E+00	2.38E-03	5.32E+00	5.81E-02	8.91E-01	3.52E-01	1.37E+00	5.37E-01
2004	1	8	7.75E-02	0.00E+00	8.45E-04	0.00E+00	0.00E+00	3.83E-01	5.26E-01	1.29E+00	8.88E-17	4.66E+00	8.38E-03	5.85E-01	2.42E-01	7.99E-01	1.31E-01

Year	Month	Day	Baseline														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	10	19	2.79E-02	0.00E+00	1.96E-02	0.00E+00	0.00E+00	6.02E-01	2.22E-01	6.41E-01	8.10E-07	0.00E+00	0.00E+00	5.96E-04	2.69E-06	5.05E-01	9.50E-02
2003	10	20	4.97E-01	2.80E-03	1.73E-01	1.80E-03	4.04E-03	2.87E+00	8.15E-01	3.18E+00	1.30E-01	2.94E-02	1.21E-02	5.67E-02	4.30E-02	2.19E+00	8.74E-01
2003	10	21	2.06E-01	3.71E-06	3.47E-02	9.99E-07	6.10E-05	1.19E+00	2.63E-01	1.13E+00	6.81E-02	9.17E-03	7.25E-04	4.98E-03	1.06E-02	9.99E-01	4.24E-01
2003	10	22	1.79E+00	5.29E-03	8.94E-01	2.37E-03	2.94E-03	2.93E+00	7.13E-01	3.84E+00	6.75E-02	1.38E-02	7.32E-03	2.55E-02	2.39E-02	3.56E+00	2.03E+00
2003	10	23	4.44E-02	0.00E+00	6.31E-03	0.00E+00	0.00E+00	4.77E-01	1.58E-01	4.54E-01	2.07E-04	4.70E-06	0.00E+00	2.56E-03	4.27E-04	4.11E-01	9.94E-02
2003	10	24	2.60E-01	3.63E-06	1.28E-01	0.00E+00	0.00E+00	2.43E+00	6.90E-01	2.87E+00	1.44E-02	1.05E-03	5.14E-05	5.10E-03	2.81E-03	1.99E+00	3.08E-01
2003	10	25	1.62E-01	2.46E-04	1.29E-01	3.16E-05	6.89E-05	1.49E+00	5.39E-01	1.55E+00	9.89E-03	2.19E-03	6.86E-04	6.05E-03	3.71E-03	1.45E+00	2.24E-01
2003	10	26	4.61E-02	0.00E+00	3.34E-03	0.00E+00	0.00E+00	7.66E-01	2.18E-01	8.63E-01	1.31E-03	0.00E+00	0.00E+00	7.01E-06	0.00E+00	5.56E-01	6.33E-02
2003	10	27	3.56E-01	2.43E-05	1.67E-01	8.79E-08	2.61E-06	3.38E+00	5.66E-01	3.10E+00	8.22E-02	1.24E-02	1.50E-03	2.53E-02	2.12E-02	2.30E+00	5.62E-01
2003	10	28	5.22E-01	1.40E-03	1.50E-01	3.50E-04	1.05E-03	2.32E+00	1.30E+00	3.12E+00	8.32E-02	1.61E-02	6.20E-03	3.87E-02	2.43E-02	2.59E+00	6.90E-01
2003	10	29	8.70E-01	0.00E+00	3.66E-01	0.00E+00	0.00E+00	1.73E+00	9.76E-03	2.03E+00	9.05E-04	0.00E+00	0.00E+00	1.88E-04	3.06E-05	1.42E+00	1.06E+00
2003	10	30	1.18E+00	0.00E+00	6.66E-01	0.00E+00	0.00E+00	1.54E+00	6.99E-03	1.66E+00	2.85E-06	0.00E+00	0.00E+00	2.85E-08	7.98E-10	1.55E+00	1.27E+00
2003	10	31	1.92E+00	6.19E-03	9.74E-01	1.56E-03	2.74E-03	3.72E+00	1.19E+00	5.09E+00	1.15E-01	2.66E-02	1.22E-02	5.34E-02	3.74E-02	5.18E+00	2.61E+00
2003	11	1	4.10E-01	1.14E-04	2.29E-01	1.20E-06	7.46E-06	1.80E+00	1.35E+00	2.31E+00	1.62E-02	1.74E-03	3.54E-04	6.77E-03	3.38E-03	2.92E+00	5.89E-01
2003	11	2	3.94E+00	9.08E-03	2.38E+00	1.21E-03	2.42E-03	5.18E+00	5.27E-01	4.48E+00	1.11E-01	2.94E-02	1.47E-02	5.37E-02	3.87E-02	4.65E+00	4.41E+00
2003	11	3	2.35E+00	0.00E+00	1.50E+00	0.00E+00	0.00E+00	2.64E+00	3.65E-04	2.26E+00	1.07E-03	1.94E-06	2.28E-08	5.98E-06	3.95E-06	2.42E+00	2.49E+00
2003	11	4	2.41E+00	1.14E-03	1.31E+00	1.96E-04	5.75E-04	4.17E+00	6.18E-01	4.24E+00	6.38E-02	1.53E-02	3.91E-03	3.30E-02	2.34E-02	4.02E+00	2.58E+00
2003	11	5	1.86E-01	2.74E-05	1.99E-01	4.14E-06	1.40E-05	3.78E+00	7.95E-01	2.44E+00	3.01E-02	3.33E-03	3.65E-04	1.61E-02	8.18E-03	4.31E+00	2.30E-01
2003	11	6	4.34E-02	0.00E+00	1.48E-02	0.00E+00	0.00E+00	5.47E-01	3.24E-01	1.22E+00	2.19E-03	2.86E-05	0.00E+00	1.27E-03	3.27E-04	9.18E-01	1.44E-01
2003	11	7	1.30E+00	5.09E-04	6.63E-01	6.58E-06	8.16E-05	3.55E+00	8.14E-01	5.41E+00	8.21E-02	1.26E-02	2.91E-03	3.66E-02	2.23E-02	4.94E+00	2.06E+00
2003	11	8	2.99E-01	5.78E-06	2.35E-01	2.56E-07	2.12E-06	2.57E+00	7.83E-01	2.81E+00	2.48E-02	3.27E-03	1.70E-04	1.17E-02	8.10E-03	3.01E+00	6.19E-01
2003	11	9	2.13E-01	8.67E-05	1.10E-01	7.24E-06	4.07E-05	2.46E+00	7.41E-01	1.70E+00	1.55E-02	2.31E-03	5.65E-04	1.19E-02	4.98E-03	3.22E+00	2.58E-01
2003	11	10	2.04E-02	0.00E+00	1.57E-02	0.00E+00	0.00E+00	5.11E-01	2.02E-01	4.99E-01	3.18E-05	0.00E+00	0.00E+00	3.67E-03	3.17E-04	4.71E-01	9.35E-02
2003	11	11	5.63E-01	4.53E-06	9.92E-02	0.00E+00	1.09E-05	3.19E+00	3.82E-01	2.91E+00	3.64E-02	4.23E-03	4.88E-04	9.76E-03	6.62E-03	2.12E+00	7.05E-01
2003	11	12	1.85E-01	3.11E-04	1.61E-01	3.83E-05	9.42E-05	2.41E+00	6.37E-01	2.83E+00	2.29E-02	4.25E-03	1.17E-03	1.19E-02	7.26E-03	2.76E+00	2.50E-01
2003	11	13	1.93E-02	0.00E+00	2.61E-03	0.00E+00	0.00E+00	4.86E-01	3.10E-01	8.32E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.16E-01	6.14E-02
2003	11	14	2.04E-01	0.00E+00	2.22E-01	0.00E+00	0.00E+00	2.51E+00	6.99E-01	2.36E+00	9.12E-03	8.15E-04	7.06E-05	3.40E-03	1.72E-03	2.76E+00	2.94E-01
2003	11	15	4.29E-01	8.40E-04	5.11E-01	9.56E-05	3.66E-04	3.24E+00	1.31E+00	4.70E+00	1.12E-01	2.29E-02	6.29E-03	5.05E-02	3.47E-02	5.58E+00	6.92E-01
2003	11	16	3.58E-01	2.53E-04	3.55E-02	6.32E-04	1.66E-03	1.23E+00	4.81E-01	2.45E+00	6.91E-03	2.61E-03	9.76E-04	1.82E-02	1.19E-02	1.45E+00	7.11E-01
2003	11	17	3.63E-02	0.00E+00	1.25E-02	0.00E+00	0.00E+00	5.82E-01	2.92E-01	7.51E-01	0.00E+00	0.00E+00	0.00E+00	1.05E-03	2.39E-06	5.75E-01	9.45E-02
2003	11	18	3.32E-01	7.50E-03	1.49E-01	3.22E-03	3.78E-03	2.56E+00	4.02E-01	1.98E+00	8.87E-02	2.38E-02	1.04E-02	3.95E-02	2.92E-02	1.48E+00	7.87E-01
2003	11	19	2.73E-01	4.98E-04	3.24E-02	1.05E-03	2.66E-03	1.06E+00	2.79E-01	9.08E-01	3.01E-02	8.25E-03	2.56E-03	8.19E-03	1.17E-02	8.29E-01	5.10E-01
2003	11	20	8.18E-01	3.54E-03	3.98E-01	8.35E-03	1.75E-02	1.70E+00	8.69E-01	2.46E+00	3.96E-02	2.60E-02	1.86E-02	2.91E-02	2.90E-02	2.46E+00	1.14E+00
2003	11	21	2.21E+00	4.49E-03	1.26E+00	7.80E-04	1.68E-03	3.10E+00	7.13E-01	3.24E+00	6.25E-02	1.44E-02	7.78E-03	3.00E-02	2.03E-02	4.19E+00	2.69E+00
2003	11	22	2.35E-01	1.09E-03	2.67E-02	2.94E-04	6.25E-04	2.31E+00	7.53E-01	2.65E+00	4.51E-02	7.24E-03	2.60E-03	2.66E-02	1.53E-02	2.92E+00	2.74E-01
2003	11	23	5.33E-02	0.00E+00	4.14E-03	0.00E+00	0.00E+00	3.65E-01	2.66E-01	5.20E-01	0.00E+00	0.00E+00	0.00E+00	3.27E-04	1.04E-04	6.09E-01	8.52E-02
2003	11	24	2.68E-02	0.00E+00	1.91E-02	0.00E+00	0.00E+00	5.44E-01	3.12E-01	9.82E-01	1.60E-04	1.75E-05	0.00E+00	2.45E-03	7.93E-04	6.13E-01	5.47E-02
2003	11	25	4.33E-02	0.00E+00	1.85E-02	0.00E+00	0.00E+00	5.32E-01	2.88E-01	6.97E-01	2.67E-04	6.77E-05	0.00E+00	2.65E-03	2.08E-03	6.18E-01	1.14E-01
2003	11	26	6.78E-02	1.34E-06	5.44E-02	0.00E+00	1.18E-07	1.82E+00	6.73E-01	2.15E+00	2.08E-02	1.08E-03	6.75E-05	8.30E-03	3.67E-03	1.64E+00	1.09E-01
2003	11	27	2.44E-01	2.38E-04	2.10E-01	3.69E-05	1.29E-04	2.25E+00	7.20E-01	2.34E+00	4.63E-02	6.88E-03	1.09E-03	1.91E-02	1.45E-02	2.45E+00	3.58E-01
2003	11	28	2.05E-02	0.00E+00	1.94E-02	0.00E+00	0.00E+00	5.00E-01	1.79E-01	4.77E-01	1.46E-03	2.55E-04	0.00E+00	6.02E-03	1.65E-03	4.95E-01	1.02E-01
2003	11	29	6.44E-02	0.00E+00	3.14E-02	0.00E+00	0.00E+00	1.10E+00	1.84E-01	6.99E-01	2.34E-02	1.07E-03	3.69E-05	9.42E-03	5.66E-03	4.82E-01	1.89E-01
2003	11	30	1.71E-01	1.10E-03	3.07E-01	2.08E-04	6.15E-04	3.79E+00	2.10E+00	3.31E+00	5.55E-02	1.17E-02	3.79E-03	2.88E-02	1.92E-02	5.89E+00	2.09E-01
2003	12	1	1.01E+00	1.75E-02	3.48E-01	1.12E-02	1.44E-02	3.68E+00	1.42E+00	3.93E+00	1.32E-01	5.47E-02	3.24E-02	6.80E-02	6.33E-02	2.50E+00	1.28E+00
2003	12	2	2.89E-01	5.95E-05	1.60E-01	3.41E-05	2.54E-04	2.29E+00	5.84E-01	2.44E+00	2.03E-02	3.52E-03	1.23E-03	7.67E-03	4.19E-03	2.16E+00	3.63E-01
2003	12	3	1.08E+00	2.44E-07	4.58E-01	1.83E-07	4.97E-05	1.91E+00	1.17E+00	2.38E+00	4.25E-02	5.01E-03	3.93E-04	1.29E-02	1.24E-02	2.16E+00	1.74E+00
2003	12	4	4.32E+00	1.21E-02	2.19E+00	5.26E-03	7.95E-03	4.64E+00	2.09E+00	7.38E+00	1.34E-01	4.55E-02	2.27E-02	1.01E-01	6.60E-02	8.06E+00	4.98E+00
2003	12	5	1.10E+00	8.33E-03	3.15E-01	3.73E-03	6.15E-03	2.44E+00	1.04E+00	3.36E+00	1.02E-01	3.86E-02	1.93E-02	7.31E-02	5.21E-02	2.55E+00	1.38E+00
2003	12	6	5.92E-01	2.91E-05	1.36E-01	1.37E-04	4.90E-04	1.75E+00	6.46E-01	1.93E+00	1.57E-02	2.16E-03	8.82E-04	1.74E-02	5.49E-03	1.73E+00	8.73E-01
2003	12	7	1.85E-01	9.63E-04	1.97E-01	1.33E-04	3.74E-04	3.45E+00	1.76E+00	4.87E+00	4.39E-02	7.96E-03	2.86E-03	2.14E-02	1.30E-02	4.14E+00	2.43E-01
2003	12	8	6.14E-01	9.90E-04	6.28E-01	1.08E-04	3.51E-04	5.65E+00	2.05E+00	6.18E+00	7.51E-02	1.44E-02	4.33E-03	3.26E-02	2.28E-02	5.57E+00	8.64E-01
2003	12	9	2.30E+00	1.65E-03	1.51E+00	2.67E-04	6.35E-04	4.49E+00	1.51E+00	4.84E+00	6.67E-02	1.16E-02	4.18E-03	2.79E-02	1.81E-02	5.97E+00	2.74E+00
2003	12	10	3.63E+00	5.37E-03	2.71E+00	1.05E-03	2.12E-03	6.59E+00	1.76E+00	7.40E+00	1.13E-01	2.54E-02	1.10E-02	5.28E-02	3.68E-02	7.77E+00	3.86E+00
2003	12	11	2.38E-01	2.46E-04	3.10E-02	8.13E-05	1.65E-04	2.19E+00	4.18E-01	2.73E+00	1.07E-02	1.85E-03	6.49E-04	8.51E-03	3.81E-03	1.86E+00	2.60E-01
2003	12	12	4.99E-02	0.00E+00	8.79E-03	0.00E+00	0.00E+00	6.16E-01	3.92E-01	8.66E-01	1.44E-04	0.00E+00	0.00E+00	1.69E-03	4.92E-04	7.56E-01	9.00E-02
2003	12	13	1.56E-01	0.00E+00	5.13E-02	2.00E-07	1.42E-06	1.85E+00	6.73E-01	1.78E+00	5.66E-03	1.74E-04	2.56E-06	2.58E-02	4.63E-03	1.25E+00	3.33E-01
2003	12	14	1.78E-01	7.71E-04	1.02E-01	3.81E-05	1.60E-04	1.71E+00	5.38E-01	1.57E+00	3.44E-02	5.90E-03	1.95E-03	1.31E-02	8.30E-03	1.18E+00	3.12E-01
2003	12	15	1.02E-01	0.00E+00	6.89E-03	0.00E+00	0.00E+00	1.02E+00	5.48E-01	1.42E+00	1.19E-02	9.75E-04	2.41E-05	5.79E-03	3.03E-03	1.09E+00	2.04E-01
2003	12	16	2.49E-02	0.00E+00	1.31E-02	0.00E+00	0.00E+00	4.18E-01	1.62E-01	4.76E-01	1.08E-03	2.75E-04	0.00E+00	4.72E-03	7.71E-04	3.65E-01	7.47E-02
2003	12	17	9.07E-02	9.74E-08	4.48E-02	0.00E+00	5.85E-08	1.39E+00	4.60E-01	1.74E+00	3.03E-03	1.54E-04	3.53E-06	1.58E-03	6.25E-04	1.33E+00	1.36E-01
2003	12	18	4.73E-01	6.97E-07	2.39E-01	0.00E+00	5.31E-07	1.68E+00	7.55E-01	2.81E+00	3.41E-02	2.61E-03	5.84E-05	1.47E-02	7.26E-03	2.14E+00	7.86E-01
2003	12	19	1.45E-01	1.01E-08	9.15E-02	0.00E+00	5.60E-08	1.09E+00	4.19E-01	1.68E+00	7.94E-03	6.12E-04	1.03E-05	4.40E-03	2.36E-03	2.29E+00	2.38E-01
2003	12	20	1.34E-01	0.00E+00	1.18E-02	0.00E+00	0.00E+00	6.60E-01	4.83E-01	1.11E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-04	4.21E-07	1.05E+00	2.12E-01
2003	12	21	1.16E-01	0.00E+00	7.07E-04	0.00E+00	0.00E+00	5.87E-01	5.37E-01	1.02E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-07	0.00E+00	1.09E+00	1.72E-01
2003	12	22	5.04E-02	0.00E+00	5.31E-03	0.00E+00	0.00E+00	4.21E-01	3.76E-01	4.92E-01	0.00E+00	0.00E+00	0.00E+00	6.40E-06	0.00E+00	7.33E-01	8.30E-02
2003	12	23	1.22E-01	0.00E+00	4.40E-02	1.72E-06	9.49E-05	8.85E-01	4.44E-01	1.44E+00	1.57E-02	1.95E-03	5.47E-05	2.01E-02	1.31E-02	1.03E+00	1.76E-01
2003	12	24	5.41E-01	1.95E-03	2.56E-01	9.86E-04	2.98E-03	2.92E+00	1.03E+00	3.83E+00	9.50E-02	2.68E-02	1.02E-02	4.50E-02	3.78E-02	2.73E+00	7.96E-01
2003	12	25	2.33E-01	3.14E-04	2.08E-01	1.29E-05	8.64E-05	3.01E+00	8.75E-01	3.33E+00	5.10E-02	9.48E-03	2.10E-03	2.94E-02	1.75E-02	2.32E+00	3.16E-01
2003	12	26	1.26E+00	2.66E-03	9.34E-01	4.19E-04	1.25E-03	6.33E+00	2.69E+00	6.19E+00	1.27E-01	2.88E-02	9.91E-03	5.92E-02	4.12E-02	8.07E+00	1.81E+00
2003	12	27	1.57E+00	4.89E-03	1.10E+00	1.12E-03	2.24E-03	3.97E+00	2.12E+00	4.39E+00	9.60E-02	2.26E-02	1.05E-02	4.64E-02	3.21E-02	6.05E+00	2.09E+00
2003	12	28	3.14E+00	9.38E-03	1.94E+00	6.38E-03	9.19E-03	3.96E+00	1.86E+00	4.36E+00	9.55E-02	3.45E-02	1.79E-02	7.45E-02	5.86E-02	4.39E+00	4.04E+00
2003	12	29	4.22E+00	1.79E-03	2.43E+00	4.23E-04	1.08E-03	5.42E+00	7.60E-01	5.54E+00	7.20E-02	1.31E-02	5.04E-03	2.95E-02	2.01E-02	6.41E+00	4.75E+00
2003	12	30	1.24E-01	8.02E-04	1.24E-01	2.14E-04	4.32E-04	1.96E+00	6.09E-01	1.72E+00	1.52E-02	4.03E-03	1.72E-03	9.99E-03	6.33E-03	2.09E+00	1.69E-01
2003	12	31	7.50E-02	0.00E+00	3.62E-03	0.00E+00	0.00E+00	4.68E-01	7.23E-01	1.12E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-05	0.00E+00	1.07E+00	1.28E-01
2004	1	1	7.78E-01	5.44E-04	4.84E-01	2.58E-05	1.18E-04	2.07E+00	1.55E+00	3.19E+00	5.00E-02	1.03E-02	2.43E-03	3.36E-02	1.93E-02	4.44E+00	1.06E+00
2004	1	2	9.72E-01	5.77E-03	4.82E-01	3.86E-03	4.03E-03	1.11E+00	3.44E-01	1.94E+00	1.55E-02	6.91E-03	6.38E-03	3.78E-03	5.06E-03	2.07E+00	1.30E+00
2004	1	3	2.79E+00	4.13E-03	1.53E+00	8.19E-04	1.77E-03	3.87E+00	9.20E-01	3.24E+00	6.97E-02	1.77E-02	8.32E-03	3.25E-02	2.39E-02	4.66E+00	3.23E+00
2004	1	4	1.06E+00	7.43E-03	7.74E-01	2.38E-03	4.75E-03	6.49E+00	3.69E+00	9.03E+00	1.29E-01	3.85E-02	1.73E-02	9.17E-02	5.96E-02	9.83E+00	1.48E+00
2004	1	5	6.34E-01	0.00E+00	2.44E-01	0.00E+00	5.11E-07	3.14E+00	2.72E+00	4.99E+00	3.66E-02	4.59E-03	2.24E-04	3.90E-02	1.66E-02	5.82E+00	7.56E-01
2004	1	6	3.03E-01	0.00E+00	9.06E-02	0.00E+00	0.00E+00	1.17E+00	7.02E-01	1.82E+00	8.89E-04	0.00E+00	0.00E+00	1.67E-03	1.93E-04	1.83E+00	4.83E-01
2004	1	7	3.35E-01	0.00E+00	1.01E-01	0.00E+00	6.56E-06	9.79E-01	8.35E-01	1.47E+00	2.08E-03	5.00E-04	3.92E-05	8.83E-03	3.81E-03	1.34E+00	4.83E-01
2004	1	8	7.75E-02	0.00E+00	8.45E-04	0.00E+00	0.00E+00	3.83E-01	4.43E-01	9.27E-01	0.00E+00	0.00E+00	0.00E+00	2.88E-07	0.00E+00	7.98E-01	1.31E-01

Year	Month	Day	Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2003	10	19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-12	0.00E+00	9.17E-03	4.83E-01	6.65E-18	1.15E+00	6.17E-02	1.85E-01	2.34E-01	2.50E-03	0.00E+00
2003	10	20	3.17E-03	0.00E+00	0.00E+00	3.02E-02	2.82E-01	0.00E+00	3.44E-02	1.10E+00	1.53E-04	2.11E+00	1.33E+00	2.06E-01	1.06E+00	8.93E-02	1.23E-02
2003	10	21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E-06	0.00E+00	2.32E-02	2.70E-01	6.83E-04	3.02E+00	8.82E-02	2.23E-01	4.55E-01	3.65E-03	0.00E+00
2003	10	22	4.39E-01	2.24E-01	1.56E-01	6.70E-02	1.92E-01	1.42E-01	6.94E-02	4.68E-01	8.28E-01	2.97E+00	8.24E-01	4.01E-01	7.05E-01	9.05E-02	7.82E-01
2003	10	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.81E-06	0.00E+00	9.07E-03	1.08E-01	7.13E-17	1.03E+00	4.01E-02	1.55E-01	2.37E-01	1.44E-03	0.00E+00
2003	10	24	4.19E-02	0.00E+00	2.93E-03	0.00E+00	0.00E+00	8.61E-03	6.85E-02	1.15E+00	4.72E-04	5.09E+00	6.23E-04	7.73E-01	9.71E-01	2.53E-02	9.85E-02
2003	10	25	3.86E-02	0.00E+00	3.37E-05	0.00E+00	0.00E+00	4.49E-04	7.51E-02	8.10E-01	5.06E-16	4.45E+00	4.44E-04	6.73E-01	2.88E-01	4.68E-02	1.02E-01
2003	10	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E-02	3.00E-01	3.62E-13	2.72E+00	2.57E-03	3.80E-01	4.89E-01	2.38E-02	0.00E+00
2003	10	27	1.42E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.42E-03	4.70E-02	1.30E+00	1.67E-03	3.88E+00	2.56E-02	3.53E-01	4.36E-01	7.60E-02	1.71E-02
2003	10	28	4.35E-03	1.34E-06	3.64E-04	1.99E-04	2.45E-02	1.52E-03	6.43E-02	9.49E-01	5.11E-03	5.25E+00	1.43E-01	1.09E+00	7.60E-01	1.40E-02	1.43E-02
2003	10	29	2.07E-01	0.00E+00	2.65E-01	0.00E+00	0.00E+00	4.23E-01	3.64E-02	2.52E-01	1.19E+00	1.53E-01	0.00E+00	2.00E-01	1.51E-01	1.36E-01	2.97E-01
2003	10	30	1.08E-01	0.00E+00	3.83E-01	0.00E+00	0.00E+00	3.73E-01	2.05E-06	1.26E-02	1.89E+00	4.45E-09	0.00E+00	0.00E+00	1.48E-18	3.06E-03	2.94E-01
2003	10	31	2.55E-01	2.18E-01	6.40E-02	3.34E-02	6.35E-02	4.95E-02	3.70E-02	7.27E-01	1.28E+00	6.24E+00	6.70E-01	9.59E-01	5.36E-01	8.14E-02	4.92E-01
2003	11	1	2.92E-02	0.00E+00	1.94E-04	0.00E+00	0.00E+00	5.24E-04	6.38E-02	1.05E+00	5.59E-02	5.60E+00	1.18E-02	1.24E+00	3.74E-01	3.01E-02	7.38E-02
2003	11	2	7.45E-01	1.01E-01	8.62E-02	3.96E-03	1.02E-02	1.24E-01	1.36E-02	9.84E-02	8.52E+00	3.78E-01	2.31E-01	1.22E-01	1.74E-01	2.14E-02	1.27E+00
2003	11	3	2.87E-01	0.00E+00	3.24E-01	0.00E+00	0.00E+00	3.07E-01	5.40E-05	2.43E-03	3.40E+00	1.24E-05	3.40E-07	4.93E-05	2.68E-05	1.20E-03	5.54E-01
2003	11	4	5.39E-01	2.10E-03	3.24E-01	6.43E-02	2.11E-01	2.68E-01	1.27E-01	9.10E-01	2.31E+00	2.15E+00	1.89E+00	5.82E-01	3.07E-01	1.39E-01	8.22E-01
2003	11	5	9.37E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.46E-02	1.57E+00	8.56E-16	5.41E+00	1.08E-03	1.26E+00	2.37E-01	8.86E-02	4.31E-02
2003	11	6	1.69E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-04	3.77E-02	5.22E-01	1.13E-15	3.38E+00	2.32E-03	4.96E-01	2.72E-01	1.12E-03	7.09E-03
2003	11	7	1.24E-01	4.20E-06	1.60E-02	0.00E+00	0.00E+00	1.08E-01	1.76E-02	5.24E-01	8.14E-03	6.06E+00	1.81E-02	8.27E-01	4.33E-01	1.20E-02	3.64E-01
2003	11	8	7.73E-02	6.50E-06	1.30E-02	2.14E-07	3.78E-06	3.14E-02	5.91E-02	1.02E+00	2.06E-02	4.08E+00	1.41E-02	9.52E-01	4.30E-01	6.39E-02	1.97E-01
2003	11	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.52E-02	1.27E+00	8.39E-17	4.90E+00	2.00E-02	1.12E+00	2.43E-01	4.26E-02	0.00E+00
2003	11	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.70E-03	1.75E-01	8.37E-17	9.77E-01	7.36E-02	2.05E-01	2.97E-01	0.00E+00	0.00E+00
2003	11	11	3.18E-02	0.00E+00	1.38E-03	0.00E+00	9.20E-11	4.36E-03	4.45E-02	6.29E-01	2.82E-03	4.35E+00	3.00E-02	6.49E-01	9.03E-01	2.82E-02	9.06E-02
2003	11	12	1.07E-01	0.00E+00	4.77E-05	0.00E+00	0.00E+00	4.65E-04	7.40E-02	1.04E+00	1.53E-03	3.36E+00	3.16E-03	6.69E-01	2.12E-01	4.73E-02	2.23E-01
2003	11	13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-02	4.29E-01	1.83E-17	3.11E+00	6.87E-04	5.98E-01	2.69E-01	0.00E+00	0.00E+00
2003	11	14	4.45E-02	0.00E+00	8.88E-04	0.00E+00	0.00E+00	6.66E-03	4.25E-02	7.36E-01	1.11E-04	4.73E+00	2.61E-03	9.68E-01	2.31E-01	5.86E-02	1.24E-01
2003	11	15	4.71E-02	3.05E-04	7.93E-03	5.38E-05	1.29E-04	2.28E-02	7.14E-02	1.31E+00	1.39E-02	7.94E+00	3.74E-02	1.32E+00	5.12E-01	1.02E-01	1.36E-01
2003	11	16	0.00E+00	0.00E+00	0.00E+00	1.75E-01	2.22E-01	0.00E+00	4.15E-03	8.05E-01	0.00E+00	1.46E+00	1.73E+00	6.86E-02	4.80E-01	1.50E-02	0.00E+00
2003	11	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.03E-03	2.84E-01	6.47E-18	9.59E-01	5.14E-02	3.02E-01	2.69E-01	0.00E+00	0.00E+00
2003	11	18	4.06E-04	6.62E-01	8.25E-05	3.11E-02	3.54E-02	1.71E-03	2.23E-03	2.88E-01	1.25E-03	9.06E-01	5.54E-01	6.96E-02	4.09E-01	2.08E-03	2.49E-03
2003	11	19	0.00E+00	2.46E-02	0.00E+00	1.98E-02	8.85E-02	0.00E+00	7.50E-05	4.40E-02	3.47E-03	1.15E+00	4.56E-01	6.87E-02	3.10E-01	0.00E+00	0.00E+00
2003	11	20	5.07E-03	2.00E-01	8.27E-03	1.80E-01	4.27E-01	2.58E-02	3.76E-02	4.27E-01	5.11E-01	2.11E+00	1.26E+00	4.74E-01	1.42E-01	4.01E-03	1.81E-02
2003	11	21	2.74E-01	3.39E-01	3.81E-02	2.91E-02	5.20E-02	5.32E-02	3.89E-03	1.51E-01	4.10E+00	5.17E-01	2.34E+00	4.80E-02	1.14E-01	1.98E-02	4.60E-01
2003	11	22	9.77E-04	1.84E-03	7.77E-04	3.34E-03	5.75E-03	1.00E-03	1.30E-01	1.70E+00	1.75E-03	5.89E+00	4.71E-03	6.81E-01	9.76E-01	5.08E-02	1.26E-03
2003	11	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-11	0.00E+00	3.33E-02	5.31E-01	1.28E-15	2.93E+00	1.80E-02	3.43E-01	2.45E-01	1.04E-02	0.00E+00
2003	11	24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.76E-06	0.00E+00	1.09E-02	2.77E-01	4.05E-17	1.45E+00	5.80E-02	3.94E-01	2.79E-01	0.00E+00	0.00E+00
2003	11	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-05	0.00E+00	1.40E-02	5.41E-01	3.69E-18	1.16E+00	1.05E-01	2.52E-01	3.04E-01	3.20E-04	0.00E+00
2003	11	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.23E-02	1.23E+00	6.14E-18	5.01E+00	2.45E-03	1.22E+00	2.89E-01	2.97E-02	1.12E-04
2003	11	27	1.27E-01	2.60E-05	1.21E-03	5.68E-07	5.83E-03	1.07E-02	5.91E-02	1.50E+00	2.52E-02	4.63E+00	1.33E-01	9.79E-01	3.52E-01	4.85E-02	3.12E-01
2003	11	28	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.11E-04	0.00E+00	5.44E-04	1.43E-01	3.01E-28	7.23E-01	1.33E-01	1.22E-01	3.09E-01	0.00E+00	0.00E+00
2003	11	29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.47E-11	0.00E+00	5.14E-05	3.16E-01	7.13E-18	7.82E-01	7.27E-02	6.71E-02	3.26E-01	9.12E-03	0.00E+00
2003	11	30	6.70E-03	3.47E-04	1.16E-05	4.25E-05	7.30E-04	5.13E-05	9.05E-02	1.30E+00	1.16E-02	1.05E+01	1.57E-02	1.41E+00	1.04E+00	1.24E-01	2.09E-02
2003	12	1	1.28E-01	3.04E-01	3.64E-03	4.11E-01	4.16E-01	1.12E-02	2.24E-02	1.12E+00	2.54E-02	5.64E+00	7.08E+00	5.88E-01	4.99E-01	2.99E-01	2.58E-01
2003	12	2	7.41E-02	0.00E+00	9.28E-04	0.00E+00	7.17E-05	2.08E-03	5.30E-02	1.18E+00	5.25E-04	3.72E+00	6.12E-02	6.75E-01	3.02E-01	1.63E-01	1.26E-01
2003	12	3	3.53E-02	5.55E-07	1.64E-02	0.00E+00	3.52E-03	2.80E-02	2.54E-02	5.10E-02	1.90E+00	3.71E+00	1.16E-01	7.37E-01	8.22E-01	3.15E-02	4.63E-02
2003	12	4	7.40E-01	8.96E-01	1.81E-01	8.18E-03	1.48E-02	1.72E-01	1.06E-01	1.67E+00	5.19E+00	1.43E+00	2.05E+00	4.41E-01	6.04E-01	3.19E-01	1.29E+00
2003	12	5	1.09E-01	1.48E-01	2.78E-03	1.72E-02	9.66E-02	5.52E-03	1.30E-02	1.56E+00	1.57E-01	1.51E+00	1.78E+00	2.23E-01	4.46E-01	1.21E-01	2.12E-01
2003	12	6	1.34E-03	0.00E+00	1.11E-04	2.13E-03	1.90E-01	4.16E-03	3.50E-02	1.84E-01	1.01E-03	2.44E+00	8.36E-01	3.24E-01	5.77E-01	1.19E-01	9.28E-03
2003	12	7	2.95E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-01	1.85E+00	5.58E-19	1.25E+01	2.26E-04	1.71E+00	1.31E+00	1.53E-01	1.31E-02
2003	12	8	1.21E-01	1.50E-05	9.03E-03	3.50E-07	2.90E-06	6.59E-02	1.45E-01	1.74E+00	4.95E-01	1.17E+01	1.01E-03	1.67E+00	2.16E+00	1.56E-01	3.09E-01
2003	12	9	5.75E-01	1.00E-02	3.35E-01	1.77E-04	6.94E-04	2.44E-01	2.49E-01	1.54E+00	2.25E+00	1.46E+01	4.30E-02	1.28E+00	1.39E+00	2.79E-01	9.94E-01
2003	12	10	1.17E+00	1.20E-01	3.08E-01	1.80E-02	3.79E-02	2.36E-01	1.00E-01	9.80E-01	3.44E+00	6.02E+00	5.60E-01	9.78E-01	1.52E+00	2.11E-01	2.17E+00
2003	12	11	1.63E-03	6.44E-04	1.11E-03	3.37E-04	6.23E-04	1.25E-03	4.28E-02	8.95E-01	1.45E-03	3.98E+00	5.11E-03	9.63E-01	1.26E+00	4.51E-02	1.65E-03
2003	12	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-11	0.00E+00	7.77E-03	9.08E-01	1.00E-15	1.49E+00	5.06E-02	5.24E-01	2.42E-01	0.00E+00	0.00E+00
2003	12	13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.28E-04	0.00E+00	2.18E-02	9.49E-01	9.20E-17	2.96E+00	5.78E-02	6.72E-01	7.06E-01	1.79E-02	0.00E+00
2003	12	14	8.18E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-02	1.21E+00	2.53E-20	1.32E+00	2.96E-02	7.13E-01	3.45E-01	4.15E-02	3.25E-02
2003	12	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-02	1.31E+00	2.15E-16	3.32E+00	1.27E-02	9.28E-01	2.42E-01	3.33E-03	0.00E+00
2003	12	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E-05	0.00E+00	1.03E-03	1.68E-01	1.03E-27	6.46E-01	8.11E-02	1.07E-01	2.40E-01	0.00E+00	0.00E+00
2003	12	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-02	1.10E+00	7.54E-18	2.10E+00	1.69E-02	5.56E-01	2.18E-01	9.30E-03	0.00E+00
2003	12	18	1.91E-02	0.00E+00	8.02E-04	0.00E+00	0.00E+00	3.09E-02	3.76E-02	4.60E-01	2.77E-03	4.55E+00	2.75E-02	7.79E-01	3.11E-01	1.47E-02	6.78E-02
2003	12	19	8.64E-02	0.00E+00	1.08E-04	0.00E+00	0.00E+00	2.97E-03	1.13E-02	2.37E-01	1.28E-04	1.67E+00	1.94E-02	3.66E-01	2.34E-01	4.41E-02	2.39E-01
2003	12	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-12	0.00E+00	6.56E-02	4.12E-01	3.22E-16	3.03E+00	2.01E-02	6.57E-01	2.70E-01	5.15E-02	0.00E+00
2003	12	21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-02	1.15E+00	2.40E-16	6.47E+00	1.87E-03	7.34E-01	3.70E-01	2.38E-03	0.00E+00
2003	12	22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E-02	6.72E-01	5.80E-17	4.86E+00	2.16E-03	4.98E-01	3.30E-01	0.00E+00	0.00E+00
2003	12	23	0.00E+00	0.00E+00	0.00E+00	1.74E-08	3.27E-03	0.00E+00	8.82E-03	4.94E-01	2.39E-18	1.66E+00	1.07E-01	2.53E-01	5.80E-01	1.24E-02	0.00E+00
2003	12	24	3.91E-02	3.11E-06	7.44E-06	1.55E-04	1.99E-01	2.96E-04	3.40E-02	1.81E+00	1.67E-03	1.71E+00	1.91E+00	2.64E-01	2.22E-01	9.49E-02	1.37E-01
2003	12	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E-02	1.55E+00	1.63E-30	1.89E+00	4.95E-02	8.99E-01	3.99E-01	7.33E-02	0.00E+00
2003	12	26	1.72E-01	5.19E-04	3.83E-02	4.44E-05	1.99E-04	1.02E-01	1.54E-01	1.87E+00	2.62E-01	1.80E+01	8.10E-03	2.71E+00	2.88E+00	1.53E-01	4.49E-01
2003	12	27	1.02E-01	2.88E-02	2.44E-01	3.94E-03	9.81E-03	2.46E-01	1.61E-01	1.34E+00	3.75E+00	8.83E+00	1.39E-01	1.76E+00	1.23E+00	1.62E-01	1.74E-01
2003	12	28	3.04E-01	7.63E-01	2.36E-01	3.40E-01	5.65E-01	3.09E-01	1.03E-01	5.30E-01	7.66E+00	6.46E+00	5.33E+00	8.00E-01	1.62E+00	1.30E-01	4.73E-01
2003	12	29	9.70E-01	1.05E-03	1.28E+00	7.09E-04	8.83E-04	8.54E-01	3.87E-02	3.76E-01	4.17E+00	7.84E-01	1.54E-03	4.13E-01	5.41E-01	7.82E-02	1.64E+00
2003	12	30	1.23E-02	4.07E-06	1.91E-05	1.72E-06	4.40E-06	2.28E-05	6.77E-02	6.96E-01	3.47E-05	3.68E+00	4.16E-03	7.94E-01	4.82E-01	2.79E-02	2.32E-02
2003	12	31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E-02	7.27E-01	3.54E-17	6.51E+00	3.78E-03	1.09E+00	2.52E-01	0.00E+00	0.00E+00
2004	1	1	6.77E-02	3.11E-04	3.85E-02	0.00E+00	1.80E-05	5.34E-02	6.03E-02	7.52E-01	9.80E-01	8.49E+00	9.02E-03	1.43E+00	6.04E-01	7.64E-02	2.12E-01
2004	1	2	0.00E+00	8.75E-01	2.72E-02	1.60E-02	1.86E-03	5.86E-02	0.00E+00	0.00E+00	1.88E+00	5.74E-04	1.38E-03	2.15E-05	1.71E-04	0.00E+00	0.00E+00
2004	1	3	3.83E-01	5.25E-02	9.99E-02	6.92E-04	3.88E-03	8.37E-02	1.24E-02	2.18E-01	4.42E+00	3.18E+00	4.61E-01	2.78E-01	3.63E-01	2.81E-02	6.90E-01
2004	1	4	7.76E-01	2.16E-01	1.56E-01	4.66E-02	1.15E-01	2.14E-01	1.51E+00	3.12E+00	8.47E-01	1.67E+01	1.39E+00	5.89E+00	5.96E+00	1.12E+00	1.15E+00
2004	1	5	5.54E-03	0.00E+00	5.23E-04	0.00E+00	0.00E+00	8.29E-03	1.95E-01	2.04E+00	3.74E-04	1.14E+01	2.27E-03	1.40E+00	7.72E-01	1.18E-01	1.97E-02
2004	1	6	7.38E-03	0.00E+00	1.14E-03	0.00E+00	0.00E+00	1.43E-02	6.06E-02	4.29E-01	4.02E-05	4.63E+00	8.98E-03	9.49E-01	1.99E-01	1.83E-02	2.29E-02
2004	1	7	1.27E-02	0.00E+00	9.68E-04	0.00E+00	0.00E+00	8.54E-03	6.11E-02	5.53E-01	3.01E-04	5.32E+00	5.80E-02	8.82E-01	3.48E-01	3.61E-02	5.38E-02
2004	1	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.33E-02	3.62E-01	8.88E-17	4.66E+00	8.38E-03	5.85E-01	2.42E-01	8.80E-04	0.00E+00

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	1	9	1.55E-01	0.00E+00	1.18E-01	0.00E+00	7.30E-05	1.42E+00	1.34E+00	4.20E+00	3.61E-03	5.56E+00	8.88E-02	1.35E+00	7.68E-01	2.48E+00	4.32E-01	1.21E-01	0.00E+00	1.18E-01	0.00E+00	3.72E-05	1.42E+00	1.27E+00	3.14E+00	3.61E-03	8.26E-04	7.31E-05	1.75E-02	4.92E-03	2.48E+00	3.08E-01	3.48E-02	0.00E+00	0.00E+00	0.00E+00	3.58E-05	0.00E+00	6.74E-02	1.06E+00	1.01E-19	5.55E+00	8.88E-02	1.34E+00	7.63E-01	8.24E-03	1.24E-01
2004	1	10	4.35E-01	3.19E-05	2.36E-01	0.00E+00	2.28E-06	1.59E+00	1.06E+00	2.70E+00	1.62E-02	4.66E+00	1.74E-02	1.37E+00	3.47E-01	2.32E+00	6.13E-01	3.47E-01	3.19E-05	2.34E-01	0.00E+00	2.28E-06	1.59E+00	9.67E-01	1.77E+00	1.13E-02	1.49E-03	3.50E-04	4.14E-03	2.35E-03	2.29E+00	4.41E-01	8.80E-02	0.00E+00	2.23E-03	0.00E+00	0.00E+00	6.18E-03	8.78E-02	9.28E-01	4.85E-03	4.66E+00	1.71E-02	1.37E+00	3.45E-01	2.95E-02	1.72E-01
2004	1	11	1.09E+00	4.85E-04	5.18E-01	7.18E-06	1.64E-04	1.94E+00	1.79E+00	4.37E+00	7.80E-02	1.17E+01	6.03E-03	1.61E+00	5.84E-01	2.89E+00	1.32E+00	1.04E+00	4.49E-04	5.09E-01	5.73E-06	1.48E-04	1.92E+00	1.67E+00	3.12E+00	4.19E-02	9.91E-03	3.16E-03	2.77E-02	1.65E-02	2.86E+00	1.20E+00	5.10E-02	3.57E-05	8.93E-03	1.45E-06	1.57E-05	2.18E-02	1.20E-01	1.24E+00	3.61E-02	1.17E+01	2.87E-03	1.59E+00	5.67E-01	2.53E-02	1.17E-01
2004	1	12	3.76E-01	0.00E+00	2.02E-01	0.00E+00	0.00E+00	1.46E+00	1.28E+00	3.42E+00	1.52E-03	8.83E+00	1.06E-02	1.25E+00	4.26E-01	2.32E+00	8.07E-01	3.29E-01	0.00E+00	2.02E-01	0.00E+00	0.00E+00	1.46E+00	1.17E+00	2.34E+00	1.52E-03	4.87E-05	5.77E-08	7.99E-03	9.62E-04	2.29E+00	6.97E-01	4.68E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-04	1.10E-01	1.08E+00	9.08E-06	8.83E+00	1.06E-02	1.24E+00	4.25E-01	2.40E-02	1.11E-01
2004	1	13	9.45E-02	0.00E+00	1.72E-03	0.00E+00	0.00E+00	4.53E-01	5.39E-01	1.37E+00	4.78E-18	2.25E+00	1.67E-02	7.22E-01	2.33E-01	8.45E-01	1.36E-01	9.45E-02	0.00E+00	1.72E-03	0.00E+00	0.00E+00	4.53E-01	4.82E-01	8.46E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.33E-01	1.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.69E-02	5.22E-01	4.78E-18	2.25E+00	1.67E-02	7.22E-01	2.33E-01	1.21E-02	0.00E+00
2004	1	14	1.66E-01	0.00E+00	2.31E-02	0.00E+00	0.00E+00	6.69E-01	6.44E-01	2.47E+00	7.71E-06	2.25E+00	2.06E-02	1.03E+00	2.70E-01	1.18E+00	2.34E-01	1.66E-01	0.00E+00	2.31E-02	0.00E+00	0.00E+00	6.69E-01	6.18E-01	1.35E+00	7.71E-06	0.00E+00	0.00E+00	4.15E-04	3.71E-05	1.17E+00	2.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-02	1.12E+00	7.88E-19	2.25E+00	2.06E-02	1.03E+00	2.70E-01	7.06E-03	0.00E+00
2004	1	15	1.10E-01	0.00E+00	1.30E-02	0.00E+00	0.00E+00	6.66E-01	6.85E-01	2.17E+00	1.25E-18	2.76E+00	1.52E-02	1.01E+00	2.91E-01	1.08E+00	1.89E-01	1.10E-01	0.00E+00	1.30E-02	0.00E+00	0.00E+00	6.66E-01	6.33E-01	1.29E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-03	2.25E-05	1.08E+00	1.89E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.12E-02	8.78E-01	1.25E-18	2.76E+00	1.52E-02	1.01E+00	2.91E-01	0.00E+00	0.00E+00
2004	1	16	8.62E-02	0.00E+00	1.90E-02	0.00E+00	0.00E+00	5.68E-01	8.66E-01	2.09E+00	6.00E-17	8.73E+00	5.22E-04	1.04E+00	3.80E-01	1.13E+00	1.29E-01	8.62E-02	0.00E+00	1.90E-02	0.00E+00	0.00E+00	5.68E-01	7.60E-01	1.19E+00	0.00E+00	0.00E+00	0.00E+00	3.19E-05	0.00E+00	1.13E+00	1.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-01	8.97E-01	6.00E-17	8.73E+00	5.22E-04	1.04E+00	3.80E-01	0.00E+00	0.00E+00
2004	1	17	4.62E-02	0.00E+00	5.59E-04	0.00E+00	0.00E+00	3.47E-01	4.37E-01	1.03E+00	1.20E-16	6.28E+00	5.05E-04	5.10E-01	2.94E-01	7.14E-01	8.34E-02	4.62E-02	0.00E+00	5.59E-04	0.00E+00	0.00E+00	3.47E-01	3.74E-01	5.56E-01	0.00E+00	0.00E+00	0.00E+00	1.72E-07	0.00E+00	7.14E-01	8.34E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.23E-02	4.78E-01	1.20E-16	6.28E+00	5.05E-04	5.10E-01	2.94E-01	0.00E+00	0.00E+00
2004	1	18	5.38E-02	0.00E+00	5.03E-04	0.00E+00	0.00E+00	4.07E-01	6.43E-01	1.43E+00	2.30E-17	6.38E+00	3.59E-04	7.40E-01	2.66E-01	8.76E-01	8.98E-02	5.38E-02	0.00E+00	5.03E-04	0.00E+00	0.00E+00	4.07E-01	5.62E-01	5.51E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.76E-01	8.98E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.18E-02	8.75E-01	2.30E-17	6.38E+00	3.59E-04	7.40E-01	2.66E-01	0.00E+00	0.00E+00
2004	1	19	1.68E-01	5.22E-04	1.55E-01	4.76E-05	1.47E-04	2.31E+00	1.59E+00	4.83E+00	1.76E-02	1.13E+01	1.12E-03	1.25E+00	1.11E+00	3.10E+00	3.09E-01	1.50E-01	5.22E-04	1.55E-01	4.76E-05	1.47E-04	2.31E+00	1.43E+00	3.39E+00	1.37E-02	2.78E-03	1.11E-03	6.65E-03	4.20E-03	3.08E+00	2.54E-01	1.82E-02	0.00E+00	1.04E-07	0.00E+00	0.00E+00	4.80E-05	1.52E-01	1.44E+00	3.97E-03	1.13E+01	6.33E-06	1.24E+00	1.11E+00	2.18E-02	5.49E-02
2004	1	20	6.80E-01	4.58E-03	4.82E-01	1.41E-03	2.50E-03	3.91E+00	3.09E+00	7.90E+00	8.72E-02	1.51E+01	9.31E-03	1.37E+00	1.73E+00	6.01E+00	8.30E-01	6.36E-01	4.58E-03	4.82E-01	1.41E-03	2.50E-03	3.91E+00	2.94E+00	5.98E+00	7.13E-02	1.78E-02	8.57E-03	4.23E-02	2.71E-02	5.78E+00	7.21E-01	4.42E-02	0.00E+00	3.56E-04	0.00E+00	0.00E+00	2.80E-03	1.53E-01	1.92E+00	1.59E-02	1.51E+01	7.40E-04	1.33E+00	1.71E+00	2.32E-01	1.10E-01
2004	1	21	4.82E-02	0.00E+00	4.02E-04	0.00E+00	0.00E+00	3.28E-01	4.24E-01	1.06E+00	2.95E-17	4.51E+00	6.06E-04	5.21E-01	3.07E-01	6.52E-01	7.49E-02	4.82E-02	0.00E+00	4.02E-04	0.00E+00	0.00E+00	3.28E-01	3.65E-01	5.07E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.52E-01	7.49E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E-02	5.56E-01	2.95E-17	4.51E+00	6.06E-04	5.21E-01	3.07E-01	0.00E+00	0.00E+00
2004	1	22	6.34E-02	0.00E+00	7.17E-04	0.00E+00	0.00E+00	3.59E-01	4.25E-01	1.13E+00	3.10E-16	3.27E+00	4.59E-03	6.76E-01	2.12E-01	6.94E-01	1.02E-01	6.34E-02	0.00E+00	7.17E-04	0.00E+00	0.00E+00	3.59E-01	3.78E-01	6.61E-01	0.00E+00	0.00E+00	0.00E+00	2.73E-07	0.00E+00	6.94E-01	1.02E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.71E-02	4.69E-01	3.10E-16	3.27E+00	4.59E-03	6.76E-01	2.12E-01	4.77E-05	0.00E+00
2004	1	23	2.43E+00	7.73E-01	1.15E+00	3.06E-02	4.90E-02	2.98E+00	2.16E+00	5.47E+00	3.48E+00	8.42E+00	1.91E+00	1.85E+00	9.65E-01	4.61E+00	3.38E+00	2.16E+00	1.25E-02	1.03E+00	1.98E-03	3.28E-03	2.84E+00	2.02E+00	4.31E+00	1.05E-01	3.42E-02	1.77E-02	6.75E-02	4.52E-02	4.49E+00	2.87E+00	2.67E-01	7.61E-01	1.13E-01	2.86E-02	4.57E-02	1.34E-01	1.49E-01	1.16E+00	3.38E+00	8.39E+00	1.90E+00	1.79E+00	9.20E-01	1.18E-01	5.02E-01
2004	1	24	1.64E+00	1.80E+00	7.78E-01	5.54E-01	7.60E-01	2.24E+00	1.44E+00	2.74E+00	1.41E+00	2.00E+00	1.33E+01	1.33E-01	2.03E-01	2.85E+00	2.19E+00	1.61E+00	7.20E-02	7.51E-01	3.23E-02	4.61E-02	2.16E+00	1.43E+00	2.62E+00	1.88E-01	1.14E-01	9.40E-02	1.09E-01	1.09E-01	2.85E+00	2.13E+00	2.76E-02	1.73E+00	2.64E-02	5.22E-01	7.14E-01	8.06E-02	3.52E-03	1.20E-01	1.22E+00	1.88E+00	1.32E+01	2.32E-02	9.42E-02	7.67E-03	6.02E-02
2004	1	25	6.29E-01	1.01E+00	3.64E-01	8.87E-03	5.14E-03	8.95E-01	6.51E-01	1.81E+00	5.83E-01	1.44E-02	3.05E-01	5.21E-03	8.82E-03	1.94E+00	8.52E-01	6.29E-01	1.21E-02	3.49E-01	3.58E-03	3.29E-03	8.57E-01	6.50E-01	1.81E+00	3.56E-02	1.24E-02	1.10E-02	4.94E-03	8.07E-03	1.94E+00	8.52E-01	1.50E-04	1.00E+00	1.51E-02	5.29E-03	1.85E-03	3.84E-02	3.09E-05	9.95E-05	5.48E-01	1.96E-03	2.94E-01	2.69E-04	7.50E-04	7.48E-05	1.51E-04
2004	1	26	6.99E-01	2.61E+00	2.99E-01	2.89E-01	5.52E-02	8.27E-01	6.00E-01	2.07E+00	4.85E-01	2.33E-02	1.08E+00	9.98E-03	1.30E-02	1.85E+00	9.60E-01	6.99E-01	3.99E-02	2.97E-01	1.51E-02	1.43E-02	8.05E-01	6.00E-01	2.07E+00	4.79E-02	1.80E-02	2.18E-02	9.92E-03	1.17E-02	1.85E+00	9.60E-01	0.00E+00	2.57E+00	1.97E-03	2.74E-01	4.10E-02	2.23E-02	0.00E+00	0.00E+00	4.37E-01	5.36E-03	1.06E+00	5.36E-05	1.22E-03	0.00E+00	0.00E+00
2004	1	27	5.74E-01	9.36E-01	2.87E-01	2.73E-03	2.06E-03	8.59E-01	5.80E-01	2.13E+00	2.74E-01	3.62E-03	7.02E-03	2.19E-03	2.24E-03	1.94E+00	7.89E-01	5.74E-01	8.27E-03	2.82E-01	1.98E-03	1.82E-03	8.43E-01	5.80E-01	2.13E+00	2.25E-02	3.49E-03	4.49E-03	2.18E-03	2.22E-03	1.94E+00	7.89E-01	1.13E-07	9.28E-01	4.89E-03	7.47E-04	2.41E-04	1.60E-02	1.99E-08	1.48E-07	2.51E-01	1.32E-04	2.53E-03	9.11E-06	2.30E-05	4.17E-08	1.62E-07
2004	1	28	1.50E+00	1.19E+00	2.93E-01	1.48E-01	3.48E-01	1.79E+00	1.68E+00	3.49E+00	1.32E-01	3.20E+00	2.29E+00	8.51E-02	5.98E-01	2.70E+00	2.16E+00	1.45E+00	8.99E-03	2.93E-01	5.51E-03	9.45E-03	1.78E+00	1.67E+00	2.99E+00	9.46E-02	3.85E-02	1.38E-02	5.01E-02	4.82E-02	2.68E+00	2.03E+00	5.02E-02	1.18E+00	3.24E-04	1.43E-01	3.39E-01	4.83E-03	4.47E-03	5.03E-01	3.70E-02	3.16E+00	2.28E+00	3.50E-02	5.49E-01	1.68E-02	1.30E-01
2004	1	29	2.47E+00	1.88E-01	9.56E-01	6.62E-02	3.59E-01	3.64E+00	2.66E+00	6.04E+00	1.30E+00	7.64E+00	2.19E+00	6.24E-01	7.59E-01	5.60E+00	3.60E+00	2.34E+00	4.46E-03	9.24E-01	9.97E-03	2.18E-02	3.54E+00	2.60E+00	5.31E+00	1.24E-01	6.99E-02	3.19E-02	7.03E-02	7.30E-02	5.54E+00	3.32E+00	1.26E-01	1.84E-01	3.20E-02	5.63E-02	3.37E-01	9.77E-02	6.22E-02	7.34E-01	1.17E+00	7.57E+00	2.16E+00	5.54E-01	6.86E-01	6.06E-02	2.85E-01
2004	1	30	1.08E+00	5.94E-02	1.47E-01	1.29E-01	2.75E-01	2.10E+00	5.38E-01	2.40E+00	5.89E-02	1.33E+00	1.84E+00	3.58E-02	1.29E-01	1.63E+00	1.48E+00	1.06E+00	2.69E-03	1.46E-01	2.97E-03	3.36E-03	2.05E+00	5.37E-01	2.14E+00	3.98E-02	1.30E-02	1.20E-02	1.87E-02	1.06E-02	1.61E+00	1.42E+00	2.25E-02	5.67E-02	6.61E-04	1.26E-01	2.71E-01	4.49E-02	2.18E-04	2.53E-01	1.91E-02	1.32E+00	1.83E+00	1.72E-02	1.18E-01	1.50E-02	6.21E-02
2004	1	31	1.46E+00	4.67E-01	4.33E-01	1.11E-01	1.97E-01	1.53E+00	1.62E+00	2.47E+00	6.10E-01	7.26E+00	2.28E+00	4.45E-01	1.06E+00	3.07E+00	1.99E+00	1.44E+00	1.28E-03	4.17E-01	1.17E-03	2.30E-03	1.48E+00	1.60E+00	2.45E+00	1.25E-01	3.03E-02	6.16E-03	7.80E-02	5.45E-02	3.06E+00	1.97E+00	1.66E-02	4.66E-01	1.59E-02	1.10E-01	1.95E-01	4.83E-02	1.81E-02	1.96E-02	4.85E-01	7.23E+00	2.27E+00	3.67E-01	1.00E+00	1.64E-02	2.00E-02
2004	2	1	3.81E+00	2.17E+00	2.22E+00	7.07E-01	7.50E-01	6.15E+00	2.43E+00	7.80E+00	6.46E+00	6.51E+00	3.83E+00	9.07E-01	5.03E-01	9.44E+00	5.02E+00	3.42E+00	3.17E-02	2.14E+00	1.94E-02	2.65E-02	6.05E+00	2.37E+00	6.72E+00	1.75E-01	7.69E-02	5.32E-02	1.07E-01	9.12E-02	9.22E+00	4.20E+00	3.92E-01	2.14E+00	7.78E-02	6.88E-01	7.24E-01	1.00E-01	6.31E-02	1.08E+00	6.29E+00	6.43E+00	3.77E+00	8.00E-01	4.12E-01	2.25E-01	8.16E-01
2004	2	2	2.59E+00	5.05E-02	2.02E+00	2.99E-03	6.77E-03	6.21E+00	4.58E+00	9.85E+00	3.90E+00	1.51E+01	1.61E-01	2.69E+00	2.03E+00	1.15E+01	3.56E+00	2.24E+00	7.58E-03	1.84E+00	1.71E-03	3.77E-03	6.04E+00	4.18E+00	7.29E+00	1.69E-01	4.62E-02	1.74E-02	1.35E-01	8.15E-02	1.10E+01	2.79E+00	3.49E-01	4.29E-02	1.82E-01	1.28E-03	3.00E-03	1.69E-01	3.96E-01	2.55E+00	3.73E+00	1.51E+01	1.44E-01	2.55E+00	1.94E+00	5.00E-01	7.65E-01
2004	2	3	1.67E+00	5.01E-01	1.20E+00	8.50E-02	2.99E-01	4.36E+00	3.58E+00	7.36E+00	1.55E+00	1.54E+01	2.31E+00	2.15E+00	1.68E+00	7.65E+00	2.33E+00	1.51E+00	1.89E-02	1.15E+00	7.49E-03	1.33E-02	4.31E+00	3.45E+00	5.93E+00	1.84E-01	7.22E-02	3.73E-02	1.40E-01	1.02E-01	7.52E+00	1.93E+00	1.56E-01	4.82E-01	5.48E-02	7.75E-02	2.86E-01	5.58E-02	1.32E-01	1.43E+00	1.37E+00	1.54E+01	2.27E+00	2.01E+00	1.58E+00	1.25E-01	4.03E-01
2004	2	4	1.48E+00	5.84E-02	7.39E-01	4.65E-03	2.11E-02	1.83E+00	1.28E+00	3.36E+00	1.64E+00	6.06E+00	1.40E+00	1.44E+00	8.44E-01	2.55E+00	1.96E+00	1.26E+00	2.00E-03	6.49E-01	1.74E-04	8.33E-04	1.74E+00	1.18E+00	2.79E+00	6.82E-02	1.60E-02	7.17E-03	2.30E-02	1.87E-02	2.50E+00	1.57E+00	2.20E-01	5.64E-02	9.01E-02	4.48E-03	2.02E-02	8.83E-02	9.85E-02	5.70E-01	1.57E+00	6.04E+00	1.39E+00	1.42E+00	8.25E-01	4.79E-02	3.87E-01
2004	2	5	1.76E+00	8.90E-02	1.39E+00	1.59E-02	3.24E-02	5.66E+00	3.29E+00	7.15E+00	1.50E+00	1.70E+01	5.15E-01	1.79E+00	1.69E+00	7.91E+00	2.33E+00	1.49E+00	1.78E-02	1.33E+00	6.42E-03	1.09E-02	5.62E+00	3.15E+00	5.73E+00	1.89E-01	6.38E-02	3.44E-02	1.06E-01	8.08E-02	7.63E+00	1.76E+00	2.76E-01	7.12E-02	5.80E-02	9.43E-03	2.15E-02	4.81E-02	1.35E-01	1.41E+00	1.31E+00	1.69E+01	4.80E-01	1.68E+00	1.61E+00	2.78E-01	5.65E-01
2004	2	6	4.81E-02	0.00E+00	5.58E-04	0.00E+00	0.00E+00	3.17E-01	3.86E-01	8.96E-01	3.76E-16	3.48E+00	2.40E-03	5.55E-01	2.13E-01	6.28E-01	6.86E-02	4.81E-02	0.00E+00	5.58E-04	0.00E+00	0.00E+00	3.17E-01	3.49E-01	4.26E-01	0.00E+00	0.00E+00	0.00E+00	3.65E-06	0.00E+00	6.28E-01	6.86E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E-02	4.70E-01	3.76E-16	3.48E+00	2.40E-03	5.55E-01	2.13E-01	0.00E+00	0.00E+00
2004	2	7	1.43E-01	0.00E+00	9.05E-04	0.00E+00	0.00E+00	6.18E-01	6.23E-01	2.33E+00	1.63E-17	3.89E+00	5.33E-03	6.57E-01	2.82E-01	1.27E+00	2.42E-01	1.43E-01	0.00E+00	9.05E-04	0.00E+00	0.00E+00	6.18E-01	5.34E-01	1.48E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E+00	2.42E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.91E-02	8.47E-01	1.63E-17	3.89E+00	5.33E-03	6.57E-01	2.82E-01	7.83E-02	0.00E+00
2004	2	8	7.87E-01	3.50E-04	4.58E-01	2.71E-05	8.75E-05	2.26E+00	1.93E+00	5.48E+00	6.10E-01	1.17E+01	1.97E-02	9.47E-01	1.09E+00	3.92E+00	1.00E+00	7.14E-01	3.44E-04	4.57E-01	2.71E-05	8.65E-05	2.25E+00	1.83E+00	4.37E+00	1.69E-02	2.77E-03	8.41E-04	1.17E-02	5.70E-03	3.79E+00	8.48E-01	7.27E-02	5.19E-06	2.16E-04	5.31E-09	9.91E-07	8.18E-03	1.05E-01	1.11E+00	5.93E-01	1.17E+01	1.88E-02	9.36E-01	1.09E+00	1.32E-01	1.55E-01
2004	2	9	2.20E-01	7.03E-08	1.22E-01	0.00E+00	4.68E-08	1.73E+00	1.78E+00	3.64E+00	4.21E-03	1.19E+01	2.01E-04	1.91E+00	1.48E+00	2.55E+00	4.97E-01	1.78E-01	7.03E-08	1.22E-01	0.00E+00	4.68E-08	1.73E+00	1.67E+00	2.87E+00	3.97E-03	2.85E-04	1.58E-05	9.84E-03	2.92E-03	2.50E+00	3.98E-01	4.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E-01	7.64E-01	2.43E-04	1.19E+01	1.85E-04	1.90E+00	1.48E+00	4.98E-02	9.90E-02
2004	2	10	2.21E+00	9.05E-04	7.98E-01	9.60E-05	1.99E-04	2.42E+00	9.85E-01	4.62E+00	1.35E+00	4.95E+00	3.08E-03	7.26E-01	5.39E-01	4.00E+00	3.13E+00	1.50E+00	8.21E-04	7.75E-01	9.60E-05	1.99E-04	2.33E+00	8.59E-01	3.59E+00	3.80E-02	5.07E-03	1.79E-03	1.29E-02	7.69E-03	3.70E+00	2.27E+00	7.05E-01	8.35E-05	2.27E-02	0.00E+00	1.18E-07	8.50E-02	1.27E-01	1.03E+00	1.31E+00	4.94E+00	1.29E-03	7.13E-01	5.32E-01	3.00E-01	8.65E-01
2004	2	11	1.07E+00	4.70E-03	8.96E-01	6.94E-05	5.33E-04	3.53E+00	2.08E+00	6.19E+00	2.14E+00	1.05E+01	9.88E-02	1.72E+00	2.24E+00	4.69E+00	1.43E+00	9.49E-01	9.46E-04	7.16E-01	6.54E-05	1.68E-04	3.37E+00	1.82E+00	5.04E+00	3.76E-02	7.41E-03	2.79E-03	2.45E-02	1.29E-02	4.38E+00	1.27E+00	1.24E-01	3.75E-03	1.81E-01	4.01E-06	3.64E-04	1.57E-01	2.66E-01	1.15E+00	2.10E+00	1.05E+01	9.61E-02	1.69E+00	2.22E+00	3.08E-01	1.55E-01
2004	2	12	1.27E-02	0.00E+00	3.73E-03	0.00E+00	0.00E+00	4.53E-01	4.33E-01	9.51E-01	4.28E-04	3.31E+00	6.42E-03	8.30E-01	2.34E-01	6.00E-01	2.55E-02	1.27E-02	0.00E+00	3.73E-03	0.00E+00	0.00E+00	4.53E-01	4.12E-01	6.55E-01	4.28E-04	5.70E-06	0.00E+00	2.98E-04	7.02E-05	6.00E-01	2.55E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E-02	2.96E-01	6.41E-17	3.31E+00	6.42E-03	8.30E-01	2.34E-01	3.60E-11	0.00E+00
2004	2	13	1.00E+00	1.71E-04	5.81E-01	6.44E-06	7.48E-05	3.43E+00	1.72E+00	4.37E+00	1.01E-01	7.61E+00	2.31E-02	1.27E+00	5.50E-01	3.77E+00	1.61E+00	8.57E-01	1.71E-04	5.72E-01	6.44E-06	7.45E-05	3.38E+00	1.66E+00	3.74E+00	8.06E-02	1.07E-02	1.94E-03	3.93E-02	2.29E-02	3.70E+00	1.25E+00	1.43E-01	0.00E+00	8.38E-03	0.00E+00	2.69E-07	5.70E-02	5.21E-02	6.28E-01	2.07E-02	7.60E+00	2.12E-02	1.23E+00	5.27E-01	6.26E-02	3.55E-01
2004	2	14	1.95E-01	1.81E-05	1.29E-01	1.06E-06	9.58E-06	1.75E+00	1.10E+00	3.42E+00	1.36E-02	3.43E+00	1.74E-02	1.20E+00	2.77E-01	2.65E+00	3.36E-01	1.77E-01	1.81E-05	1.28E-01	1.06E-06	9.58E-06	1.75E+00	1.00E+00	2.26E+00	1.17E-02	1.11E-03	1.93E-04	9.81E-03	3.68E-03	2.63E+00	2.89E-01	1.76E-02	0.00E+00	1.20E-04	0.00E+00	0.00E+00	2.87E-04	9.26E-02	1.17E+00	1.91E-03	3.43E+00	1.72E-02	1.19E+00	2.74E-01	1.45E-02	4.64E-02
2004	2	15	1.32E-01	0.00E+00	2.76E-02	0.00E+00	0.00E+00	9.28E-01	8.04E-01	2.17E+00	1.09E-04	4.39E+00	7.42E-03	9.83E-01	3.00E-01	1.38E+00	1.66E-01	1.32E-01	0.00E+00	2.76E-02	0.00E+00	0.00E+00	9.28E-01	7.29E-01	1.60E+00	1.09E-04	0.00E+00	0.00E+00	2.47E-04	5.57E-05	1.37E+00	1.66E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.52E-02	5.77E-01	7.33E-18	4.39E+00	7.42E-03	9.82E-01	3.00E-01	6.60E-03	0.00E+00
2004	2	16	2.02E-01	3.31E-01	1.14E-01	3.02E-01	2.99E-01	1.35E+00	1.31E+00	3.46E+00	3.14E-02	2.92E+00	4.98E+00	7.68E-01	9.23E-01	1.94E+00	4.25E-01	2.02E-01	2.48E-03	1.14E-01	7.47E-03	1.12E-02	1.35E+00	1.28E+00	2.19E+00	2.69E-02	1.27E-02	7.69E-03	3.74E-02	2.26E-02	1.86E+00	4.25E-01	0.00E+00	3.29E-01	0.00E+00	2.94E-01	2.88E-01	0.00E+00	3.57E-02	1.27E+00	4.47E-03	2.91E+00	4.97E+00	7.30E-01	9.00E-01	8.09E-02	0.00E+00
2004	2	17	4.16E-01	1.66E-03	2.04E-01	5.50E-02	1.66E-01	1.01E+00	1.53E+00	2.83E+00	4.54E-02	5.43E+00	1.17E+00	1.02E+00	1.21E+00	2.12E+00	6.33E-01	3.67E-01	1.66E-03	2.04E-01	3.77E-03	5.11E-03	1.01E+00	1.47E+00	2.36E+00	5.44E-03	1.38E-02	7.86E-03	2.09E-02	2.04E-02	2.06E+00	5.35E-01	4.91E-02	2.52E-06	0.00E+00	5.12E-02	1.61E-01	3.84E-04	6.52E-02	4.69E-01	4.00E-02	5.42E+00	1.16E+00	9.96E-01	1.19E+00	6.67E-02	9.78E-02
2004	2	18	1.30E+00	2.84E-01	8.79E-01	1.81E-01	3.67E-01	4.83E+00	2.74E+00	6.06E+00	6.81E-01	7.95E+00	4.02E+00	1.49E+00	1.96E+00	4.38E+00	1.78E+00	1.09E+00	1.45E-02	8.54E-01	6.71E-03	1.13E-02	4.79E+00	2.61E+00	4.57E+00	1.83E-01	6.02E-02	3.15E-02	1.12E-01	8.14E-02	4.21E+00	1.38E+00	2.11E-01	2.70E-01	2.43E-02	1.74E-01	3.56E-01	4.26E-02	1.27E-01	1.49E+00	4.98E-01	7.89E+00	3.99E+00	1.38E+00	1.88E+00	1.64E-01	3.99E-01
2004	2	19	1.10E-01	2.22E-08	3.46E-02	0.00E+00	9.19E-09	1.71E+00	1.41E+00	4.96E+00	6.89E-03	9.68E+00	4.26E-04	1.57E+00	3.83E-01	2.52E+00	1.97E-01	1.10E-01	2.22E-08	3.46E-02	0.00E+00	9.19E-09	1.71E+00	1.25E+00	3.13E+00	6.89E-03	3.06E-04	1.92E-05	3.49E-03	1.08E-03	2.51E+00	1.97E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-01	1.84E+00	5.65E-21	9.68E+00	4.06E-04	1.57E+00	3.82E-01	6.82E-03	0.00E+00
2004	2	20	8.13E-01	2.14E-03	6.69E-01	4.39E-04	9.41E-04	4.32E+00	2.92E+00	6.72E+00	7.17E-02	1.83E+01	1.60E-02	2.15E+00	1.57E+00	6.46E+00	1.33E+00	6.98E-01	2.03E-03	6.64E-01	4.37E-04	9.31E-04	4.30E+00	2.73E+00	5.15E+00	5.43E-02	1.15E-02	4.65E-03	2.63E-02	1.72E-02	6.33E+00	1.02E+00	1.15E-01	1.09E-04	5.49E-03	1.69E-06	9.57E-06	1.37E-02	1.89E-01	1.57E+00	1.74E-02	1.83E+01	1.14E-02	2.12E+00	1.55E+00	1.24E-01	3.07E-01
2004	2	21	1.52E+00	1.16E+00	1.09E+00	3.11E-01	3.08E-01	7.64E+00	4.09E+00	1.11E+01	1.26E+00	1.42E+01	4.67E+00	2.16E+00	2.85E+00	9.68E+00	2.03E+00	1.16E+00	2.27E-02	8.63E-01	9.54E-03	1.55E-02	7.29E+00	3.70E+00	9.01E+00	2.42E-01	7.73E-02	4.27E-02	1.48E-01	1.06E-01	9.07E+00	1.54E+00	3.60E-01	1.14E+00	2.31E-01	3.02E-01	2.93E-01	3.48E-01	3.85E-01	2.06E+00	1.02E+00	1.42E+01	4.63E+00	2.01E+00	2.75E+00	6.09E-01	4.86E-01
2004	2	22	1.79E+00	1.03E+00	1.44E+00	2.55E-01	3.60E-01	7.58E+00	5.15E+00	1.38E+01	1.62E+00	1.74E+01	2.66E+00	3.16E+00	3.90E+00	1.31E+01	2.70E+00	1.55E+00	2.59E-02	1.42E+00	1.18E-02	1.76E-02	7.53E+00	4.71E+00	1.17E+01	2.67E-01	8.75E-02	4.56E-02	1.66E-01	1.22E-01	1.26E+01	2.10E+00	2.33E-01	1.00E+00	2.35E-02	2.43E-01	3.43E-01	4.23E-02	4.35E-01	2.17E+00	1.36E+00	1.73E+01	2.62E+00	2.99E+00	3.78E+00	5.67E-01	6.01E-01
2004	2	23	9.41E-01	4.30E-01	8.33E-01	3.31E-01	5.69E-01	7.78E+00	4.19E+00	1.01E+01	3.68E-01	1.73E+01	4.15E+00	1.75E+00	1.57E+00	1.09E+01	1.32E+00	8.90E-01	1.70E-02	8.30E-01	1.19E-02	1.89E-02	7.77E+00	4.07E+00	7.91E+00	1.90E-01	7.64E-02	4.05E-02	1.53E-01	1.10E-01	1.06E+01	1.16E+00	5.09E-02	4.13E-01	2.86E-03	3.20E-01	5.50E-01	6.45E-03	1.14E-01	2.17E+00	1.77E-01	1.72E+01	4.11E+00	1.59E+00	1.46E+00	2.70E-01	1.59E-01
2004	2	24	9.69E-01	8.92E-03	6.33E-01	6.24E-03	2.33E-01	5.86E+00	2.82E+00	8.07E+00	2.06E-01	8.49E+00	1.90E+00	6.99E-01	1.34E+00	6.95E+00	1.25E+00	9.52E-01	8.91E-03	6.33E-01	4.42E-03	1.15E-02	5.86E+00	2.76E+00	6.07E+00	2.02E-01	6.86E-02	3.17E-02	1.15E-01	8.72E-02	6.70E+00	1.18E+00	1.75E-02	9.73E-06	1.83E-05	1.82E-03	2.22E-01	2.90E-04	6.24E-02	2.00E+00	3.83E-03	8.42E+00	1.87E+00	5.84E-01	1.26E+00	2.57E-01	6.82E-02
2004	2	25	2.61E+00	4.47E-02	1.42E+00	2.10E-02	3.67E-02	2.87E+00	9.87E-01	4.02E+00	2.56E+00	5.10E+00	1.09E-01	9.44E-01	6.47E-01	3.44E+00	3.48E+00	2.29E+00	1.63E-03	1.39E+00	6.73E-04	1.19E-03	2.83E+00	9.33E-01	3.14E+00	7.87E-02	9.06E-03	3.54E-03	1.87E-02	1.28E-02	3.43E+00	2.88E+00	3.24E-01	4.31E-02	3.37E-02	2.04E-02	3.55E-02	3.75E-02	5.40E-02	8.81E-01	2.48E+00	5.09E+00	1.06E-01	9.25E-01	6.35E-01	1.42E-02	5.97E-01
2004	2	26	2.85E+00	7.16E-01	1.56E+00	1.36E-01	4.29E-01	5.21E+00	2.43E+00	7.03E+00	2.67E+00	4.66E+00	4.77E+00	6.45E-01	1.22E+00	6.37E+00	3.75E+00	2.59E+00	3.20E-02	1.53E+00	1.05E-02	1.66E-02	5.18E+00	2.39E+00	5.98E+00	3.04E-01	1.01E-01	5.39E-02	1.79E-01	1.34E-01	6.28E+00	3.25E+00	2.59E-01	6.84E-01	2.87E-02	1.25E-01	4.12E-01	2.98E-02	3.58E-02	1.05E+00	2.36E+00	4.56E+00	4.72E+00	4.66E-01	1.08E+00	9.70E-02	5.01E-01
2004	2	27	8.76E-01	1.84E-03	6.77E-01	3.84E-04	1.00E-03	4.86E+00	2.61E+00	6.44E+00	1.58E-01	9.98E+00	2.33E-02	1.98E+00	7.11E-01	5.96E+00	1.37E+00	8.20E-01	1.79E-03	6.72E-01	3.84E-04	9.96E-04	4.84E+00	2.51E+00	4.87E+00	1.51E-01	3.28E-02	9.65E-03	7.69E-02	5.19E-02	5.84E+00	1.18E+00	5.58E-02	4.73E-05	4.77E-03	5.33E-09	8.65E-06	2.21E-02	9.87E-02	1.57E+00	6.36E-03	9.95E+00	1.36E-02	1.90E+00	6.59E-01	1.17E-01	1.98E-01
2004	2	28	5.15E-01	1.81E-03	6.73E-01	3.36E-04	1.13E-03	6.76E+00	4.10E+00	8.41E+00	1.56E-01	1.37E+01	1.56E-02	2.43E+00	7.51E-01	9.76E+00	7.75E-01	4.97E-01	1.64E-03	6.72E-01	2.99E-04	1.06E-03	6.75E+00	3.97E+00	6.13E+00	1.53E-01	2.94E-02	8.12E-03	9.81E-02	5.77E-02	9.50E+00	7.12E-01	1.85E-02	1.69E-04	1.05E-03	3.66E-05	7.41E-05	1.30E-03	1.26E-01	2.28E+00	2.82E-03	1.36E+01	7.44E-03	2.33E+00	6.93E-01	2.63E-01	6.31E-02
2004	2	29	1.00E+00	1.03E-01	9.28E-01	4.17E-03	1.41E-02	5.79E+00	3.78E+00	7.09E+00	2.41E+00	1.51E+01	1.19E+00	2.20E+00	2.01E+00	9.94E+00	1.32E+00	8.79E-01	7.23E-03	7.69E-01	1.35E-03	3.16E-03	5.58E+00	3.58E+00	5.40E+00	1.37E-01	4.32E-02	1.93E-02	9.76E-02	6.73E-02	9.54E+00	1.18E+00	1.25E-01	9.54E-02	1.59E-01	2.82E-03	1.09E-02	2.06E-01	1.98E-01	1.69E+00	2.27E+00	1.51E+01	1.17E+00	2.10E+00	1.94E+00	4.06E-01	1.36E-01
2004	3	1	3.99E+00	6.49E-01	2.37E+00	6.92E-02	1.07E-01	3.75E+00	9.05E-01	3.41E+00	1.25E+01	8.72E-01	9.28E-01	2.89E-01	3.75E-01	4.96E+00	5.36E+00	3.81E+00	1.03E-02	1.89E+00	1.37E-03	1.97E-03	3.25E+00	7.99E-01	3.25E+00	9.23E-02	1.77E-02	1.10E-02	2.23E-02	1.82E-02	4.81E+00	5.16E+00	1.81E-01	6.39E-01	4.75E-01	6.79E-02	1.05E-01	4.94E-01	1.06E-01	1.61E-01	1.24E+01	8.54E-01	9.17E-01	2.67E-01	3.57E-01	1.49E-01	1.95E-01
2004	3	2	3.88E+00	7.18E-01	1.99E+00	1.01E-01	1.54E-01	4.52E+00	2.13E+00	6.73E+00	5.18E+00	3.62E+00	1.62E+00	9.91E-01	9.64E-01	6.10E+00	5.23E+00	3.14E+00	1.60E-02	1.62E+00	3.78E-03	7.16E-03	4.00E+00	1.85E+00	5.83E+00	1.92E-01	5.61E-02	2.85E-02	1.11E-01	7.69E-02	5.63E+00	4.23E+00	7.47E-01	7.02E-01	3.73E-01	9.76E-02	1.47E-01	5.19E-01	2.84E-01	9.06E-01	4.98E+00	3.56E+00	1.59E+00	8.80E-01	8.88E-01	4.71E-01	9.91E-01
2004	3	3	8.00E-01	2.65E-01	3.51E-01	5.36E-02	8.52E-02	2.94E+00	1.13E+00	3.90E+00	1.32E-01	1.57E+00	2.08E+00	3.25E-01	5.57E-01	2.02E+00	1.29E+00	7.16E-01	8.80E-03	3.47E-01	2.78E-03	4.85E-03	2.93E+00	1.11E+00	2.86E+00	1.24E-01	3.62E-02	1.77E-02	5.71E-02	4.61E-02	1.97E+00	1.09E+00	8.40E-02	2.56E-01	3.50E-03	5.09E-02	8.04E-02	1.02E-02	2.04E-02	1.04E+00	8.54E-03	1.54E+00	2.07E+00	2.68E-01	5.11E-01	5.22E-02	1.97E-01
2004	3	4	1.54E+00	3.16E-02	7.03E-01	1.88E-04	2.28E-03	1.65E+00	8.60E-01	2.80E+00	5.86E-01	1.57E+00	2.14E-01	6.32E-01	4.24E-01	2.25E+00	2.05E+00	1.41E+00	3.95E-06	6.47E-01	0.00E+00	5.20E-07	1.56E+00	8.32E-01	2.15E+00	6.69E-03	7.55E-04	7.22E-05	4.34E-03	2.11E-03	2.22E+00	1.76E+00	1.24E-01	3.16E-02	5.66E-02	1.88E-04	2.28E-03	8.94E-02	2.80E-02	6.51E-01	5.80E-01	1.57E+00	2.14E-01	6.27E-01	4.22E-01	2.92E-02	2.88E-01
2004	3	5	5.74E-01	1.37E-01	2.43E-01	3.24E-02	4.34E-02	1.34E+00	8.99E-01	2.54E+00	1.09E-01	1.84E+00	8.52E-01	2.29E-01	8.87E-01	1.52E+00	9.27E-01	4.80E-01	5.95E-03	2.41E-01	1.87E-03	3.49E-03	1.33E+00	8.85E-01	2.06E+00	9.20E-02	2.56E-02	1.26E-02	3.63E-02	3.02E-02	1.48E+00	7.37E-01	9.41E-02	1.31E-01	2.49E-03	3.05E-02	3.99E-02	7.78E-03	1.35E-02	4.79E-01	1.67E-02	1.81E+00	8.40E-01	1.93E-01	8.57E-01	3.61E-02	1.90E-01
2004	3	6	8.55E-03	0.00E+00	4.63E-03	0.00E+00	8.61E-15	3.91E-01	3.58E-01	9.58E-01	1.91E-17	1.76E+00	1.27E-02	5.95E-01	2.54E-01	4.87E-01	2.07E-02	8.55E-03	0.00E+00	4.63E-03	0.00E+00	0.00E+00	3.91E-01	3.47E-01	7.03E-01	0.00E+00	0.00E+00	0.00E+00	2.39E-04	0.00E+00	4.87E-01	2.07E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.61E-15	0.00E+00	1.13E-02	2.55E-01	1.91E-17	1.76E+00	1.27E-02	5.94E-01	2.54E-01	0.00E+00	0.00E+00
2004	3	7	1.67E-02	0.00E+00	4.96E-03	0.00E+00	0.00E+00	3.20E-01	2.12E-01	6.80E-01	7.24E-18	7.51E-01	3.79E-02	2.74E-01	1.69E-01	3.67E-01	3.80E-02	1.67E-02	0.00E+00	4.96E-03	0.00E+00	0.00E+00	3.20E-01	2.08E-01	4.90E-01	0.00E+00	0.00E+00	0.00E+00	2.64E-04	0.00E+00	3.67E-01	3.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.18E-03	1.90E-01	7.24E-18	7.51E-01	3.79E-02	2.73E-01	1.69E-01	0.00E+00	0.00E+00
2004	3	8	3.04E-01	1.08E-04	9.92E-02	1.10E-05	2.98E-04	1.31E+00	9.32E-01	3.60E+00	7.18E-02	2.51E+00	6.76E-02	6.34E-01	5.15E-01	1.91E+00	3.93E-01	2.97E-01	8.66E-05	9.86E-02	7.92E-06	2.87E-04	1.31E+00	8.77E-01	2.69E+00	7.04E-02	1.20E-02	2.89E-03	9.84E-03	1.23E-02	1.87E+00	3.72E-01	6.79E-03	2.10E-05	6.25E-04	3.05E-06	1.08E-05	1.43E-03	5.60E-02	9.09E-01	1.37E-03	2.50E+00	6.47E-02	6.25E-01	5.03E-01	3.53E-02	2.09E-02
2004	3	9	1.15E-01	0.00E+00	5.22E-02	0.00E+00	0.00E+00	4.83E-01	1.34E+00	1.01E+00	4.63E-02	4.19E+00	3.78E-02	5.18E-01	3.76E-01	7.78E-01	1.66E-01	1.15E-01	0.00E+00	5.22E-02	0.00E+00	0.00E+00	4.83E-01	1.32E+00	8.71E-01	6.32E-03	9.14E-05	2.60E-06	2.34E-03	5.36E-04	7.75E-01	1.66E-01	7.03E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-02	1.34E-01	4.00E-02	4.19E+00	3.78E-02	5.15E-01	3.75E-01	3.60E-03	1.02E-05
2004	3	10	9.54E-01	1.25E+00	4.60E-01	1.99E-01	2.38E-01	2.47E+00	1.92E+00	4.79E+00	3.86E-01	6.76E+00	2.09E+00	1.39E+00	5.04E-01	4.17E+00	1.43E+00	8.67E-01	1.12E-02	4.24E-01	2.63E-03	3.78E-03	2.40E+00	1.81E+00	3.96E+00	7.92E-02	2.17E-02	1.32E-02	3.78E-02	2.70E-02	4.07E+00	1.22E+00	8.70E-02	1.23E+00	3.68E-02	1.97E-01	2.34E-01	6.51E-02	1.02E-01	8.27E-01	3.07E-01	6.74E+00	2.08E+00	1.36E+00	4.77E-01	9.53E-02	2.14E-01
2004	3	11	1.32E+00	1.42E-03	1.15E+00	1.91E-04	7.11E-04	4.20E+00	3.04E+00	6.64E+00	1.42E-01	1.11E+01	1.51E-02	1.59E+00	6.91E-01	5.70E+00	1.81E+00	1.24E+00	1.33E-03	1.13E+00	1.80E-04	6.72E-04	4.15E+00	2.96E+00	5.61E+00	9.07E-02	1.92E-02	6.09E-03	4.79E-02	3.10E-02	5.66E+00	1.59E+00	8.49E-02	8.91E-05	2.03E-02	1.04E-05	3.94E-05	5.52E-02	8.68E-02	1.03E+00	5.09E-02	1.11E+01	8.99E-03	1.54E+00	6.60E-01	4.80E-02	2.18E-01
2004	3	12	2.93E-01	1.91E-04	2.31E-01	6.21E-06	9.67E-05	2.31E+00	1.00E+00	4.08E+00	3.78E-02	2.72E+00	1.40E-02	9.27E-01	4.64E-01	3.06E+00	6.11E-01	2.43E-01	1.91E-04	2.27E-01	6.21E-06	9.67E-05	2.30E+00	9.67E-01	3.54E+00	3.06E-02	4.85E-03	1.50E-03	1.06E-02	6.40E-03	3.03E+00	4.86E-01	4.93E-02	3.94E-09	4.27E-03	0.00E+00	0.00E+00	1.09E-02	3.69E-02	5.36E-01	7.12E-03	2.72E+00	1.25E-02	9.16E-01	4.58E-01	2.99E-02	1.25E-01
2004	3	13	2.24E+00	1.02E-01	1.72E+00	1.47E-01	3.33E-01	4.53E+00	2.78E+00	7.26E+00	5.31E+00	3.18E+00	1.64E+00	1.40E+00	1.67E+00	7.76E+00	2.96E+00	1.84E+00	7.44E-03	1.36E+00	5.31E-03	8.36E-03	4.07E+00	2.43E+00	6.04E+00	1.10E-01	3.76E-02	1.70E-02	7.24E-02	5.44E-02	7.34E+00	2.50E+00	3.99E-01	9.44E-02	3.56E-01	1.42E-01	3.24E-01	4.59E-01	3.48E-01	1.22E+00	5.20E+00	3.14E+00	1.62E+00	1.33E+00	1.62E+00	4.28E-01	4.59E-01
2004	3	14	7.18E-01	2.36E-03	4.08E-01	6.22E-04	2.31E-03	3.42E+00	1.53E+00	5.36E+00	1.18E-01	3.36E+00	6.03E-02	9.83E-01	6.26E-01	3.00E+00	9.65E-01	6.61E-01	2.27E-03	3.97E-01	6.02E-04	2.21E-03	3.39E+00	1.45E+00	4.08E+00	1.01E-01	2.73E-02	1.08E-02	4.97E-02	3.87E-02	2.97E+00	8.26E-01	5.75E-02	9.08E-05	1.07E-02	2.00E-05	9.49E-05	2.52E-02	7.64E-02	1.28E+00	1.71E-02	3.33E+00	4.95E-02	9.33E-01	5.88E-01	3.40E-02	1.39E-01
2004	3	15	3.53E-01	1.01E-03	2.81E-01	6.50E-05	2.87E-04	2.78E+00	1.78E+00	3.83E+00	1.15E-01	6.22E+00	4.34E-02	1.12E+00	3.25E-01	3.07E+00	5.00E-01	3.32E-01	1.01E-03	2.81E-01	6.50E-05	2.87E-04	2.78E+00	1.71E+00	2.97E+00	6.42E-02	1.23E-02	3.71E-03	3.46E-02	2.13E-02	3.02E+00	4.46E-01	2.11E-02	0.00E+00	3.81E-06	0.00E+00	0.00E+00	1.11E-03	6.69E-02	8.57E-01	5.08E-02	6.21E+00	3.97E-02	1.08E+00	3.04E-01	4.77E-02	5.41E-02
2004	3	16	3.57E-02	0.00E+00	5.73E-03	0.00E+00	3.16E-12	4.67E-01	3.84E-01	1.03E+00	5.67E-19	2.02E+00	5.33E-02	3.98E-01	2.47E-01	6.17E-01	7.29E-02	3.57E-02	0.00E+00	5.73E-03	0.00E+00	0.00E+00	4.67E-01	3.46E-01	5.76E-01	0.00E+00	0.00E+00	0.00E+00	3.27E-05	0.00E+00	6.17E-01	7.29E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E-12	0.00E+00	3.87E-02	4.52E-01	5.67E-19	2.02E+00	5.33E-02	3.98E-01	2.47E-01	0.00E+00	0.00E+00
2004	3	17	1.97E-01	7.44E-01	7.75E-02	4.86E-02	7.19E-02	6.37E-01	1.68E+00	2.30E+00	7.23E-02	8.64E+00	3.30E+00	1.55E+00	1.55E+00	1.68E+00	1.78E-01	1.96E-01	4.25E-03	7.69E-02	1.07E-03	2.44E-03	6.36E-01	1.63E+00	1.94E+00	3.79E-02	2.32E-02	1.22E-02	4.16E-02	3.06E-02	1.68E+00	1.77E-01	8.34E-04	7.40E-01	5.59E-04	4.75E-02	6.95E-02	1.14E-03	4.94E-02	3.64E-01	3.44E-02	8.62E+00	3.29E+00	1.51E+00	1.52E+00	2.67E-03	1.15E-03
2004	3	18	4.68E-01	1.90E-02	1.61E-01	1.37E-02	1.03E-01	2.43E+00	4.58E-01	2.65E+00	9.00E-02	1.53E+00	7.54E-01	9.97E-02	5.83E-01	1.42E+00	9.06E-01	4.62E-01	1.18E-03	1.60E-01	7.20E-04	2.10E-03	2.43E+00	4.53E-01	2.29E+00	8.52E-02	1.72E-02	5.38E-03	2.49E-02	2.23E-02	1.41E+00	8.88E-01	5.42E-03	1.79E-02	1.02E-03	1.29E-02	1.01E-01	2.76E-03	5.41E-03	3.54E-01	4.85E-03	1.52E+00	7.49E-01	7.48E-02	5.60E-01	1.11E-02	1.72E-02
2004	3	19	1.65E-01	1.81E-06	8.70E-02	0.00E+00	3.33E-06	1.95E+00	9.43E-01	3.56E+00	1.19E-02	2.62E+00	5.01E-02	7.44E-01	3.52E-01	2.07E+00	2.44E-01	1.65E-01	1.81E-06	8.70E-02	0.00E+00	3.33E-06	1.95E+00	8.85E-01	2.72E+00	1.19E-02	1.22E-03	1.15E-04	1.70E-02	4.92E-03	2.06E+00	2.44E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.80E-02	8.33E-01	1.95E-19	2.62E+00	4.99E-02	7.27E-01	3.47E-01	8.13E-03	1.10E-05
2004	3	20	3.18E+00	1.72E-02	1.94E+00	3.97E-03	5.49E-03	5.11E+00	1.99E+00	6.84E+00	3.05E+00	5.99E+00	3.37E-02	1.61E+00	1.54E+00	7.12E+00	4.28E+00	2.66E+00	4.81E-03	1.69E+00	7.27E-04	1.36E-03	4.82E+00	1.76E+00	5.79E+00	1.51E-01	3.15E-02	1.08E-02	5.24E-02	4.20E-02	6.80E+00	3.32E+00	5.25E-01	1.24E-02	2.59E-01	3.24E-03	4.12E-03	2.95E-01	2.30E-01	1.05E+00	2.90E+00	5.96E+00	2.30E-02	1.56E+00	1.50E+00	3.25E-01	9.67E-01
2004	3	21	4.80E+00	5.34E-01	3.69E+00	6.58E-02	1.15E-01	5.73E+00	1.82E+00	7.60E+00	5.26E+00	5.11E+00	1.53E+00	2.54E+00	3.05E+00	6.82E+00	5.89E+00	4.02E+00	2.10E-02	3.52E+00	8.63E-03	1.27E-02	5.57E+00	1.13E+00	6.56E+00	2.40E-01	6.98E-02	3.70E-02	1.08E-01	8.70E-02	6.26E+00	4.64E+00	7.77E-01	5.13E-01	1.65E-01	5.72E-02	1.03E-01	1.63E-01	6.94E-01	1.04E+00	5.02E+00	5.04E+00	1.50E+00	2.43E+00	2.96E+00	5.57E-01	1.25E+00
2004	3	22	3.87E+00	2.00E+00	1.96E+00	4.06E-01	4.92E-01	6.67E+00	4.15E+00	9.38E+00	3.63E+00	1.07E+01	4.93E+00	1.90E+00	2.59E+00	9.36E+00	5.03E+00	3.38E+00	6.35E-02	1.84E+00	3.01E-02	3.69E-02	6.51E+00	3.78E+00	8.34E+00	3.16E-01	1.22E-01	7.81E-02	1.98E-01	1.55E-01	9.05E+00	4.12E+00	4.89E-01	1.94E+00	1.22E-01	3.76E-01	4.55E-01	1.56E-01	3.65E-01	1.04E+00	3.31E+00	1.05E+01	4.85E+00	1.71E+00	2.44E+00	3.09E-01	9.02E-01
2004	3	23	4.72E-01	6.95E-02	5.04E-01	5.31E-02	8.30E-02	3.98E+00	2.42E+00	5.27E+00	1.63E-01	8.17E+00	5.41E-01	1.22E+00	1.03E+00	5.49E+00	7.13E-01	4.57E-01	1.29E-02	5.03E-01	4.95E-03	9.02E-03	3.98E+00	2.34E+00	3.93E+00	1.50E-01	5.30E-02	2.74E-02	1.04E-01	7.46E-02	5.36E+00	6.87E-01	1.52E-02	5.67E-02	9.28E-04	4.82E-02	7.40E-02	1.98E-03	7.68E-02	1.35E+00	1.28E-02	8.11E+00	5.14E-01	1.11E+00	9.53E-01	1.26E-01	2.65E-02
2004	3	24	7.65E-02	0.00E+00	1.18E-02	2.48E-08	4.00E-03	5.51E-01	5.23E-01	1.28E+00	1.29E-03	2.43E+00	1.95E-01	6.96E-01	3.34E-01	7.70E-01	1.31E-01	7.65E-02	0.00E+00	1.18E-02	2.48E-08	2.23E-05	5.51E-01	4.98E-01	7.51E-01	1.29E-03	5.67E-04	7.35E-05	3.08E-03	2.35E-03	7.70E-01	1.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.97E-03	0.00E+00	2.50E-02	5.26E-01	7.58E-23	2.43E+00	1.95E-01	6.93E-01	3.32E-01	0.00E+00	0.00E+00
2004	3	25	2.56E+00	8.41E-02	1.36E+00	1.86E-01	1.56E-01	2.25E+00	3.13E-01	2.65E+00	2.05E+00	1.52E+00	1.24E+00	2.53E-01	2.27E-01	2.79E+00	3.12E+00	2.32E+00	3.90E-03	1.33E+00	4.01E-03	5.47E-03	2.22E+00	3.10E-01	2.22E+00	2.74E-02	1.10E-02	7.32E-03	1.74E-02	1.39E-02	2.78E+00	2.67E+00	2.39E-01	8.02E-02	2.42E-02	1.82E-01	1.51E-01	2.80E-02	3.37E-03	4.35E-01	2.02E+00	1.51E+00	1.23E+00	2.36E-01	2.13E-01	2.80E-03	4.53E-01
2004	3	26	2.42E+00	3.32E-01	1.83E+00	6.93E-02	1.76E-01	3.07E+00	7.05E-01	3.17E+00	1.24E+00	1.36E+00	1.26E+00	2.44E-01	4.15E-01	3.04E+00	2.89E+00	2.15E+00	9.78E-03	1.73E+00	3.12E-03	5.00E-03	3.02E+00	6.99E-01	2.75E+00	1.05E-01	3.16E-02	1.67E-02	6.09E-02	4.40E-02	3.02E+00	2.44E+00	2.69E-01	3.22E-01	9.32E-02	6.62E-02	1.71E-01	4.60E-02	6.29E-03	4.24E-01	1.14E+00	1.33E+00	1.24E+00	1.83E-01	3.71E-01	2.81E-02	4.51E-01
2004	3	27	8.11E-02	0.00E+00	3.42E-02	0.00E+00	2.79E-05	8.97E-01	7.32E-01	2.43E+00	5.34E-04	3.87E+00	8.54E-02	5.40E-01	4.13E-01	1.23E+00	1.22E-01	8.11E-02	0.00E+00	3.42E-02	0.00E+00	3.26E-07	8.97E-01	6.70E-01	1.59E+00	5.34E-04	1.21E-04	7.33E-06	5.04E-03	1.57E-03	1.22E+00	1.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E-05	0.00E+00	6.21E-02	8.45E-01	1.96E-18	3.87E+00	8.54E-02	5.35E-01	4.11E-01	1.00E-02	0.00E+00
2004	3	28	9.90E-01	2.60E-05	7.87E-01	5.30E-08	6.88E-07	2.94E+00	2.17E+00	4.10E+00	2.06E-02	1.02E+01	9.76E-04	1.49E+00	5.56E-01	3.27E+00	1.37E+00	8.75E-01	2.57E-05	7.72E-01	5.30E-08	5.06E-07	2.91E+00	2.08E+00	3.29E+00	1.87E-02	2.01E-03	1.67E-04	2.50E-02	7.20E-03	3.25E+00	1.09E+00	1.15E-01	2.92E-07	1.51E-02	0.00E+00	1.82E-07	3.01E-02	8.39E-02	8.19E-01	1.92E-03	1.02E+01	8.09E-04	1.47E+00	5.49E-01	2.19E-02	2.77E-01
2004	3	29	1.68E+00	8.95E-01	9.40E-01	1.22E-01	3.50E-01	4.49E+00	2.30E+00	5.02E+00	2.40E-01	8.68E+00	4.94E+00	9.96E-01	4.66E-01	4.53E+00	2.37E+00	1.58E+00	1.65E-02	9.13E-01	6.22E-03	9.59E-03	4.42E+00	2.28E+00	4.44E+00	2.07E-01	7.06E-02	3.49E-02	1.25E-01	9.32E-02	4.46E+00	2.13E+00	1.02E-01	8.78E-01	2.78E-02	1.16E-01	3.41E-01	6.65E-02	2.62E-02	5.80E-01	3.32E-02	8.61E+00	4.90E+00	8.71E-01	3.73E-01	7.59E-02	2.40E-01
2004	3	30	5.66E-01	2.66E-03	4.08E-01	2.72E-02	4.60E-01	4.63E+00	2.16E+00	6.46E+00	1.73E-01	4.60E+00	2.63E+00	6.99E-01	1.23E+00	3.68E+00	1.08E+00	5.40E-01	2.66E-03	4.08E-01	2.73E-03	6.88E-03	4.63E+00	2.08E+00	4.79E+00	1.71E-01	4.86E-02	1.67E-02	1.09E-01	8.63E-02	3.50E+00	1.03E+00	2.66E-02	2.01E-07	1.14E-06	2.45E-02	4.54E-01	3.95E-04	7.62E-02	1.67E+00	2.21E-03	4.55E+00	2.61E+00	5.90E-01	1.14E+00	1.79E-01	4.54E-02

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	3	31	2.27E+00	3.24E-01	1.07E+00	2.70E-02	5.14E-02	2.27E+00	7.47E-01	2.30E+00	1.93E+00	2.73E+00	9.58E-01	3.97E-01	6.02E-01	2.70E+00	2.86E+00	2.06E+00	4.20E-03	1.04E+00	1.56E-03	2.97E-03	2.24E+00	7.26E-01	2.04E+00	2.90E-02	1.02E-02	6.95E-03	2.14E-02	1.52E-02	2.65E+00	2.47E+00	2.08E-01	3.20E-01	2.79E-02	2.54E-02	4.85E-02	3.20E-02	2.09E-02	2.57E-01	1.90E+00	2.72E+00	9.51E-01	3.76E-01	5.86E-01	4.44E-02	3.97E-01
2004	4	1	3.02E+00	1.21E-04	1.73E+00	2.33E-17	1.76E-06	2.74E+00	2.76E-01	2.75E+00	5.69E+00	3.47E-03	2.54E-03	6.58E-03	3.99E-03	4.18E+00	3.96E+00	2.85E+00	7.02E-05	1.67E+00	2.33E-17	1.76E-06	2.66E+00	2.76E-01	2.74E+00	2.52E-02	1.75E-03	3.55E-04	5.17E-03	2.49E-03	4.18E+00	3.62E+00	1.67E-01	5.11E-05	5.86E-02	0.00E+00	0.00E+00	7.95E-02	3.03E-05	6.83E-03	5.67E+00	1.71E-03	2.18E-03	1.41E-03	1.50E-03	1.37E-03	3.43E-01
2004	4	2	4.00E+00	5.61E-02	3.14E+00	2.03E-03	4.94E-03	4.57E+00	1.41E+00	6.85E+00	4.49E+00	1.34E+00	2.93E-01	6.19E-01	5.94E-01	7.47E+00	5.46E+00	3.28E+00	7.92E-03	2.60E+00	1.57E-03	2.92E-03	4.12E+00	1.31E+00	6.35E+00	1.62E-01	3.92E-02	1.70E-02	7.88E-02	5.53E-02	7.34E+00	4.17E+00	7.20E-01	4.82E-02	5.46E-01	4.63E-04	2.03E-03	4.52E-01	9.65E-02	4.92E-01	4.33E+00	1.30E+00	2.76E-01	5.40E-01	5.38E-01	1.30E-01	1.29E+00
2004	4	3	2.80E+00	1.86E-01	1.92E+00	1.49E-01	2.47E-01	2.88E+00	5.05E-01	3.15E+00	2.29E+00	2.58E+00	1.66E+00	4.65E-01	3.36E-01	3.81E+00	3.39E+00	2.28E+00	3.31E-03	1.75E+00	1.40E-03	1.24E-03	2.75E+00	4.88E-01	2.95E+00	5.58E-02	8.88E-03	3.58E-03	1.59E-02	1.16E-02	3.80E+00	2.51E+00	5.20E-01	1.83E-01	1.71E-01	1.47E-01	2.45E-01	1.30E-01	1.64E-02	1.98E-01	2.23E+00	2.57E+00	1.65E+00	4.49E-01	3.25E-01	1.89E-02	8.84E-01
2004	4	4	1.86E+00	6.95E-04	1.17E+00	5.10E-06	2.71E-05	3.17E+00	1.71E+00	3.86E+00	4.39E+00	3.62E+00	3.04E-02	6.75E-01	5.38E-01	3.48E+00	2.47E+00	1.76E+00	1.69E-04	1.06E+00	1.13E-09	1.04E-05	3.01E+00	1.66E+00	3.24E+00	2.75E-02	3.63E-03	7.86E-04	1.03E-02	6.29E-03	3.41E+00	2.27E+00	1.00E-01	5.26E-04	1.06E-01	5.10E-06	1.67E-05	1.59E-01	5.69E-02	6.15E-01	4.36E+00	3.62E+00	2.96E-02	6.64E-01	5.32E-01	7.50E-02	1.96E-01
2004	4	5	2.83E+00	8.81E-01	1.24E+00	1.16E-01	1.49E-01	5.50E+00	3.17E+00	8.30E+00	1.39E+00	4.04E+00	3.99E+00	2.02E+00	1.90E+00	6.66E+00	3.96E+00	2.21E+00	2.44E-02	1.12E+00	7.61E-03	1.19E-02	5.34E+00	2.31E+00	6.81E+00	2.27E-01	7.51E-02	4.02E-02	1.37E-01	1.01E-01	5.95E+00	3.07E+00	6.22E-01	8.57E-01	1.23E-01	1.09E-01	1.37E-01	1.63E-01	8.58E-01	1.49E+00	1.16E+00	3.97E+00	3.95E+00	1.89E+00	1.80E+00	7.13E-01	8.96E-01
2004	4	6	1.67E+00	1.07E-01	1.01E+00	4.33E-02	6.83E-02	4.59E+00	1.72E+00	6.52E+00	3.25E+00	6.36E+00	3.50E-01	1.51E+00	2.47E+00	5.29E+00	2.28E+00	1.52E+00	1.05E-02	9.60E-01	2.76E-03	5.27E-03	4.54E+00	1.42E+00	5.49E+00	9.16E-02	2.98E-02	1.72E-02	5.45E-02	3.97E-02	5.01E+00	1.94E+00	1.46E-01	9.66E-02	4.63E-02	4.05E-02	6.30E-02	5.51E-02	2.98E-01	1.03E+00	3.16E+00	6.33E+00	3.33E-01	1.45E+00	2.44E+00	2.79E-01	3.40E-01
2004	4	7	1.94E+00	4.25E-01	1.25E+00	3.03E-02	3.98E-02	6.17E+00	2.71E+00	8.02E+00	8.88E-01	7.85E+00	1.74E+00	1.04E+00	6.14E-01	7.87E+00	2.78E+00	1.77E+00	1.81E-02	1.24E+00	5.62E-03	8.58E-03	6.15E+00	2.65E+00	6.79E+00	1.80E-01	5.13E-02	2.73E-02	9.93E-02	7.01E-02	7.69E+00	2.43E+00	1.71E-01	4.07E-01	1.40E-02	2.47E-02	3.12E-02	2.06E-02	6.46E-02	1.23E+00	7.09E-01	7.79E+00	1.71E+00	9.40E-01	5.44E-01	1.81E-01	3.54E-01
2004	4	8	2.90E+00	2.17E-03	2.06E+00	3.49E-04	7.41E-04	4.52E+00	7.08E-01	5.32E+00	3.09E+00	7.25E-01	4.77E-03	2.38E-01	3.26E-01	5.03E+00	3.72E+00	2.46E+00	2.17E-03	1.58E+00	3.49E-04	7.41E-04	4.06E+00	6.78E-01	4.78E+00	7.02E-02	1.18E-02	4.76E-03	2.78E-02	1.77E-02	4.90E+00	3.05E+00	4.41E-01	1.96E-06	4.83E-01	0.00E+00	1.89E-10	4.60E-01	3.03E-02	5.39E-01	3.02E+00	7.13E-01	1.46E-05	2.11E-01	3.09E-01	1.26E-01	6.74E-01
2004	4	9	4.55E+00	1.03E-02	2.77E+00	1.74E-03	2.75E-03	4.61E+00	7.41E-01	5.29E+00	6.09E+00	1.08E-01	1.37E-02	1.62E-01	9.37E-02	6.03E+00	6.24E+00	3.58E+00	3.73E-03	2.37E+00	4.14E-04	1.16E-03	4.25E+00	4.24E-01	4.47E+00	1.12E-01	2.16E-02	8.63E-03	4.68E-02	3.17E-02	5.40E+00	4.89E+00	9.62E-01	6.59E-03	4.02E-01	1.33E-03	1.59E-03	3.62E-01	3.17E-01	8.18E-01	5.98E+00	8.62E-02	5.02E-03	1.15E-01	6.21E-02	6.38E-01	1.36E+00
2004	4	10	4.00E+00	7.66E-01	2.54E+00	8.69E-02	1.09E-01	5.88E+00	2.15E+00	7.10E+00	3.63E+00	4.83E+00	2.60E+00	8.79E-01	1.36E+00	7.85E+00	5.41E+00	3.38E+00	1.42E-02	2.13E+00	3.04E-03	5.70E-03	5.42E+00	1.91E+00	6.29E+00	2.02E-01	4.97E-02	2.45E-02	9.34E-02	6.72E-02	7.49E+00	4.45E+00	6.25E-01	7.52E-01	4.07E-01	8.39E-02	1.03E-01	4.63E-01	2.38E-01	8.05E-01	3.43E+00	4.78E+00	2.58E+00	7.86E-01	1.29E+00	3.62E-01	9.59E-01
2004	4	11	5.84E-01	1.48E-02	7.43E-01	1.25E-02	1.84E-02	6.03E+00	2.62E+00	8.47E+00	1.33E-01	1.24E+01	6.04E-02	1.39E+00	1.31E+00	8.56E+00	7.41E-01	5.53E-01	6.82E-03	7.41E-01	1.83E-03	3.92E-03	6.02E+00	2.54E+00	6.96E+00	1.26E-01	3.50E-02	1.56E-02	8.52E-02	5.59E-02	8.32E+00	6.58E-01	3.11E-02	8.02E-03	1.53E-03	1.07E-02	1.44E-02	3.52E-03	8.54E-02	1.51E+00	6.76E-03	1.24E+01	4.48E-02	1.31E+00	1.25E+00	2.41E-01	8.30E-02
2004	4	12	2.60E+00	1.87E-02	1.58E+00	4.71E-03	7.28E-03	5.25E+00	1.26E+00	4.70E+00	2.47E+00	5.10E+00	8.16E-02	9.27E-01	8.00E-01	6.05E+00	3.28E+00	2.32E+00	1.98E-03	1.54E+00	3.42E-04	8.60E-04	5.22E+00	1.18E+00	3.72E+00	9.80E-02	1.71E-02	6.39E-03	4.87E-02	2.89E-02	5.92E+00	2.80E+00	2.80E-01	1.67E-02	4.19E-02	4.37E-03	6.42E-03	2.86E-02	8.43E-02	9.79E-01	2.37E+00	5.08E+00	7.52E-02	8.78E-01	7.71E-01	1.21E-01	4.78E-01
2004	4	13	1.88E+00	2.23E-01	1.31E+00	2.51E-02	4.53E-02	4.93E+00	1.55E+00	4.86E+00	2.96E+00	4.68E+00	3.51E-01	7.06E-01	6.87E-01	7.42E+00	2.43E+00	1.79E+00	6.80E-03	1.27E+00	1.91E-03	4.04E-03	4.86E+00	1.49E+00	3.99E+00	1.22E-01	3.79E-02	1.65E-02	7.86E-02	5.63E-02	7.27E+00	2.23E+00	8.78E-02	2.16E-01	4.37E-02	2.31E-02	4.13E-02	6.46E-02	5.80E-02	8.65E-01	2.84E+00	4.65E+00	3.34E-01	6.27E-01	6.31E-01	1.51E-01	1.97E-01
2004	4	14	1.92E+00	1.41E-01	1.03E+00	2.74E-02	4.72E-02	2.05E+00	5.36E-01	1.80E+00	7.33E-01	1.20E+00	5.50E-01	1.84E-01	1.95E-01	1.84E+00	2.46E+00	1.53E+00	2.76E-03	8.66E-01	1.37E-03	1.84E-03	1.95E+00	5.33E-01	1.62E+00	2.48E-02	4.51E-03	2.88E-03	6.52E-03	4.85E-03	1.83E+00	1.73E+00	3.97E-01	1.38E-01	1.67E-01	2.61E-02	4.54E-02	9.93E-02	2.66E-03	1.80E-01	7.09E-01	1.19E+00	5.47E-01	1.78E-01	1.91E-01	9.07E-03	7.31E-01
2004	4	15	5.12E-01	3.50E-03	2.10E-01	1.56E-02	1.37E-01	1.23E+00	8.23E-01	2.16E+00	6.81E-02	3.66E+00	1.69E+00	2.25E-01	4.48E-01	1.85E+00	9.77E-01	4.59E-01	3.31E-03	2.09E-01	2.37E-03	8.29E-03	1.22E+00	8.12E-01	1.90E+00	3.48E-02	1.08E-02	1.51E-02	2.07E-02	1.42E-02	1.83E+00	8.24E-01	5.31E-02	1.92E-04	1.24E-03	1.33E-02	1.29E-01	1.07E-02	1.12E-02	2.55E-01	3.33E-02	3.65E+00	1.67E+00	2.04E-01	4.34E-01	1.46E-02	1.53E-01
2004	4	16	1.61E+00	8.03E-02	4.09E-01	2.41E-02	1.30E-01	1.73E+00	6.79E-01	3.58E+00	1.38E+00	2.24E+00	1.70E+00	2.81E-02	8.66E-02	3.18E+00	2.44E+00	1.57E+00	3.69E-03	3.93E-01	2.00E-03	9.20E-03	1.71E+00	6.78E-01	3.54E+00	8.20E-02	2.46E-02	2.52E-02	1.93E-02	1.87E-02	3.18E+00	2.35E+00	3.35E-02	7.67E-02	1.55E-02	2.21E-02	1.21E-01	2.14E-02	1.24E-03	3.44E-02	1.30E+00	2.22E+00	1.68E+00	8.72E-03	6.79E-02	6.21E-03	8.43E-02
2004	4	17	1.91E+00	6.70E-01	9.99E-01	6.58E-02	1.12E-01	5.13E+00	2.56E+00	6.30E+00	1.90E+00	9.57E+00	2.52E+00	8.63E-01	1.80E+00	5.81E+00	3.08E+00	1.79E+00	1.52E-02	9.76E-01	5.49E-03	7.96E-03	5.08E+00	2.48E+00	5.64E+00	1.71E-01	4.67E-02	2.47E-02	8.78E-02	6.30E-02	5.64E+00	2.74E+00	1.21E-01	6.55E-01	2.32E-02	6.03E-02	1.04E-01	4.95E-02	8.33E-02	6.62E-01	1.73E+00	9.52E+00	2.50E+00	7.75E-01	1.73E+00	1.65E-01	3.38E-01
2004	4	18	3.43E-01	3.74E-03	3.17E-01	4.56E-03	3.02E-02	3.45E+00	1.88E+00	6.08E+00	2.17E-01	7.49E+00	2.77E-01	1.23E+00	1.64E+00	4.20E+00	4.08E-01	2.73E-01	3.46E-03	3.15E-01	1.01E-03	2.27E-03	3.44E+00	1.53E+00	4.91E+00	7.66E-02	2.06E-02	9.10E-03	5.22E-02	3.23E-02	3.94E+00	3.17E-01	7.07E-02	2.79E-04	1.92E-03	3.55E-03	2.79E-02	1.05E-02	3.50E-01	1.17E+00	1.40E-01	7.47E+00	2.68E-01	1.17E+00	1.61E+00	2.57E-01	9.11E-02
2004	4	19	1.61E-01	7.74E-05	1.29E-01	1.03E-06	5.94E-05	2.05E+00	6.60E-01	3.05E+00	6.26E-02	1.79E+00	9.48E-02	4.23E-01	5.31E-01	1.80E+00	4.23E-01	1.61E-01	7.74E-05	1.29E-01	1.03E-06	2.66E-05	2.05E+00	6.30E-01	2.32E+00	6.26E-02	9.92E-03	1.28E-03	1.99E-02	1.73E-02	1.77E+00	4.20E-01	4.24E-04	0.00E+00	0.00E+00	0.00E+00	3.28E-05	0.00E+00	3.08E-02	7.29E-01	6.17E-06	1.78E+00	9.35E-02	4.03E-01	5.14E-01	2.89E-02	3.18E-03
2004	4	20	1.43E-01	1.53E-03	5.18E-01	4.71E-04	6.76E-03	3.57E+00	1.22E+00	5.68E+00	6.04E-02	5.00E+00	1.45E-01	7.89E-01	7.41E-01	4.54E+00	2.50E-01	1.06E-01	1.53E-03	5.18E-01	1.89E-04	7.42E-04	3.57E+00	1.18E+00	4.60E+00	5.61E-02	1.48E-02	5.91E-03	3.06E-02	2.14E-02	4.45E+00	1.44E-01	3.70E-02	0.00E+00	4.26E-07	2.82E-04	6.02E-03	1.69E-05	4.19E-02	1.08E+00	4.31E-03	4.99E+00	1.39E-01	7.58E-01	7.20E-01	9.81E-02	1.06E-01
2004	4	21	4.16E-01	3.11E-04	2.60E-01	1.77E-05	9.65E-05	2.75E+00	1.44E+00	3.65E+00	4.29E-02	9.72E+00	4.62E-02	1.36E+00	1.61E+00	4.39E+00	7.25E-01	3.90E-01	3.11E-04	2.60E-01	1.77E-05	9.65E-05	2.75E+00	1.36E+00	2.51E+00	4.08E-02	5.84E-03	1.21E-03	2.49E-02	1.33E-02	4.29E+00	6.81E-01	2.60E-02	0.00E+00	5.40E-05	0.00E+00	0.00E+00	6.78E-04	8.24E-02	1.13E+00	2.08E-03	9.72E+00	4.50E-02	1.34E+00	1.60E+00	1.03E-01	4.41E-02
2004	4	22	2.85E+00	2.45E-01	1.17E+00	1.30E-03	2.74E-03	5.12E+00	1.63E+00	7.27E+00	9.32E-01	6.44E+00	8.38E-01	7.10E-01	1.44E+00	5.03E+00	3.71E+00	2.74E+00	3.71E-03	1.15E+00	3.12E-04	1.05E-03	5.09E+00	1.56E+00	6.26E+00	9.73E-02	1.95E-02	8.44E-03	4.72E-02	2.92E-02	4.91E+00	3.51E+00	1.18E-01	2.41E-01	1.57E-02	9.85E-04	1.69E-03	2.95E-02	6.75E-02	1.01E+00	8.35E-01	6.42E+00	8.30E-01	6.63E-01	1.41E+00	1.12E-01	1.98E-01
2004	4	23	3.17E-01	2.71E-02	2.84E-01	1.49E-02	2.54E-02	1.77E+00	5.54E-01	2.33E+00	7.31E-02	1.52E+00	3.08E-01	2.16E-01	5.26E-01	1.66E+00	6.35E-01	2.82E-01	7.58E-03	2.82E-01	2.26E-03	4.00E-03	1.76E+00	5.33E-01	1.89E+00	6.79E-02	2.63E-02	1.46E-02	3.69E-02	3.08E-02	1.61E+00	5.44E-01	3.57E-02	1.96E-02	2.18E-03	1.26E-02	2.14E-02	3.30E-03	2.12E-02	4.36E-01	5.26E-03	1.49E+00	2.93E-01	1.79E-01	4.95E-01	5.58E-02	9.11E-02
2004	4	24	2.86E-02	0.00E+00	2.35E-02	0.00E+00	0.00E+00	1.04E+00	7.60E-01	2.39E+00	2.28E-03	5.90E+00	6.52E-04	7.03E-01	5.22E-01	1.37E+00	1.22E-01	2.85E-02	0.00E+00	2.35E-02	0.00E+00	0.00E+00	1.04E+00	6.91E-01	2.02E+00	2.28E-03	0.00E+00	0.00E+00	1.19E-04	4.94E-06	1.36E+00	1.21E-01	1.90E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.94E-02	3.75E-01	3.15E-19	5.90E+00	6.52E-04	7.03E-01	5.22E-01	8.41E-03	7.42E-05
2004	4	25	1.82E+00	7.27E-02	9.01E-01	2.08E-02	7.40E-02	4.03E+00	1.96E+00	6.11E+00	1.49E+00	7.09E+00	1.28E+00	1.31E+00	1.30E+00	5.46E+00	2.45E+00	1.01E+00	9.89E-04	6.28E-01	1.33E-04	4.60E-04	3.61E+00	1.81E+00	4.97E+00	8.27E-02	1.78E-02	4.93E-03	4.88E-02	2.96E-02	4.89E+00	1.56E+00	8.07E-01	7.17E-02	2.72E-01	2.06E-02	7.35E-02	4.15E-01	1.44E-01	1.14E+00	1.41E+00	7.08E+00	1.28E+00	1.26E+00	1.28E+00	5.72E-01	8.85E-01
2004	4	26	1.70E-01	5.57E-04	1.54E-01	2.82E-05	2.04E-04	2.41E+00	7.33E-01	3.43E+00	8.08E-02	3.10E+00	4.54E-02	8.51E-01	3.25E-01	2.58E+00	2.26E-01	1.69E-01	5.23E-04	1.54E-01	2.78E-05	1.87E-04	2.41E+00	6.70E-01	2.33E+00	7.88E-02	1.25E-02	2.97E-03	3.61E-02	2.27E-02	2.52E+00	2.25E-01	9.24E-04	3.33E-05	1.79E-04	3.43E-07	1.70E-05	9.19E-04	6.27E-02	1.10E+00	1.97E-03	3.09E+00	4.25E-02	8.15E-01	3.02E-01	5.38E-02	1.16E-03
2004	4	27	8.35E-01	4.56E-05	3.17E-01	3.41E-06	2.56E-04	1.34E+00	4.44E-01	1.76E+00	1.33E+00	1.66E+00	1.17E-01	2.60E-01	4.35E-01	1.46E+00	1.29E+00	6.07E-01	4.56E-05	3.07E-01	3.41E-06	3.10E-05	1.30E+00	4.18E-01	1.44E+00	1.68E-02	1.50E-03	3.24E-04	3.60E-03	2.42E-03	1.37E+00	1.02E+00	2.28E-01	0.00E+00	1.08E-02	0.00E+00	2.25E-04	4.25E-02	2.59E-02	3.23E-01	1.31E+00	1.66E+00	1.17E-01	2.57E-01	4.33E-01	8.92E-02	2.65E-01
2004	4	28	1.51E+00	3.55E-01	6.67E-01	4.21E-02	5.88E-02	2.61E+00	6.78E-01	3.58E+00	1.30E+00	3.91E-01	2.01E+00	4.85E-02	6.41E-02	3.07E+00	2.20E+00	1.15E+00	1.19E-02	5.27E-01	3.29E-03	4.44E-03	2.44E+00	6.71E-01	3.39E+00	8.22E-02	2.98E-02	1.71E-02	4.10E-02	3.54E-02	2.99E+00	1.69E+00	3.55E-01	3.43E-01	1.41E-01	3.88E-02	5.44E-02	1.75E-01	6.58E-03	1.90E-01	1.22E+00	3.61E-01	1.99E+00	7.49E-03	2.87E-02	7.71E-02	5.09E-01
2004	4	29	1.51E+00	2.46E-03	1.11E+00	2.61E-03	8.39E-03	4.37E+00	1.12E+00	5.35E+00	2.50E+00	4.07E+00	3.42E-02	7.02E-01	5.19E-01	6.27E+00	2.04E+00	1.40E+00	2.34E-03	8.07E-01	7.80E-04	1.77E-03	4.08E+00	1.04E+00	4.41E+00	1.05E-01	1.78E-02	6.84E-03	4.53E-02	2.83E-02	6.07E+00	1.84E+00	1.11E-01	1.20E-04	3.03E-01	1.83E-03	6.62E-03	2.87E-01	7.18E-02	9.44E-01	2.39E+00	4.05E+00	2.73E-02	6.56E-01	4.91E-01	1.97E-01	1.97E-01
2004	4	30	4.43E+00	1.79E-03	2.63E+00	9.26E-07	5.22E-06	4.19E+00	2.64E-01	3.60E+00	4.13E+00	6.79E-02	4.14E-02	1.13E-02	9.28E-03	4.71E+00	5.58E+00	3.60E+00	1.24E-04	2.40E+00	6.46E-07	4.15E-06	4.09E+00	2.63E-01	3.53E+00	6.50E-02	3.16E-03	5.41E-04	7.46E-03	5.00E-03	4.68E+00	4.08E+00	8.37E-01	1.66E-03	2.26E-01	2.80E-07	1.07E-06	1.01E-01	1.30E-04	6.88E-02	4.06E+00	6.47E-02	4.08E-02	3.86E-03	4.28E-03	2.84E-02	1.49E+00
2004	5	1	7.28E+00	1.57E-01	3.79E+00	4.04E-01	7.94E-01	2.30E+01	1.09E+01	2.59E+01	3.56E+00	1.58E+01	2.71E+00	4.54E+00	6.80E+00	2.27E+01	9.80E+00	6.76E+00	1.90E-02	3.66E+00	5.00E-03	1.23E-02	2.28E+01	9.83E+00	2.44E+01	4.61E-01	1.22E-01	4.93E-02	2.91E-01	1.90E-01	2.20E+01	9.11E+00	5.19E-01	1.38E-01	1.22E-01	3.99E-01	7.82E-01	1.47E-01	1.04E+00	1.53E+00	3.10E+00	1.57E+01	2.67E+00	4.25E+00	6.61E+00	6.32E-01	6.90E-01
2004	5	2	2.22E+00	4.88E-03	6.84E-01	6.73E-04	2.00E-03	8.76E+00	3.87E+00	1.22E+01	1.11E-01	5.49E+00	1.65E-01	8.16E-01	7.98E-01	9.64E+00	2.75E+00	2.20E+00	4.88E-03	6.82E-01	6.73E-04	2.00E-03	8.75E+00	3.83E+00	1.14E+01	1.10E-01	2.68E-02	1.18E-02	5.98E-02	3.97E-02	9.60E+00	2.70E+00	1.58E-02	0.00E+00	2.57E-03	0.00E+00	0.00E+00	9.78E-03	3.74E-02	8.02E-01	7.66E-04	5.47E+00	1.53E-01	7.56E-01	7.58E-01	3.63E-02	5.05E-02
2004	5	3	1.58E+01	6.73E-01	6.61E+00	3.92E-02	4.12E-02	2.28E+01	4.95E+00	2.53E+01	6.63E+00	1.03E+00	4.84E+00	2.87E-01	2.73E-01	2.68E+01	1.98E+01	1.55E+01	2.23E-02	6.37E+00	5.17E-03	9.94E-03	2.26E+01	4.93E+00	2.50E+01	5.26E-01	1.06E-01	4.51E-02	2.13E-01	1.47E-01	2.68E+01	1.91E+01	3.43E-01	6.51E-01	2.40E-01	3.40E-02	3.13E-02	1.73E-01	1.73E-02	2.56E-01	6.11E+00	9.19E-01	4.79E+00	7.38E-02	1.26E-01	5.11E-02	7.23E-01
2004	5	4	1.46E+00	4.86E-02	1.19E+00	4.26E-02	7.98E-02	1.62E+01	6.06E+00	1.79E+01	4.31E-01	4.65E+00	8.49E-01	8.84E-01	1.45E+00	2.07E+01	3.22E+00	1.38E+00	1.56E-02	1.19E+00	6.25E-03	1.31E-02	1.62E+01	6.01E+00	1.71E+01	3.73E-01	1.08E-01	4.68E-02	2.77E-01	1.75E-01	2.06E+01	3.07E+00	7.88E-02	3.30E-02	7.15E-04	3.64E-02	6.67E-02	1.41E-03	5.16E-02	8.36E-01	5.75E-02	4.54E+00	8.02E-01	6.07E-01	1.27E+00	9.58E-02	1.49E-01
2004	5	5	2.83E+00	1.19E-01	6.12E-01	7.16E-02	8.62E-02	6.84E+00	1.65E+00	6.84E+00	5.59E-01	2.69E+00	8.08E-01	1.72E-01	4.93E-01	9.39E+00	3.80E+00	2.82E+00	1.42E-02	6.04E-01	7.77E-03	9.19E-03	6.83E+00	1.63E+00	6.76E+00	2.35E-01	4.85E-02	4.07E-02	7.30E-02	6.92E-02	9.37E+00	3.79E+00	9.79E-03	1.05E-01	7.50E-03	6.39E-02	7.70E-02	1.53E-02	2.32E-02	7.19E-02	3.23E-01	2.64E+00	7.67E-01	9.92E-02	4.24E-01	1.78E-02	1.12E-02
2004	5	6	4.24E+00	8.33E-01	1.99E+00	1.27E-01	1.28E-01	1.12E+01	4.82E+00	1.58E+01	4.03E-01	4.67E+00	7.23E-01	3.79E-01	9.08E-01	1.56E+01	5.82E+00	4.17E+00	2.59E-02	1.97E+00	2.03E-02	1.88E-02	1.12E+01	4.81E+00	1.55E+01	2.31E-01	7.52E-02	4.23E-02	1.34E-01	9.87E-02	1.56E+01	5.67E+00	6.66E-02	8.07E-01	1.18E-02	1.06E-01	1.09E-01	2.88E-02	7.37E-03	2.67E-01	1.72E-01	4.59E+00	6.81E-01	2.45E-01	8.09E-01	1.40E-02	1.50E-01
2004	5	7	6.72E+00	2.87E-01	4.66E+00	7.85E-02	1.67E-01	2.24E+01	7.71E+00	2.24E+01	3.67E+00	1.18E+01	1.94E+00	1.68E+00	2.77E+00	1.63E+01	8.55E+00	6.29E+00	1.38E-02	4.23E+00	3.56E-03	7.15E-03	2.20E+01	7.42E+00	2.12E+01	5.52E-01	1.10E-01	3.78E-02	2.48E-01	1.68E-01	1.59E+01	7.99E+00	4.29E-01	2.73E-01	4.21E-01	7.50E-02	1.60E-01	3.72E-01	2.92E-01	1.21E+00	3.12E+00	1.17E+01	1.91E+00	1.43E+00	2.60E+00	3.49E-01	5.61E-01
2004	5	8	1.99E+00	1.80E-03	1.10E+00	2.12E-04	1.92E-03	1.13E+01	5.26E+00	1.25E+01	2.87E-01	1.06E+01	2.78E-01	1.10E+00	9.07E-01	1.05E+01	3.08E+00	1.89E+00	1.79E-03	1.10E+00	2.12E-04	1.06E-03	1.13E+01	5.22E+00	1.19E+01	2.77E-01	4.76E-02	1.15E-02	1.32E-01	8.66E-02	1.05E+01	2.87E+00	9.80E-02	6.23E-06	8.20E-04	2.07E-07	8.62E-04	3.10E-03	3.95E-02	5.34E-01	9.87E-03	1.06E+01	2.67E-01	9.64E-01	8.21E-01	4.80E-02	2.06E-01
2004	5	9	6.53E-01	1.02E-01	2.97E-01	1.65E-02	3.68E-02	4.03E+00	9.91E-01	3.03E+00	1.63E-01	2.23E+00	8.80E-01	2.60E-01	2.52E-01	4.12E+00	1.38E+00	6.53E-01	3.83E-03	2.94E-01	1.37E-03	3.00E-03	4.03E+00	9.85E-01	2.89E+00	1.20E-02	5.78E-03	1.09E-02	9.65E-03	5.75E-03	4.12E+00	1.38E+00	0.00E+00	9.78E-02	3.90E-03	1.51E-02	3.38E-02	4.78E-03	6.02E-03	1.40E-01	1.51E-01	2.22E+00	8.69E-01	2.50E-01	2.46E-01	0.00E+00	0.00E+00
2004	5	10	4.91E+00	9.43E-02	2.27E+00	8.84E-05	2.99E-05	6.22E+00	1.77E-01	7.53E+00	1.21E+00	3.98E-03	1.63E-03	9.29E-04	1.20E-03	1.21E+01	5.54E+00	4.76E+00	6.07E-03	2.07E+00	8.84E-05	2.99E-05	6.09E+00	1.77E-01	7.53E+00	2.46E-02	2.03E-03	1.63E-03	9.29E-04	1.20E-03	1.21E+01	5.30E+00	1.58E-01	8.82E-02	1.98E-01	0.00E+00	0.00E+00	1.38E-01	1.46E-06	1.07E-03	1.18E+00	1.95E-03	1.40E-11	0.00E+00	4.81E-20	7.56E-04	2.41E-01
2004	5	11	5.89E+00	0.00E+00	2.57E+00	0.00E+00	0.00E+00	7.12E+00	1.32E-02	7.65E+00	2.96E+00	1.97E-05	0.00E+00	0.00E+00	1.20E-20	1.10E+01	6.58E+00	5.82E+00	0.00E+00	2.34E+00	0.00E+00	0.00E+00	6.90E+00	1.32E-02	7.65E+00	3.94E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E+01	6.40E+00	6.35E-02	0.00E+00	2.33E-01	0.00E+00	0.00E+00	2.14E-01	0.00E+00	3.55E-04	2.96E+00	1.97E-05	0.00E+00	0.00E+00	1.20E-20	7.95E-04	1.74E-01
2004	5	12	7.10E+00	7.84E-05	3.95E+00	0.00E+00	0.00E+00	8.83E+00	1.65E+00	1.08E+01	2.61E+00	7.19E-04	9.42E-04	3.62E-03	1.47E-03	1.53E+01	9.29E+00	7.09E+00	0.00E+00	3.93E+00	0.00E+00	0.00E+00	8.78E+00	1.65E+00	1.08E+01	3.13E-02	7.18E-04	1.41E-05	3.62E-03	1.47E-03	1.53E+01	9.28E+00	1.76E-03	7.84E-05	2.39E-02	0.00E+00	0.00E+00	5.03E-02	0.00E+00	0.00E+00	2.58E+00	6.52E-07	9.28E-04	0.00E+00	0.00E+00	0.00E+00	1.14E-02
2004	5	13	1.58E+01	1.34E+00	7.90E+00	5.59E-01	4.98E-01	2.15E+01	8.15E+00	2.83E+01	1.55E+00	6.19E+00	1.22E+01	4.06E-01	1.18E+00	2.65E+01	2.28E+01	1.56E+01	9.31E-02	7.81E+00	3.13E-02	3.79E-02	2.13E+01	8.12E+00	2.82E+01	4.09E-01	1.23E-01	9.56E-02	1.30E-01	1.16E-01	2.65E+01	2.25E+01	1.59E-01	1.25E+00	8.31E-02	5.27E-01	4.61E-01	1.85E-01	3.39E-02	7.96E-02	1.14E+00	6.07E+00	1.21E+01	2.76E-01	1.06E+00	4.63E-02	3.47E-01
2004	5	14	2.60E+00	1.93E-01	1.72E+00	6.09E-02	1.07E-01	2.03E+01	6.86E+00	1.97E+01	4.25E-01	9.27E+00	1.33E+00	1.25E+00	1.18E+00	1.87E+01	3.35E+00	2.56E+00	3.18E-02	1.71E+00	9.61E-03	1.72E-02	2.03E+01	6.82E+00	1.85E+01	4.02E-01	1.20E-01	6.26E-02	2.59E-01	1.74E-01	1.86E+01	3.25E+00	3.96E-02	1.61E-01	6.06E-03	5.13E-02	9.01E-02	1.16E-02	4.46E-02	1.22E+00	2.32E-02	9.15E+00	1.27E+00	9.93E-01	1.01E+00	1.00E-01	1.03E-01
2004	5	15	8.45E+00	1.85E-01	4.32E+00	2.47E-02	1.82E-02	2.41E+01	7.07E+00	2.44E+01	2.98E+00	1.20E+01	5.78E-02	2.42E+00	3.93E+00	3.38E+01	1.05E+01	8.08E+00	1.48E-02	4.22E+00	4.64E-03	5.23E-03	2.40E+01	6.87E+00	2.35E+01	3.29E-01	6.05E-02	2.06E-02	1.71E-01	1.07E-01	3.36E+01	9.75E+00	3.74E-01	1.71E-01	9.61E-02	2.01E-02	1.30E-02	9.39E-02	1.98E-01	9.35E-01	2.65E+00	1.20E+01	3.72E-02	2.25E+00	3.82E+00	2.45E-01	7.31E-01
2004	5	16	1.41E+01	3.49E-01	8.11E+00	2.03E-02	3.94E-02	2.38E+01	5.77E+00	2.56E+01	7.79E+00	3.20E+00	1.09E+00	2.22E+00	1.85E+00	2.45E+01	1.83E+01	1.32E+01	3.69E-02	7.68E+00	5.58E-03	1.24E-02	2.34E+01	5.22E+00	2.47E+01	7.23E-01	1.51E-01	7.06E-02	2.73E-01	2.02E-01	2.38E+01	1.72E+01	8.41E-01	3.12E-01	4.26E-01	1.47E-02	2.70E-02	4.94E-01	5.43E-01	9.69E-01	7.07E+00	3.05E+00	1.02E+00	1.94E+00	1.64E+00	6.83E-01	1.09E+00
2004	5	17	1.18E+01	1.57E-01	5.52E+00	1.02E-02	2.10E-02	2.53E+01	6.84E+00	3.15E+01	6.71E+00	1.57E+00	5.80E-01	1.78E+00	1.33E+00	3.41E+01	1.57E+01	1.08E+01	2.89E-02	5.14E+00	7.58E-03	1.42E-02	2.49E+01	5.94E+00	3.00E+01	6.12E-01	1.27E-01	5.89E-02	2.52E-01	1.73E-01	3.31E+01	1.44E+01	9.90E-01	1.28E-01	3.83E-01	2.57E-03	6.79E-03	4.69E-01	8.98E-01	1.53E+00	6.10E+00	1.45E+00	5.21E-01	1.53E+00	1.16E+00	9.92E-01	1.28E+00
2004	5	18	7.87E+00	5.07E-01	5.43E+00	2.64E-02	4.75E-02	1.97E+01	9.05E+00	2.53E+01	7.13E+00	3.88E+00	1.14E+00	1.64E+00	1.69E+00	2.73E+01	1.12E+01	6.85E+00	3.29E-02	4.15E+00	7.59E-03	1.36E-02	1.83E+01	8.67E+00	2.39E+01	4.90E-01	1.23E-01	5.82E-02	2.59E-01	1.75E-01	2.65E+01	1.00E+01	1.02E+00	4.74E-01	1.27E+00	1.88E-02	3.39E-02	1.45E+00	3.80E-01	1.37E+00	6.64E+00	3.75E+00	1.08E+00	1.38E+00	1.51E+00	7.72E-01	1.17E+00
2004	5	19	9.31E+00	1.04E-02	4.31E+00	1.27E-03	2.44E-03	2.45E+01	5.29E+00	3.36E+01	2.74E+00	3.56E+00	1.39E-01	1.54E+00	1.56E+00	3.18E+01	1.17E+01	8.81E+00	2.31E-03	4.23E+00	4.50E-04	1.14E-03	2.44E+01	4.94E+00	3.22E+01	2.55E-01	2.78E-02	7.79E-03	9.02E-02	4.95E-02	3.13E+01	1.10E+01	4.94E-01	8.06E-03	8.22E-02	8.17E-04	1.31E-03	8.76E-02	3.43E-01	1.39E+00	2.48E+00	3.53E+00	1.31E-01	1.45E+00	1.51E+00	5.19E-01	7.34E-01
2004	5	20	9.20E+00	2.08E+00	4.81E+00	4.96E-01	4.45E-01	2.05E+01	9.45E+00	2.17E+01	3.45E+00	5.77E+00	8.26E+00	9.11E-01	1.23E+00	1.79E+01	1.23E+01	8.87E+00	7.47E-02	4.19E+00	2.91E-02	4.36E-02	2.02E+01	9.38E+00	2.14E+01	6.54E-01	2.21E-01	1.27E-01	3.82E-01	2.87E-01	1.78E+01	1.16E+01	3.36E-01	2.01E+00	6.22E-01	4.67E-01	4.02E-01	2.88E-01	6.52E-02	3.99E-01	2.79E+00	5.54E+00	8.14E+00	5.28E-01	9.42E-01	1.27E-01	6.24E-01
2004	5	21	1.41E+01	9.21E-07	8.74E+00	0.00E+00	0.00E+00	1.63E+01	9.07E-02	1.19E+01	5.08E+00	1.09E-04	1.26E-05	3.55E-04	1.78E-04	2.13E+01	1.54E+01	1.38E+01	9.21E-07	8.12E+00	0.00E+00	0.00E+00	1.60E+01	9.06E-02	1.19E+01	3.16E-02	4.99E-05	9.22E-07	3.49E-04	1.53E-04	2.13E+01	1.49E+01	2.46E-01	0.00E+00	6.14E-01	0.00E+00	0.00E+00	3.65E-01	8.07E-06	3.37E-03	5.04E+00	5.92E-05	1.17E-05	5.78E-06	2.42E-05	1.78E-03	5.10E-01
2004	5	22	7.84E+00	0.00E+00	5.70E+00	0.00E+00	0.00E+00	1.27E+01	4.19E-02	1.34E+01	3.83E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E+01	8.83E+00	7.59E+00	0.00E+00	5.05E+00	0.00E+00	0.00E+00	1.23E+01	4.19E-02	1.34E+01	1.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E+01	8.33E+00	2.47E-01	0.00E+00	6.48E-01	0.00E+00	0.00E+00	3.63E-01	0.00E+00	2.86E-04	3.83E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-05	5.01E-01
2004	5	23	1.49E+01	7.61E-05	9.41E+00	0.00E+00	1.42E-07	1.56E+01	1.18E-02	1.63E+01	6.41E+00	2.62E-03	3.82E-04	5.67E-03	3.93E-03	1.91E+01	1.75E+01	1.45E+01	7.48E-05	7.90E+00	0.00E+00	1.42E-07	1.46E+01	1.16E-02	1.63E+01	5.74E-02	2.38E-03	3.66E-04	5.43E-03	3.75E-03	1.91E+01	1.66E+01	4.19E-01	1.33E-06	1.51E+00	0.00E+00	0.00E+00	9.71E-01	1.76E-04	1.12E-02	6.36E+00	2.33E-04	1.52E-05	2.38E-04	1.79E-04	5.19E-03	8.47E-01
2004	5	24	8.49E+00	7.57E-01	4.78E+00	4.11E-01	5.57E-01	2.67E+01	1.23E+01	3.02E+01	3.97E+00	1.89E+01	5.29E+00	3.65E+00	5.66E+00	3.26E+01	1.11E+01	8.03E+00	4.64E-02	4.33E+00	2.43E-02	3.87E-02	2.63E+01	1.19E+01	2.90E+01	6.55E-01	2.06E-01	1.04E-01	3.86E-01	2.80E-01	3.22E+01	1.03E+01	4.56E-01	7.11E-01	4.51E-01	3.87E-01	5.18E-01	4.11E-01	3.56E-01	1.19E+00	3.31E+00	1.87E+01	5.19E+00	3.26E+00	5.38E+00	3.88E-01	8.17E-01
2004	5	25	7.05E-01	6.38E-03	9.51E-01	1.58E-03	4.10E-03	1.65E+01	7.80E+00	1.76E+01	3.27E-01	1.58E+01	1.33E-01	1.28E+00	1.07E+00	2.08E+01	8.76E-01	7.02E-01	6.37E-03	9.51E-01	1.57E-03	4.06E-03	1.65E+01	7.75E+00	1.67E+01	3.26E-01	7.07E-02	2.21E-02	1.66E-01	1.17E-01	2.06E+01	8.62E-01	2.69E-03	1.71E-05	5.46E-05	1.21E-05	3.08E-05	8.25E-05	5.05E-02	9.02E-01	1.52E-03	1.57E+01	1.11E-01	1.11E+00	9.54E-01	1.55E-01	1.35E-02
2004	5	26	1.00E+00	0.00E+00	1.69E-01	0.00E+00	3.34E-06	5.12E+00	2.34E+00	7.56E+00	3.64E-03	3.92E+00	1.11E-01	6.21E-01	7.38E-01	5.51E+00	1.28E+00	1.00E+00	0.00E+00	1.69E-01	0.00E+00	0.00E+00	5.12E+00	2.31E+00	7.09E+00	3.64E-03	5.28E-04	0.00E+00	9.67E-03	2.76E-03	5.49E+00	1.26E+00	1.75E-03	0.00E+00	0.00E+00	0.00E+00	3.34E-06	0.00E+00	2.95E-02	4.70E-01	4.55E-18	3.92E+00	1.11E-01	6.11E-01	7.35E-01	2.00E-02	1.36E-02
2004	5	27	2.18E+00	1.75E-03	9.69E-01	6.14E-04	2.13E-02	1.36E+01	5.00E+00	1.75E+01	4.30E-01	4.32E+00	1.04E+00	5.37E-01	1.07E+00	1.10E+01	4.05E+00	2.15E+00	1.75E-03	9.69E-01	6.14E-04	3.52E-03	1.36E+01	4.96E+00	1.65E+01	4.29E-01	8.79E-02	2.44E-02	1.08E-01	1.14E-01	1.09E+01	3.93E+00	2.99E-02	0.00E+00	7.20E-05	2.18E-08	1.78E-02	1.25E-03	4.79E-02	1.06E+00	8.68E-04	4.23E+00	1.02E+00	4.28E-01	9.55E-01	9.78E-02	1.21E-01
2004	5	28	1.38E+00	8.95E-04	8.45E-01	3.11E-04	6.20E-03	1.31E+01	3.07E+00	1.07E+01	3.13E-01	3.00E+00	4.75E-01	2.79E-01	9.06E-01	8.44E+00	2.44E+00	1.34E+00	8.47E-04	8.45E-01	3.10E-04	2.61E-03	1.31E+01	3.05E+00	1.00E+01	3.07E-01	8.00E-02	2.15E-02	1.24E-01	1.10E-01	8.39E+00	2.34E+00	4.82E-02	4.74E-05	4.90E-04	9.50E-07	3.59E-03	1.16E-03	2.15E-02	6.90E-01	5.81E-03	2.92E+00	4.53E-01	1.55E-01	7.96E-01	4.18E-02	1.02E-01
2004	5	29	3.77E-01	0.00E+00	1.14E-01	0.00E+00	0.00E+00	7.43E+00	1.61E+00	6.90E+00	1.77E-02	4.23E+00	1.16E-02	6.72E-01	5.28E-01	4.22E+00	1.03E+00	3.77E-01	0.00E+00	1.14E-01	0.00E+00	0.00E+00	7.43E+00	1.59E+00	6.26E+00	1.77E-02	2.58E-05	0.00E+00	2.96E-02	2.62E-03	4.21E+00	1.03E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-02	6.36E-01	7.31E-16	4.23E+00	1.16E-02	6.42E-01	5.25E-01	9.68E-03	0.00E+00
2004	5	30	1.39E-01	0.00E+00	1.66E-02	0.00E+00	0.00E+00	3.30E+00	1.27E+00	3.97E+00	8.83E-16	2.67E+00	8.26E-02	4.47E-01	4.54E-01	2.60E+00	3.07E-01	1.39E-01	0.00E+00	1.66E-02	0.00E+00	0.00E+00	3.30E+00	1.26E+00	3.53E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-04	0.00E+00	2.60E+00	3.07E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.41E-03	4.39E-01	8.83E-16	2.67E+00	8.26E-02	4.47E-01	4.54E-01	0.00E+00	0.00E+00
2004	5	31	6.48E-01	1.16E-04	8.96E-01	0.00E+00	9.75E-05	1.23E+01	4.16E+00	1.52E+01	1.15E-01	8.73E+00	1.78E-02	9.01E-01	9.97E-01	9.87E+00	1.95E+00	5.38E-01	1.16E-04	8.96E-01	0.00E+00	9.75E-05	1.23E+01	4.12E+00	1.44E+01	1.15E-01	1.79E-02	3.73E-03	3.32E-02	2.55E-02	9.85E+00	1.73E+00	1.10E-01	0.00E+00	1.82E-04	0.00E+00	0.00E+00	8.39E-04	3.96E-02	7.72E-01	2.57E-05	8.71E+00	1.41E-02	8.67E-01	9.72E-01	2.45E-02	2.24E-01
2004	6	1	8.49E-01	9.21E-04	1.46E+00	6.17E-05	7.99E-04	2.05E+01	6.41E+00	2.03E+01	2.10E-01	9.41E+00	1.93E-01	9.23E-01	1.17E+00	2.37E+01	2.43E+00	8.42E-01	9.21E-04	1.46E+00	6.17E-05	6.05E-04	2.05E+01	6.36E+00	1.93E+01	2.09E-01	3.89E-02	9.84E-03	1.01E-01	6.33E-02	2.36E+01	2.39E+00	7.44E-03	0.00E+00	0.00E+00	0.00E+00	1.94E-04	6.89E-06	4.68E-02	1.03E+00	2.84E-04	9.37E+00	1.84E-01	8.22E-01	1.10E+00	9.05E-02	3.21E-02
2004	6	2	1.12E+00	2.40E-03	1.47E+00	2.33E-02	8.31E-02	2.90E+01	1.12E+01	2.38E+01	3.14E-01	1.59E+01	4.21E-01	1.70E+00	1.64E+00	3.80E+01	1.68E+00	1.12E+00	2.40E-03	1.47E+00	4.78E-04	1.92E-03	2.90E+01	1.11E+01	2.23E+01	3.13E-01	6.69E-02	1.72E-02	1.97E-01	1.25E-01	3.78E+01	1.66E+00	3.51E-03	0.00E+00	0.00E+00	2.28E-02	8.12E-02	0.00E+00	7.45E-02	1.53E+00	6.73E-04	1.59E+01	4.04E-01	1.50E+00	1.52E+00	2.46E-01	1.71E-02
2004	6	3	7.76E+00	7.71E-01	4.65E+00	3.67E-02	6.43E-02	2.45E+01	7.91E+00	2.77E+01	3.65E+00	5.72E+00	1.18E+00	1.31E+00	1.28E+00	3.19E+01	1.12E+01	7.08E+00	2.86E-02	4.46E+00	8.74E-03	1.39E-02	2.42E+01	7.26E+00	2.65E+01	5.12E-01	9.97E-02	4.86E-02	1.94E-01	1.31E-01	3.12E+01	1.03E+01	6.76E-01	7.43E-01	1.97E-01	2.79E-02	5.04E-02	2.87E-01	6.47E-01	1.12E+00	3.14E+00	5.62E+00	1.13E+00	1.12E+00	1.15E+00	6.42E-01	8.63E-01
2004	6	4	3.34E+00	9.15E-01	1.84E+00	1.24E-01	1.73E-01	2.52E+01	1.15E+01	3.33E+01	1.43E+00	1.87E+01	2.35E+00	2.83E+00	3.85E+00	2.91E+01	5.22E+00	3.15E+00	3.43E-02	1.80E+00	8.52E-03	1.80E-02	2.51E+01	1.11E+01	3.20E+01	5.31E-01	1.82E-01	7.92E-02	4.06E-01	2.79E-01	2.88E+01	4.92E+00	1.94E-01	8.81E-01	4.51E-02	1.16E-01	1.55E-01	8.42E-02	3.76E-01	1.33E+00	9.02E-01	1.85E+01	2.27E+00	2.42E+00	3.58E+00	3.73E-01	2.98E-01
2004	6	5	2.78E+00	5.27E-01	1.25E+00	2.06E-01	2.98E-01	2.31E+01	7.49E+00	2.01E+01	4.85E-01	9.30E+00	2.88E+00	9.78E-01	1.30E+00	2.29E+01	3.43E+00	2.75E+00	3.47E-02	1.25E+00	1.35E-02	2.61E-02	2.31E+01	7.46E+00	1.92E+01	4.26E-01	1.60E-01	8.24E-02	2.80E-01	2.16E-01	2.27E+01	3.37E+00	2.53E-02	4.92E-01	1.04E-03	1.93E-01	2.72E-01	2.60E-03	3.56E-02	8.64E-01	5.95E-02	9.14E+00	2.80E+00	6.98E-01	1.08E+00	1.87E-01	6.76E-02
2004	6	6	2.15E-01	0.00E+00	5.98E-02	0.00E+00	2.47E-04	2.99E+00	8.92E-01	3.30E+00	1.54E-03	1.84E+00	3.22E-01	1.45E-01	4.69E-01	2.23E+00	3.98E-01	2.15E-01	0.00E+00	5.98E-02	0.00E+00	0.00E+00	2.99E+00	8.91E-01	3.18E+00	1.54E-03	2.01E-04	0.00E+00	1.04E-02	5.15E-03	2.22E+00	3.98E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-04	0.00E+00	1.39E-03	1.22E-01	1.57E-20	1.84E+00	3.22E-01	1.35E-01	4.63E-01	3.87E-03	0.00E+00
2004	6	7	5.26E+00	0.00E+00	2.49E+00	0.00E+00	0.00E+00	8.36E+00	1.02E+00	1.16E+01	1.72E+00	5.07E+00	2.55E-03	4.39E-01	8.07E-01	9.31E+00	7.19E+00	4.74E+00	0.00E+00	2.23E+00	0.00E+00	0.00E+00	8.08E+00	9.15E-01	1.11E+01	3.47E-02	2.69E-03	6.50E-05	1.02E-02	6.68E-03	9.07E+00	6.47E+00	5.19E-01	0.00E+00	2.55E-01	0.00E+00	0.00E+00	2.79E-01	1.04E-01	4.78E-01	1.68E+00	5.07E+00	2.48E-03	4.29E-01	8.01E-01	2.50E-01	7.27E-01
2004	6	8	1.30E+01	4.47E-04	6.63E+00	0.00E+00	4.12E-05	1.67E+01	1.15E-01	1.20E+01	1.43E+00	5.85E-03	1.81E-03	1.38E-02	8.51E-03	1.65E+01	1.40E+01	1.24E+01	4.34E-04	6.41E+00	0.00E+00	4.12E-05	1.66E+01	1.15E-01	1.19E+01	9.73E-02	5.74E-03	1.77E-03	1.36E-02	8.37E-03	1.65E+01	1.30E+01	5.87E-01	1.24E-05	2.26E-01	0.00E+00	0.00E+00	1.15E-01	1.62E-04	3.40E-02	1.34E+00	1.13E-04	4.17E-05	1.91E-04	1.41E-04	1.89E-02	9.86E-01
2004	6	9	1.60E+01	3.53E-02	8.72E+00	6.03E-06	4.84E-05	2.01E+01	9.26E-01	1.82E+01	4.68E+00	1.67E-02	1.53E-01	3.01E-02	2.11E-02	2.48E+01	1.88E+01	1.55E+01	1.31E-03	8.46E+00	6.03E-06	4.84E-05	1.99E+01	9.25E-01	1.81E+01	2.13E-01	1.49E-02	4.17E-03	2.85E-02	2.00E-02	2.47E+01	1.79E+01	5.42E-01	3.40E-02	2.67E-01	0.00E+00	1.87E-08	1.98E-01	9.50E-04	1.06E-01	4.47E+00	1.82E-03	1.48E-01	1.62E-03	1.07E-03	4.89E-02	9.63E-01
2004	6	10	8.24E+00	9.41E-01	4.06E+00	8.71E-02	1.18E-01	1.69E+01	5.06E+00	1.78E+01	4.20E+00	6.37E+00	1.95E+00	8.79E-01	1.06E+00	2.02E+01	1.10E+01	7.94E+00	4.07E-02	3.94E+00	8.81E-03	1.39E-02	1.67E+01	5.03E+00	1.73E+01	4.60E-01	1.11E-01	5.73E-02	1.85E-01	1.41E-01	2.01E+01	1.03E+01	3.00E-01	9.00E-01	1.21E-01	7.82E-02	1.04E-01	1.15E-01	3.09E-02	5.05E-01	3.73E+00	6.26E+00	1.89E+00	6.93E-01	9.16E-01	1.08E-01	6.45E-01
2004	6	11	3.16E-01	0.00E+00	4.46E-03	0.00E+00	0.00E+00	3.37E+00	1.53E+00	4.11E+00	1.44E-16	5.19E+00	1.24E-02	6.60E-01	5.91E-01	3.70E+00	4.29E-01	3.16E-01	0.00E+00	4.46E-03	0.00E+00	0.00E+00	3.37E+00	1.50E+00	3.57E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.70E+00	4.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-02	5.40E-01	1.44E-16	5.19E+00	1.24E-02	6.60E-01	5.91E-01	8.48E-06	0.00E+00
2004	6	12	3.44E-01	0.00E+00	1.02E-01	0.00E+00	0.00E+00	6.11E+00	1.82E+00	6.78E+00	3.74E-05	3.13E+00	9.83E-02	5.28E-01	5.71E-01	4.99E+00	7.00E-01	3.44E-01	0.00E+00	1.02E-01	0.00E+00	0.00E+00	6.11E+00	1.80E+00	6.17E+00	3.74E-05	0.00E+00	0.00E+00	1.82E-02	1.32E-03	4.99E+00	7.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E-02	6.14E-01	5.47E-16	3.13E+00	9.83E-02	5.10E-01	5.70E-01	3.36E-03	0.00E+00
2004	6	13	1.18E-01	0.00E+00	5.88E-02	0.00E+00	0.00E+00	4.11E+00	1.69E+00	5.19E+00	6.14E-06	2.79E+00	1.28E-01	4.14E-01	4.67E-01	3.60E+00	4.66E-01	1.18E-01	0.00E+00	5.88E-02	0.00E+00	0.00E+00	4.11E+00	1.68E+00	4.65E+00	6.14E-06	0.00E+00	0.00E+00	1.45E-03	1.73E-05	3.59E+00	4.66E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.54E-03	5.37E-01	4.10E-16	2.79E+00	1.28E-01	4.13E-01	4.67E-01	8.07E-03	0.00E+00
2004	6	14	4.04E+00	1.59E-03	1.98E+00	1.07E-04	1.40E-03	1.76E+01	3.77E+00	1.67E+01	3.73E-01	4.60E+00	1.48E-01	5.18E-01	1.04E+00	1.43E+01	5.67E+00	3.90E+00	1.37E-03	1.96E+00	8.92E-05	1.34E-03	1.75E+01	3.75E+00	1.63E+01	3.45E-01	7.87E-02	2.22E-02	1.31E-01	1.05E-01	1.42E+01	5.29E+00	1.40E-01	2.29E-04	2.11E-02	1.81E-05	6.10E-05	6.02E-02	2.05E-02	4.05E-01	2.77E-02	4.52E+00	1.25E-01	3.88E-01	9.37E-01	3.22E-02	3.80E-01
2004	6	15	3.34E+00	3.87E-02	1.76E+00	7.25E-03	3.64E-02	1.94E+01	7.40E+00	2.60E+01	1.37E+00	1.75E+01	7.59E-01	3.35E+00	4.90E+00	2.53E+01	4.50E+00	3.12E+00	4.70E-03	1.73E+00	7.30E-04	2.34E-03	1.93E+01	7.16E+00	2.49E+01	2.98E-01	5.51E-02	1.78E-02	1.42E-01	9.03E-02	2.51E+01	4.06E+00	2.25E-01	3.40E-02	2.84E-02	6.52E-03	3.41E-02	6.47E-02	2.41E-01	1.12E+00	1.07E+00	1.74E+01	7.41E-01	3.21E+00	4.81E+00	1.71E-01	4.35E-01
2004	6	16	6.66E+00	1.83E-01	3.34E+00	3.51E-02	6.14E-02	2.56E+01	6.57E+00	2.25E+01	1.72E+00	1.39E+01	5.06E-01	1.81E+00	1.59E+00	2.98E+01	8.95E+00	6.33E+00	1.07E-02	3.00E+00	3.06E-03	7.63E-03	2.52E+01	6.33E+00	2.14E+01	3.20E-01	8.29E-02	3.33E-02	1.88E-01	1.31E-01	2.94E+01	8.49E+00	3.34E-01	1.72E-01	3.39E-01	3.21E-02	5.38E-02	3.85E-01	2.42E-01	1.06E+00	1.40E+00	1.38E+01	4.72E-01	1.63E+00	1.46E+00	3.93E-01	4.57E-01
2004	6	17	1.75E+01	1.58E-03	9.88E+00	2.14E-07	1.14E-05	1.85E+01	8.42E-01	2.15E+01	1.10E+01	5.19E-02	3.56E-02	7.24E-02	5.56E-02	2.57E+01	2.08E+01	1.69E+01	4.90E-04	8.10E+00	2.13E-07	1.13E-05	1.72E+01	8.19E-01	2.13E+01	2.01E-01	9.64E-03	2.45E-03	2.20E-02	1.46E-02	2.55E+01	1.98E+01	5.93E-01	1.09E-03	1.78E+00	4.70E-10	1.17E-07	1.31E+00	2.25E-02	1.84E-01	1.08E+01	4.23E-02	3.32E-02	5.04E-02	4.10E-02	1.40E-01	9.70E-01
2004	6	18	1.49E+01	6.48E-02	9.17E+00	2.05E-04	7.23E-04	1.98E+01	1.68E+00	1.81E+01	4.77E+00	5.11E-02	1.33E-01	7.37E-02	5.07E-02	2.09E+01	1.75E+01	1.44E+01	4.32E-03	8.82E+00	2.04E-04	7.19E-04	1.96E+01	1.68E+00	1.80E+01	2.58E-01	3.03E-02	1.04E-02	6.71E-02	4.37E-02	2.08E+01	1.66E+01	5.23E-01	6.05E-02	3.45E-01	1.11E-06	3.93E-06	2.19E-01	2.07E-03	1.05E-01	4.51E+00	2.07E-02	1.23E-01	6.65E-03	6.99E-03	4.08E-02	9.65E-01
2004	6	19	8.85E+00	2.97E-01	5.48E+00	1.54E-01	1.54E-01	1.82E+01	3.15E+00	1.92E+01	2.71E+00	2.71E+00	4.08E+00	2.89E-01	3.18E-01	2.41E+01	1.06E+01	8.45E+00	1.11E-02	4.97E+00	3.75E-03	9.17E-03	1.78E+01	3.13E+00	1.88E+01	4.04E-01	9.77E-02	3.84E-02	1.71E-01	1.38E-01	2.41E+01	9.96E+00	4.08E-01	2.86E-01	5.04E-01	1.50E-01	1.45E-01	4.54E-01	1.72E-02	3.89E-01	2.31E+00	2.61E+00	4.04E+00	1.18E-01	1.80E-01	8.19E-02	6.56E-01
2004	6	20	5.55E+00	7.34E-02	2.36E+00	1.87E-03	5.75E-03	2.63E+01	7.90E+00	3.68E+01	3.59E+00	9.08E+00	4.05E-01	1.33E+00	1.12E+00	3.22E+01	8.55E+00	5.19E+00	7.68E-03	1.92E+00	1.04E-03	2.78E-03	2.58E+01	7.63E+00	3.54E+01	3.05E-01	5.55E-02	2.04E-02	1.65E-01	9.57E-02	3.17E+01	7.96E+00	3.56E-01	6.57E-02	4.35E-01	8.29E-04	2.96E-03	4.10E-01	2.73E-01	1.39E+00	3.28E+00	9.02E+00	3.85E-01	1.17E+00	1.03E+00	4.96E-01	5.90E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	6	21	4.45E+00	3.27E-01	2.31E+00	1.14E-01	2.52E-01	2.30E+01	1.12E+01	2.69E+01	1.94E+00	1.73E+01	2.85E+00	3.45E+00	3.53E+00	2.52E+01	6.85E+00
2004	6	22	9.47E+00	9.73E-01	4.75E+00	8.91E-02	1.75E-01	1.82E+01	5.69E+00	1.91E+01	3.59E+00	3.23E+00	4.08E+00	3.26E-01	4.37E-01	2.14E+01	1.21E+01
2004	6	23	8.43E+00	5.37E-01	4.39E+00	1.61E-01	2.37E-01	1.81E+01	5.34E+00	2.20E+01	6.51E+00	1.04E+01	1.30E+00	2.52E+00	4.52E+00	1.63E+01	9.90E+00
2004	6	24	1.16E+01	2.27E-01	4.59E+00	3.17E-05	9.76E-05	1.58E+01	1.54E+00	2.08E+01	4.89E+00	9.66E-02	8.99E-01	7.45E-02	5.91E-02	3.06E+01	1.66E+01
2004	6	25	1.40E+01	2.16E-02	7.46E+00	3.58E-04	6.61E-04	1.95E+01	3.42E-01	2.01E+01	8.58E+00	3.10E-02	7.95E-03	5.35E-02	3.64E-02	2.90E+01	1.81E+01
2004	6	26	1.23E+01	5.61E-03	7.93E+00	4.47E-04	1.07E-03	1.77E+01	6.45E-01	1.95E+01	1.04E+01	1.04E-01	1.80E-02	1.97E-01	1.48E-01	2.07E+01	1.45E+01
2004	6	27	1.46E+01	1.17E-02	6.52E+00	2.16E-05	9.15E-05	1.76E+01	8.97E-01	1.82E+01	5.92E+00	3.47E-02	4.74E-02	5.37E-02	4.21E-02	2.57E+01	1.95E+01
2004	6	28	8.50E+00	6.29E-01	4.79E+00	8.70E-02	1.32E-01	2.47E+01	8.94E+00	3.02E+01	3.32E+00	1.57E+01	1.47E+00	1.35E+00	2.67E+00	3.37E+01	1.08E+01
2004	6	29	7.67E+00	1.62E+00	4.14E+00	1.11E-01	1.80E-01	1.75E+01	9.46E+00	2.31E+01	2.37E+00	1.66E+01	2.43E+00	1.39E+00	2.22E+00	2.39E+01	1.09E+01
2004	6	30	6.62E+00	3.86E-01	3.01E+00	1.23E-01	2.05E-01	1.74E+01	8.09E+00	2.20E+01	3.51E+00	9.05E+00	1.74E+00	1.31E+00	2.58E+00	2.00E+01	9.16E+00
2004	7	1	2.19E+00	1.04E-03	1.38E+00	4.02E-04	3.80E-03	1.45E+01	6.96E+00	1.37E+01	1.63E-01	1.10E+01	2.97E-01	9.97E-01	1.25E+00	1.30E+01	4.29E+00
2004	7	2	3.48E+00	3.44E-04	1.22E+00	3.99E-05	2.79E-04	1.97E+01	7.27E+00	1.56E+01	2.29E-01	1.22E+01	1.43E-01	1.34E+00	1.06E+00	1.98E+01	4.99E+00
2004	7	3	3.19E+00	5.32E-03	2.04E+00	1.36E-03	3.21E-02	2.11E+01	6.41E+00	1.57E+01	2.87E-01	7.92E+00	7.22E-01	9.13E-01	9.06E-01	1.85E+01	5.08E+00
2004	7	4	8.65E+00	2.68E-03	4.18E+00	1.67E-04	4.49E-04	1.60E+01	1.73E+00	2.17E+01	7.44E+00	2.88E+00	1.11E-02	2.13E+00	2.60E+00	2.45E+01	1.31E+01
2004	7	5	9.42E+00	2.12E+00	4.52E+00	2.82E-01	3.00E-01	1.63E+01	6.64E+00	1.94E+01	3.39E+00	7.51E+00	4.22E+00	8.29E-01	1.43E+00	1.54E+01	1.17E+01
2004	7	6	2.43E+00	3.84E-05	1.03E+00	4.59E-06	2.64E-04	7.63E+00	3.16E+00	6.40E+00	9.26E-02	3.94E+00	2.46E-01	4.09E-01	7.97E-01	7.11E+00	3.50E+00
2004	7	7	2.07E-01	0.00E+00	1.26E-01	0.00E+00	0.00E+00	9.26E+00	1.85E+00	7.55E+00	1.13E-01	4.05E+00	1.02E-01	5.89E-01	5.62E-01	4.83E+00	6.71E-01
2004	7	8	3.07E-01	3.05E-04	2.37E-01	5.95E-05	1.47E-04	1.34E+01	1.70E+00	9.93E+00	2.47E-01	2.63E+00	8.42E-02	3.20E-01	7.12E-01	6.54E+00	7.87E-01
2004	7	9	7.77E-01	8.18E-06	1.10E-01	1.08E-02	1.57E-01	5.62E+00	4.48E+00	9.57E+00	3.06E-03	1.01E+01	5.34E-01	1.02E+00	1.00E+00	8.66E+00	1.24E+00
2004	7	10	4.53E-01	1.37E-01	5.14E-01	2.11E-01	5.04E-01	8.20E+00	7.02E+00	1.07E+01	2.59E-02	9.43E+00	5.29E+00	1.25E+00	1.89E+00	1.01E+01	1.17E+00
2004	7	11	8.42E-01	2.28E-04	6.28E-01	1.22E-05	3.30E-03	1.02E+01	1.97E+00	1.07E+01	1.16E-01	3.01E+00	4.13E-01	2.73E-01	5.50E-01	8.74E+00	9.55E-01
2004	7	12	3.23E+00	1.03E+00	1.24E+00	7.76E-02	8.29E-02	1.98E+01	6.69E+00	2.29E+01	5.22E-01	1.30E+01	2.79E+00	1.47E+00	1.45E+00	1.68E+01	4.78E+00
2004	7	13	4.82E+00	1.57E+00	3.06E+00	5.56E-02	9.20E-02	9.04E+00	9.51E+00	1.17E+01	4.56E+00	9.37E+00	4.63E+00	3.93E+00	5.66E+00	1.31E+01	6.33E+00
2004	7	14	7.16E+00	2.48E-02	2.93E+00	3.27E-03	1.02E-02	2.01E+01	5.36E+00	2.72E+01	2.69E+00	1.25E+01	7.51E-02	1.63E+00	3.17E+00	2.22E+01	9.06E+00
2004	7	15	8.70E+00	5.85E-02	4.13E+00	1.37E-02	2.29E-02	1.48E+01	1.38E+00	1.78E+01	2.36E+00	1.51E+00	1.06E-01	1.69E+00	1.13E+00	1.74E+01	1.07E+01
2004	7	16	7.98E+00	1.29E-01	1.89E+00	7.48E-02	3.09E-01	1.50E+01	1.03E+01	2.19E+01	1.22E+00	1.45E+01	2.65E+00	1.88E+00	3.04E+00	1.98E+01	9.84E+00
2004	7	17	2.79E+00	1.08E-02	1.27E+00	7.21E-03	5.28E-02	1.83E+01	8.25E+00	2.45E+01	8.06E-01	1.37E+01	4.97E-01	1.01E+00	2.61E+00	2.34E+01	5.02E+00
2004	7	18	1.28E+00	5.98E-03	7.53E-01	1.71E-02	5.51E-02	1.47E+01	7.69E+00	1.78E+01	2.81E-01	1.95E+01	1.14E+00	1.64E+00	2.37E+00	2.03E+01	2.20E+00
2004	7	19	2.32E+00	9.48E-02	8.15E-01	2.86E-01	5.11E-01	8.50E+00	4.45E+00	1.33E+01	2.25E-01	7.01E+00	4.84E+00	3.50E-01	6.92E-01	1.14E+01	3.55E+00
2004	7	20	1.72E+00	6.24E-03	6.13E-01	1.58E-03	2.60E-02	5.56E+00	3.55E+00	7.05E+00	7.18E-02	5.67E+00	1.59E+00	1.90E-01	3.17E-01	8.21E+00	2.75E+00
2004	7	21	1.51E+00	2.83E-03	8.98E-01	1.95E-04	3.89E-03	1.81E+01	7.59E+00	2.77E+01	5.98E-01	2.24E+01	7.13E-01	1.80E+00	3.48E+00	2.54E+01	1.99E+00
2004	7	22	9.57E+00	1.13E-02	5.01E+00	1.46E-03	2.92E-03	1.96E+01	4.24E+00	1.67E+01	6.84E+00	1.81E+00	2.52E-02	2.49E+00	1.89E+00	1.44E+01	1.18E+01
2004	7	23	3.04E+00	1.34E-02	1.11E+00	3.18E-04	9.01E-04	6.71E+00	3.87E+00	1.23E+01	1.29E+00	9.32E+00	1.06E-01	4.23E+00	5.64E+00	9.58E+00	4.01E+00
2004	7	24	6.69E+00	1.38E+00	3.25E+00	2.22E-01	5.73E-01	1.79E+01	1.08E+01	2.18E+01	1.86E+00	9.78E+00	6.33E+00	9.32E-01	1.42E+00	1.76E+01	8.91E+00
2004	7	25	2.27E+00	5.56E-02	1.31E+00	3.45E-02	1.17E-01	1.78E+01	8.41E+00	2.48E+01	7.55E-01	1.18E+01	2.23E+00	1.15E+00	1.70E+00	2.69E+01	3.61E+00
2004	7	26	2.15E+00	4.82E-02	1.50E+00	4.88E-02	1.07E-01	2.36E+01	7.64E+00	2.53E+01	1.25E+00	1.18E+01	5.37E-01	2.21E+00	2.22E+00	2.45E+01	3.07E+00
2004	7	27	1.16E+01	1.51E+00	5.87E+00	2.13E-01	3.26E-01	1.91E+01	4.00E+00	2.58E+01	6.47E+00	4.76E+00	4.00E+00	9.43E-01	1.31E+00	2.98E+01	1.51E+01
2004	7	28	1.10E+01	9.53E-01	5.94E+00	3.34E-01	4.36E-01	2.24E+01	4.79E+00	2.40E+01	5.20E+00	6.60E+00	3.18E+00	6.43E-01	1.25E+00	2.60E+01	1.45E+01
2004	7	29	3.16E+00	7.58E-02	1.36E+00	3.80E-03	1.28E-02	1.19E+01	8.38E+00	2.03E+01	8.67E-01	2.16E+01	2.91E-01	2.30E+00	4.02E+00	1.53E+01	5.28E+00
2004	7	30	2.10E+00	1.60E-03	1.14E+00	1.44E-04	6.78E-04	1.66E+01	7.46E+00	2.38E+01	4.18E-01	1.37E+01	3.15E-02	1.74E+00	1.65E+00	1.83E+01	3.80E+00
2004	7	31	2.46E+00	2.07E-02	8.48E-01	3.47E-01	6.29E-01	1.75E+01	9.05E+00	2.05E+01	6.42E-01	1.12E+01	3.34E+00	1.29E+00	1.77E+00	1.91E+01	3.57E+00
2004	8	1	1.29E+01	1.88E-01	4.28E+00	5.08E-02	7.72E-02	2.11E+01	3.50E+00	2.67E+01	1.20E+01	2.07E+00	4.36E-01	2.70E+00	2.08E+00	2.75E+01	1.80E+01
2004	8	2	1.36E+01	1.39E+00	6.59E+00	4.87E-01	6.90E-01	1.73E+01	5.30E+00	2.18E+01	8.96E+00	1.53E+01	6.07E+00	2.28E+00	4.32E+00	2.25E+01	1.66E+01
2004	8	3	4.21E+00	6.78E-01	3.07E+00	2.40E-01	4.31E-01	1.95E+01	1.04E+01	2.42E+01	2.25E+00	1.50E+01	6.60E+00	1.64E+00	3.03E+00	2.54E+01	6.24E+00
2004	8	4	2.32E+00	4.12E-03	1.44E+00	7.10E-04	3.18E-03	2.40E+01	1.09E+01	2.69E+01	5.25E-01	1.44E+01	1.31E-01	1.55E+00	1.89E+00	3.23E+01	3.57E+00
2004	8	5	2.15E+00	8.10E-02	1.47E+00	1.30E-02	1.95E-02	2.19E+01	9.58E+00	2.89E+01	2.30E+00	1.31E+01	3.06E-01	2.60E+00	3.29E+00	2.48E+01	4.37E+00
2004	8	6	1.42E+00	4.73E-03	1.06E+00	3.50E-03	1.46E-01	2.12E+01	5.95E+00	2.06E+01	4.67E-01	6.60E+00	1.23E+00	8.37E-01	1.10E+00	1.95E+01	4.21E+00
2004	8	7	2.97E+00	1.72E+00	1.19E+00	3.56E-02	1.99E-02	1.42E+01	4.09E+00	1.66E+01	7.40E-01	4.72E+00	2.01E+00	4.86E-01	7.70E-01	1.48E+01	4.44E+00
2004	8	8	5.17E+00	4.35E-01	2.11E+00	1.19E-01	9.05E-02	1.09E+01	4.24E+00	1.81E+01	1.66E+00	1.07E+01	2.77E-01	1.74E+00	2.42E+00	1.76E+01	7.79E+00
2004	8	9	7.94E+00	3.80E-03	3.75E+00	1.12E-06	1.59E-06	9.35E+00	1.06E+00	1.48E+01	3.28E+00	4.50E-03	5.28E-04	6.88E-03	4.15E-03	1.84E+01	1.09E+01
2004	8	10	8.69E+00	2.62E+00	4.58E+00	7.56E-02	3.30E-02	1.07E+01	2.16E+00	1.89E+01	4.48E+00	6.36E-02	5.25E-01	6.35E-02	4.22E-02	1.93E+01	1.05E+01
2004	8	11	1.28E+01	3.93E-01	6.44E+00	1.46E-02	1.01E-02	1.52E+01	1.46E+00	1.98E+01	1.01E+01	7.51E-02	1.60E-01	7.84E-02	6.42E-02	2.06E+01	1.96E+01
2004	8	12	8.26E+00	1.48E+00	3.25E+00	2.67E-01	2.91E-01	2.20E+01	9.56E+00	2.72E+01	1.29E+00	1.45E+01	7.42E+00	1.72E+00	2.66E+00	2.69E+01	1.04E+01
2004	8	13	7.48E+00	7.54E-01	2.43E+00	6.85E-02	1.12E-01	2.35E+01	9.89E+00	2.64E+01	1.89E+00	1.28E+01	1.92E+00	2.28E+00	3.11E+00	2.28E+01	9.88E+00
2004	8	14	2.22E+00	2.70E-01	1.87E+00	6.03E-02	9.08E-02	2.09E+01	6.55E+00	3.01E+01	2.28E+00	1.45E+01	6.09E-01	3.42E+00	4.40E+00	2.08E+01	3.46E+00
2004	8	15	6.06E+00	1.20E-04	3.27E+00	0.00E+00	0.00E+00	9.69E+00	4.28E-01	1.23E+01	2.46E+00	1.74E-03	2.44E-04	4.63E-03	2.71E-03	1.43E+01	6.93E+00
2004	8	16	4.33E+00	1.09E-03	1.96E+00	0.00E+00	0.00E+00	5.21E+00	1.89E-01	1.02E+01	4.67E+00	6.56E-03	1.49E-03	1.32E-02	6.48E-03	1.20E+01	5.92E+00
2004	8	17	8.63E+00	3.66E-01	4.41E+00	9.79E-02	8.33E-02	8.30E+00	5.74E-01	1.75E+01	5.51E+00	1.63E+00	2.47E-01	2.65E-01	5.67E-01	1.72E+01	1.16E+01
2004	8	18	1.51E+01	1.62E+00	6.64E+00	4.40E-01	4.08E-01	2.42E+01	4.90E+00	2.36E+01	5.73E+00	5.96E+00	5.58E+00	3.76E-01	6.11E-01	2.84E+01	1.98E+01
2004	8	19	3.88E+00	2.05E-02	2.53E+00	2.21E-02	3.37E-02	2.57E+01	1.15E+01	3.78E+01	1.29E+00	2.24E+01	1.48E-01	5.90E+00	7.93E+00	2.94E+01	4.31E+00
2004	8	20	4.67E+00	1.58E-01	3.70E+00	8.12E-02	2.04E-01	2.39E+01	1.02E+01	2.66E+01	4.46E+00	1.16E+01	1.15E+00	1.85E+00	2.74E+00	2.93E+01	6.32E+00
2004	8	21	3.85E+00	2.35E-03	1.54E+00	2.09E-04	1.02E-03	2.00E+01	7.13E+00	2.47E+01	1.50E+00	1.39E+01	1.56E-02	2.02E+00	3.00E+00	3.03E+01	4.38E+00
2004	8	22	8.05E+00	9.93E-01	3.06E+00	1.19E+00	1.40E+00	1.77E+01	3.64E+00	1.55E+01	1.98E+00	2.54E+00	7.45E+00	1.62E-01	2.70E-01	1.73E+01	1.03E+01
2004	8	23	2.42E+00	1.11E+00	1.11E+00	7.02E-01	1.30E+00	1.81E+01	8.95E+00	2.72E+01	8.87E-01	1.52E+01	6.02E+00	1.90E+00	3.15E+00	2.45E+01	4.38E+00
2004	8	24	4.23E+00	2.83E-04	6.35E-01	3.78E-05	7.74E-03	1.63E+01	2.50E+00	1.65E+01	4.87E-01	3.71E+00	4.41E-01	1.93E-01	7.91E-01	1.27E+01	6.15E+00
2004	8	25	1.98E+00	3.75E-04	4.57E-01	5.95E-05	1.16E-02	2.01E+01	2.67E+00	1.61E+01	5.88E-01	6.27E+00	3.64E-01	6.14E-01	1.11E+00	1.17E+01	3.52E+00
2004	8	26	7.37E+00	1.69E+00	3.81E+00	7.75E-02	9.64E-02	2.61E+01	1.30E+01	3.35E+01	3.78E+00	1.03E+01	2.12E+00	4.88E+00	4.60E+00	2.80E+01	1.07E+01
2004	8	27	1.99E+00	5.22E-02	6.02E-01	2.46E-02	6.03E-02	2.37E+01	3.06E+00	1.67E+01	6.75E-01	3.51E+00	9.07E-01	3.49E-01	1.09E+00	1.11E+01	3.68E+00
2004	8	28	2.78E+00	1.38E-03	7.68E-01	8.73E-05	5.24E-04	1.97E+01	4.07E+00	2.05E+01	2.61E-01	6.09E+00	1.41E-01	7.19E-01	7.75E-01	1.38E+01	4.76E+00
2004	8	29	8.95E-01	1.28E-03	8.62E-01	1.19E-04	6.96E-04	1.89E+01	7.16E+00	1.59E+01	3.27E-01	1.28E+01	1.96E-01	1.69E+00	8.65E-01	2.54E+01	1.06E+00
2004	8	30	2.21E+00	9.51E-05	7.37E-01	2.18E-05	3.19E-04	1.10E+01	4.72E+00	1.63E+01	2.14E-01	4.72E+00	1.79E-01	7.76E-01	1.15E+00	1.34E+01	3.29E+00
2004	8	31	3.27E+00	1.70E-02	1.12E+00	2.63E-02	2.13E-01	1.78E+01	7.97E+00	1.94E+01	4.99E-01	5.85E+00	2.68E+00	7.34E-01	1.57E+00	1.47E+01	4.89E+00
2004	9	1	2.77E+00	4.50E-02	1.07E+00	6.79E-02	7.45E-01	2.18E+01	8.51E+00	2.25E+01	5.53E-01	9.57E+00	2.83E+00	1.08E+00	1.91E+00	1.93E+01	5.33E+00
2004	9	2	3.26E-01	0.00E+00	9.59E-02	0.00E+00	1.53E-04	4.52E+00	1.30E+00	3.66E+00	1.07E-02	2.42E+00	3.84E-01	1.49E-01	7.41E-01	2.96E+00	1.13E+00
2004	9	3	8.14E-01	0.00E+00	1.34E-01	0.00E+00	0.00E+00	5.61E+00	2.77E+00	7.27E+00	2.07E-02	6.11E+00	2.99E-02	8.75E-01	7.17E-01	5.49E+00	1.05E+00
2004	9	4	2.47E+00	5.31E-03	2.29E+00	8.82E-04	2.20E-03	1.40E+01	6.94E+00	1.61E+01	2.46E-01	1.29E+01	1.42E-01	1.38E+00	7.43E-01	1.73E+01	3.64E+00
2004	9	5	3.27E+00	1.13E-01	1.47E+00	3.63E-03	8.54E-03	1.71E+01	8.42E+00	2.07E+01	6.77E-01	1.62E+01	9.46E-01	1.63E+00	3.18E+00	1.82E+01	4.54E+00
2004	9	6	1.48E+01	1.82E+00	6.66E+00	6.51E-01	1.20E+00	3.41E+01	1.35E+01	2.86E+01	4.28E+00	1.24E+01	1.41E+01	8.17E-01	1.72E+00	2.67E+01	2.00E+01
2004	9	7	4.13E+00	6.01E-01	1.83E+00	7.24E-01	1.22E+00	2.92E+01	1.50E+01	2.68E+01	9.33E-01	9.77E+00	1.58E+01	1.18E+00	2.15E+00	2.24E+01	7.16E+00
2004	9	8	4.55E+00	7.76E-03	2.38E+00	2.09E-03	1.07E-02	2.37E+01	1.21E+01	2.34E+01	5.79E-01	1.35E+01	5.36E-01	1.34E+00	1.54E+00	3.08E+01	6.73E+00
2004	9	9	2.89E+00	6.38E-03	9.45E-01	2.23E-03	3.30E-02	1.40E+01	8.30E+00	1.60E+01	2.70E-01	6.81E+00	3.40E+00	8.55E-01	1.13E+00	1.86E+01	5.14E+00
2004	9	10	9.29E+00	1.08E+00	3.98E+00	8.28E-01	1.39E+00	1.65E+01	9.32E+00	2.08E+01	8.98E-01	7.22E+00	1.54E+01	4.33E-01	9.60E-01	2.13E+01	1.28E+01

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	6	21	3.84E+00	2.82E-02	2.01E+00	9.86E-03	1.69E-02	2.26E+01	1.05E+01	2.52E+01	4.26E-01	1.28E-01	6.07E-02	2.84E-01	1.92E-01	2.46E+01	6.01E+00
2004	6	22	9.34E+00	1.72E-02	4.61E+00	3.61E-03	6.01E-03	1.81E+01	5.66E+00	1.88E+01	4.05E-01	7.87E-02	3.14E-02	1.41E-01	1.05E-01	2.14E+01	1.17E+01
2004	6	23	7.63E+00	6.10E-02	3.83E+00	1.44E-02	2.41E-02	1.74E+01	4.75E+00	2.09E+01	4.89E-01	1.80E-01	1.02E-01	2.74E-01	2.18E-01	1.56E+01	8.87E+00
2004	6	24	1.13E+01	3.46E-03	4.52E+00	7.60E-06	6.00E-05	1.57E+01	1.54E+00	2.07E+01	2.90E-01	3.47E-02	8.82E-03	6.94E-02	4.82E-02	3.05E+01	1.59E+01
2004	6	25	1.33E+01	4.12E-03	6.48E+00	3.41E-04	6.24E-04	1.85E+01	2.84E-01	1.98E+01	3.36E-01	2.34E-02	7.14E-03	4.66E-02	3.20E-02	2.87E+01	1.71E+01
2004	6	26	1.16E+01	4.88E-03	5.85E+00	4.35E-04	1.04E-03	1.59E+01	6.19E-01	1.93E+01	3.69E-01	4.17E-02	1.24E-02	8.46E-02	5.87E-02	2.05E+01	1.36E+01
2004	6	27	1.42E+01	1.90E-03	6.42E+00	1.98E-05	7.44E-05	1.75E+01	8.97E-01	1.82E+01	3.17E-01	2.23E-02	5.27E-03	4.29E-02	2.97E-02	2.57E+01	1.87E+01
2004	6	28	8.30E+00	4.07E-02	4.73E+00	1.19E-02	2.01E-02	2.47E+01	8.86E+00	2.95E+01	5.00E-01	1.25E-01	6.52E-02	2.30E-01	1.69E-01	3.36E+01	1.04E+01
2004	6	29	7.56E+00	7.12E-02	4.11E+00	1.97E-02	2.74E-02	1.75E+01	9.43E+00	2.27E+01	6.04E-01	1.84E-01	9.87E-02	3.27E-01	2.40E-01	2.39E+01	1.07E+01
2004	6	30	6.35E+00	1.93E-02	2.75E+00	6.33E-03	1.15E-02	1.71E+01	7.94E+00	2.13E+01	5.15E-01	1.30E-01	4.70E-02	2.70E-01	1.97E-01	1.97E+01	8.76E+00
2004	7	1	2.10E+00	1.04E-03	1.38E+00	3.97E-04	1.94E-03	1.45E+01	6.90E+00	1.29E+01	1.16E-01	2.78E-02	6.49E-03	1.31E-01	7.22E-02	1.30E+01	4.06E+00
2004	7	2	3.38E+00	3.44E-04	1.22E+00	3.99E-05	1.74E-04	1.97E+01	7.20E+00	1.45E+01	2.11E-01	2.78E-02	4.07E-03	1.12E-01	6.13E-02	1.97E+01	4.81E+00
2004	7	3	3.04E+00	5.18E-03	2.04E+00	1.31E-03	5.76E-03	2.11E+01	6.37E+00	1.49E+01	2.58E-01	7.87E-02	3.03E-02	1.48E-01	1.08E-01	1.84E+01	4.73E+00
2004	7	4	8.01E+00	1.58E-03	3.14E+00	1.56E-04	3.91E-04	1.50E+01	1.05E+00	2.06E+01	1.99E-01	1.69E-02	4.71E-03	3.83E-02	2.55E-02	2.40E+01	1.20E+01
2004	7	5	9.13E+00	6.54E-02	4.34E+00	2.01E-02	3.11E-02	1.61E+01	6.60E+00	1.91E+01	6.70E-01	2.00E-01	1.07E-01	4.14E-01	2.76E-01	1.53E+01	1.12E+01
2004	7	6	2.33E+00	3.84E-05	1.03E+00	4.59E-06	1.92E-04	7.62E+00	3.14E+00	6.14E+00	5.86E-02	1.36E-02	2.74E-03	5.25E-02	2.71E-02	7.08E+00	3.30E+00
2004	7	7	2.07E-01	0.00E+00	1.26E-01	0.00E+00	0.00E+00	9.26E+00	1.84E+00	7.04E+00	1.13E-01	4.28E-03	1.21E-04	2.80E-02	1.31E-02	4.83E+00	6.71E-01
2004	7	8	3.07E-01	3.05E-04	2.37E-01	5.95E-05	1.47E-04	1.34E+01	1.68E+00	8.92E+00	2.47E-01	2.31E-02	2.59E-03	1.09E-01	6.27E-02	6.52E+00	7.87E-01
2004	7	9	7.77E-01	8.18E-06	1.10E-01	7.22E-04	2.44E-03	5.62E+00	4.41E+00	8.93E+00	3.06E-03	5.16E-03	1.16E-03	3.49E-02	1.96E-02	8.59E+00	1.24E+00
2004	7	10	4.52E-01	1.09E-03	5.14E-01	8.59E-03	1.54E-02	8.20E+00	6.96E+00	9.93E+00	2.56E-02	3.21E-02	1.56E-02	7.95E-02	4.47E-02	1.00E+01	1.17E+00
2004	7	11	8.20E-01	2.28E-04	6.28E-01	1.22E-05	1.28E-04	1.02E+01	1.96E+00	9.89E+00	1.16E-01	1.56E-02	3.02E-03	5.67E-02	4.25E-02	8.72E+00	8.78E-01
2004	7	12	3.21E+00	2.41E-02	1.24E+00	3.91E-03	6.38E-03	1.98E+01	6.61E+00	2.19E+01	5.08E-01	1.38E-01	5.11E-02	3.16E-01	2.14E-01	1.67E+01	4.74E+00
2004	7	13	4.57E+00	5.30E-02	2.79E+00	2.30E-02	3.25E-02	8.71E+00	9.09E+00	1.10E+01	1.60E-01	1.08E-01	7.60E-02	1.72E-01	1.35E-01	1.29E+01	6.02E+00
2004	7	14	6.92E+00	3.29E-03	2.74E+00	5.41E-04	1.47E-03	2.00E+01	5.17E+00	2.60E+01	2.55E-01	3.61E-02	1.04E-02	1.00E-01	6.21E-02	2.20E+01	8.65E+00
2004	7	15	8.29E+00	7.61E-03	3.84E+00	1.43E-03	2.51E-03	1.46E+01	1.01E+00	1.73E+01	2.77E-01	4.10E-02	1.64E-02	7.47E-02	5.60E-02	1.71E+01	1.00E+01
2004	7	16	7.76E+00	1.72E-02	1.78E+00	6.71E-03	1.90E-02	1.49E+01	9.89E+00	2.10E+01	4.06E-01	1.25E-01	5.79E-02	2.58E-01	1.78E-01	1.95E+01	9.51E+00
2004	7	17	2.73E+00	1.05E-02	1.26E+00	3.60E-03	9.19E-03	1.83E+01	8.22E+00	2.38E+01	7.45E-01	1.38E-01	4.49E-02	2.50E-01	1.96E-01	2.34E+01	4.88E+00
2004	7	18	1.28E+00	5.23E-03	7.53E-01	8.21E-04	2.85E-03	1.47E+01	7.62E+00	1.68E+01	2.80E-01	7.26E-02	2.59E-02	1.83E-01	1.17E-01	2.02E+01	2.19E+00
2004	7	19	2.31E+00	1.80E-02	8.15E-01	1.34E-02	3.12E-02	8.50E+00	4.44E+00	1.30E+01	1.96E-01	8.29E-02	7.26E-02	8.08E-02	7.20E-02	1.13E+01	3.50E+00
2004	7	20	1.69E+00	6.01E-03	6.12E-01	1.56E-03	2.00E-02	5.56E+00	3.54E+00	6.96E+00	4.97E-02	3.33E-02	6.00E-02	3.22E-02	2.24E-02	8.20E+00	2.64E+00
2004	7	21	1.49E+00	2.68E-03	8.96E-01	1.88E-04	1.31E-03	1.81E+01	7.49E+00	2.65E+01	3.52E-01	5.78E-02	1.76E-02	1.53E-01	9.40E-02	2.52E+01	1.95E+00
2004	7	22	9.02E+00	9.68E-03	3.09E+00	1.43E-03	2.85E-03	1.78E+01	4.09E+00	1.62E+01	2.75E-01	5.20E-02	2.05E-02	1.04E-01	7.35E-02	1.42E+01	1.09E+01
2004	7	23	2.74E+00	9.00E-06	9.98E-01	0.00E+00	4.65E-11	6.58E+00	3.34E+00	1.15E+01	6.87E-02	4.03E-03	2.96E-04	1.45E-02	8.02E-03	9.24E+00	3.65E+00
2004	7	24	6.63E+00	8.47E-02	3.23E+00	3.32E-02	4.84E-02	1.79E+01	1.08E+01	2.14E+01	7.48E-01	2.38E-01	1.35E-01	3.92E-01	3.06E-01	1.75E+01	8.75E+00
2004	7	25	2.24E+00	2.58E-02	1.31E+00	8.44E-03	1.97E-02	1.78E+01	8.36E+00	2.37E+01	6.97E-01	1.74E-01	7.31E-02	2.91E-01	2.34E-01	2.68E+01	3.54E+00
2004	7	26	1.94E+00	2.65E-03	9.92E-01	5.81E-04	1.57E-03	2.31E+01	7.41E+00	2.42E+01	2.06E-01	3.25E-02	9.38E-03	1.13E-01	6.30E-02	2.42E+01	2.78E+00
2004	7	27	1.10E+01	4.92E-02	5.34E+00	8.53E-03	1.45E-02	1.87E+01	3.83E+00	2.52E+01	5.97E-01	1.51E-01	7.55E-02	2.74E-01	1.98E-01	2.96E+01	1.40E+01
2004	7	28	1.05E+01	2.38E-02	5.73E+00	1.07E-02	1.57E-02	2.22E+01	4.74E+00	2.36E+01	4.32E-01	8.72E-02	4.21E-02	1.82E-01	1.21E-01	2.59E+01	1.37E+01
2004	7	29	3.09E+00	4.15E-03	1.35E+00	6.30E-04	1.95E-03	1.19E+01	8.14E+00	1.98E+01	1.96E-01	4.54E-02	1.56E-02	1.04E-01	6.96E-02	1.51E+01	5.17E+00
2004	7	30	2.10E+00	1.60E-03	1.14E+00	1.43E-04	6.76E-04	1.66E+01	7.38E+00	2.25E+01	4.14E-01	6.46E-02	1.40E-02	2.07E-01	1.19E-01	1.82E+01	3.79E+00
2004	7	31	2.45E+00	1.17E-02	8.48E-01	5.94E-03	1.36E-02	1.75E+01	8.98E+00	1.94E+01	5.82E-01	1.64E-01	5.78E-02	2.74E-01	2.24E-01	1.90E+01	3.55E+00
2004	8	1	1.15E+01	1.84E-02	3.16E+00	3.85E-03	7.88E-03	1.98E+01	2.38E+00	2.48E+01	5.05E-01	1.00E-01	4.00E-02	2.16E-01	1.46E-01	2.61E+01	1.63E+01
2004	8	2	1.30E+01	3.99E-02	6.17E+00	2.54E-02	3.90E-02	1.68E+01	4.88E+00	2.10E+01	4.72E-01	1.41E-01	7.75E-02	2.46E-01	1.84E-01	2.21E+01	1.58E+01
2004	8	3	4.12E+00	4.81E-02	3.03E+00	2.11E-02	3.01E-02	1.95E+01	1.03E+01	2.33E+01	5.54E-01	1.67E-01	8.47E-02	3.14E-01	2.28E-01	2.53E+01	6.02E+00
2004	8	4	2.32E+00	4.06E-03	1.44E+00	7.02E-04	3.10E-03	2.40E+01	1.08E+01	2.55E+01	5.22E-01	1.08E-01	3.34E-02	2.77E-01	1.80E-01	3.21E+01	3.55E+00
2004	8	5	1.68E+00	9.50E-03	1.06E+00	5.18E-03	9.25E-03	2.13E+01	9.17E+00	2.71E+01	5.42E-01	1.19E-01	3.90E-02	2.55E-01	1.87E-01	2.43E+01	3.77E+00
2004	8	6	1.38E+00	4.66E-03	1.06E+00	1.95E-03	6.31E-03	2.11E+01	5.88E+00	1.92E+01	4.66E-01	8.25E-02	2.52E-02	2.28E-01	1.44E-01	1.94E+01	4.13E+00
2004	8	7	2.96E+00	2.40E-02	1.14E+00	2.13E-03	3.65E-03	1.42E+01	4.06E+00	1.56E+01	3.84E-01	8.79E-02	3.53E-02	2.02E-01	1.30E-01	1.48E+01	4.41E+00
2004	8	8	5.05E+00	2.78E-02	2.03E+00	1.36E-02	1.41E-02	1.08E+01	4.14E+00	1.76E+01	2.08E-01	5.81E-02	2.93E-02	7.37E-02	6.29E-02	1.74E+01	7.62E+00
2004	8	9	7.91E+00	9.01E-05	3.73E+00	1.12E-06	1.59E-06	9.29E+00	1.06E+00	1.48E+01	7.71E-02	2.64E-03	3.21E-04	6.88E-03	4.14E-03	1.84E+01	1.08E+01
2004	8	10	8.60E+00	3.66E-02	4.45E+00	8.51E-03	6.93E-03	1.06E+01	2.16E+00	1.89E+01	1.49E-01	3.02E-02	2.17E-02	6.23E-02	3.90E-02	1.93E+01	1.04E+01
2004	8	11	1.27E+01	1.36E-02	6.12E+00	4.45E-03	5.02E-03	1.50E+01	1.46E+00	1.98E+01	3.33E-01	3.28E-02	1.45E-02	6.78E-02	4.39E-02	2.05E+01	1.93E+01
2004	8	12	8.04E+00	8.58E-02	3.20E+00	2.85E-02	4.19E-02	2.19E+01	9.43E+00	2.64E+01	6.99E-01	2.46E-01	1.41E-01	4.26E-01	3.18E-01	2.67E+01	9.94E+00
2004	8	13	7.21E+00	4.48E-02	2.34E+00	1.42E-02	2.62E-02	2.33E+01	9.59E+00	2.53E+01	9.31E-01	2.60E-01	1.13E-01	4.87E-01	3.60E-01	2.24E+01	9.55E+00
2004	8	14	2.02E+00	2.52E-02	1.73E+00	9.54E-03	1.58E-02	2.07E+01	6.20E+00	2.90E+01	4.42E-01	1.06E-01	5.04E-02	2.21E-01	1.57E-01	2.05E+01	3.23E+00
2004	8	15	5.86E+00	1.00E-04	3.13E+00	0.00E+00	0.00E+00	9.60E+00	4.28E-01	1.23E+01	3.01E-02	1.63E-03	2.43E-04	4.63E-03	2.71E-03	1.43E+01	6.57E+00
2004	8	16	4.20E+00	8.93E-06	1.64E+00	0.00E+00	0.00E+00	4.91E+00	1.64E-01	1.01E+01	1.15E-02	5.85E-04	2.87E-05	1.39E-03	7.74E-04	1.19E+01	5.76E+00
2004	8	17	8.24E+00	1.97E-02	3.53E+00	8.27E-03	9.27E-03	7.81E+00	4.94E-01	1.73E+01	4.25E-02	1.54E-02	1.64E-02	1.46E-02	1.33E-02	1.69E+01	1.11E+01
2004	8	18	1.48E+01	3.84E-02	6.16E+00	1.98E-02	2.93E-02	2.40E+01	4.89E+00	2.33E+01	5.29E-01	1.38E-01	7.05E-02	2.50E-01	1.85E-01	2.84E+01	1.92E+01
2004	8	19	3.69E+00	1.11E-02	2.48E+00	3.45E-03	7.70E-03	2.57E+01	1.06E+01	3.61E+01	3.98E-01	8.49E-02	3.28E-02	1.97E-01	1.31E-01	2.90E+01	4.01E+00
2004	8	20	4.49E+00	3.53E-02	3.53E+00	1.28E-02	2.14E-02	2.38E+01	1.00E+01	2.54E+01	6.26E-01	1.71E-01	8.01E-02	3.21E-01	2.36E-01	2.90E+01	6.01E+00
2004	8	21	3.77E+00	2.01E-03	1.50E+00	2.07E-04	1.01E-03	2.00E+01	7.02E+00	2.35E+01	1.85E-01	3.33E-02	9.21E-03	1.14E-01	6.54E-02	3.01E+01	4.27E+00
2004	8	22	7.86E+00	5.00E-02	3.04E+00	3.28E-02	3.55E-02	1.76E+01	3.63E+00	1.52E+01	4.96E-01	1.04E-01	6.01E-02	1.56E-01	1.25E-01	1.73E+01	9.78E+00
2004	8	23	2.27E+00	6.08E-02	1.01E+00	3.95E-02	6.36E-02	1.79E+01	8.78E+00	2.55E+01	4.68E-01	1.82E-01	1.12E-01	3.22E-01	2.49E-01	2.42E+01	4.18E+00
2004	8	24	4.23E+00	2.80E-04	6.35E-01	3.74E-05	1.31E-03	1.63E+01	2.49E+00	1.53E+01	4.81E-01	8.03E-02	1.75E-02	1.23E-01	1.02E-01	1.26E+01	6.13E+00
2004	8	25	1.98E+00	3.75E-04	4.57E-01	5.95E-05	8.49E-04	2.01E+01	2.66E+00	1.51E+01	5.88E-01	8.11E-02	9.09E-03	1.83E-01	1.70E-01	1.17E+01	3.52E+00
2004	8	26	6.59E+00	3.79E-02	3.63E+00	1.17E-02	1.81E-02	2.58E+01	1.16E+01	3.12E+01	7.69E-01	1.79E-01	7.69E-02	3.91E-01	2.76E-01	2.70E+01	9.78E+00
2004	8	27	1.99E+00	8.87E-03	6.02E-01	2.93E-03	6.18E-03	2.37E+01	3.04E+00	1.53E+01	6.62E-01	1.29E-01	3.63E-02	2.66E-01	2.11E-01	1.10E+01	3.67E+00
2004	8	28	2.75E+00	1.38E-03	7.68E-01	8.73E-05	5.24E-04	1.97E+01	4.02E+00	1.91E+01	2.61E-01	4.21E-02	1.00E-02	1.54E-01	8.11E-02	1.38E+01	4.70E+00
2004	8	29	8.95E-01	1.28E-03	8.62E-01	1.19E-04	6.69E-04	1.89E+01	7.08E+00	1.47E+01	3.26E-01	5.89E-02	1.35E-02	1.94E-01	1.21E-01	2.53E+01	1.06E+00
2004	8	30	2.17E+00	9.51E-05	7.36E-01	2.18E-05	3.18E-04	1.10E+01	4.66E+00	1.54E+01	2.10E-01	3.57E-02	5.12E-03	1.16E-01	7.86E-02	1.33E+01	3.16E+00
2004	8	31	3.21E+00	1.53E-02	1.12E+00	4.06E-03	8.83E-03	1.78E+01	7.92E+00	1.83E+01	4.83E-01	1.01E-01	3.96E-02	1.70E-01	1.41E-01	1.46E+01	4.72E+00
2004	9	1	2.74E+00	2.74E-02	1.07E+00	1.77E-02	3.69E-02	2.18E+01	8.45E+00	2.13E+01	4.68E-01	1.73E-01	8.69E-02	2.81E-01	2.17E-01	1.92E+01	5.28E+00
2004	9	2	3.26E-01	0.00E+00	9.59E-02	0.00E+00	0.00E+00	4.52E+00	1.30E+00	3.26E+00	1.07E-02	1.91E-03	0.00E+00	5.52E-02	2.33E-02	2.96E+00	1.13E+00
2004	9	3	8.14E-01	0.00E+00	1.34E-01	0.00E+00	0.00E+00	5.61E+00	2.72E+00	6.45E+00	2.07E-02	1.01E-03	4.63E-06	1.00E-02	4.26E-03	5.47E+00	1.05E+00
2004	9	4	2.37E+00	5.30E-03	2.29E+00	8.82E-04	2.20E-03	1.40E+01	6.88E+00	1.53E+01	1.05E-01	2.28E-02	1.18E-02	5.63E-02	3.13E-02	1.72E+01	3.39E+00
2004	9	5	3.19E+00	8.01E-03	1.46E+00	1.39E-03	2.80E-03	1.71E+01	8.26E+00	1.96E+01	1.74E-01	3.60E-02	1.55E-02	1.01E-01	5.62E-02	1.81E+01	4.38E+00
2004	9	6	1.44E+01	6.70E-02	6.56E+00	2.45E-02	4.03E-02	3.40E+01	1.34E+01	2.80E+01	7.15E-01	2.30E-01	1.22E-01	4.35E-01	3.14E-01	2.66E+01	1.91E+01
2004	9	7	4.06E+00	6.09E-02	1.83E+00	3.88E-02	6.57E-02	2.92E+01	1.50E+01	2.54E+01	7.88E-01	2.78E-01	1.50E-01	4.69E-01	3.57E-01	2.22E+01	6.95E+00
2004	9	8	4.51E+00	7.64E-03	2.38E+00	1.93E-03	7.96E-03	2.37E+01	1.20E+01	2.23E+01	5.39E-01	1.36E-01	4.64E-02	2.83E-01	2.02E-01	3.07E+01	6.61E+00
2004	9	9	2.89E+00	6.31E-03	9.45E-01	2.20E-03	2.01E-02	1.40E+01	8.25E+00	1.52E+01	2.51E-01	1.03E-01	5.97E-02	2.13E-01	1.57E-01	1.85E+01	5.12E+00
2004	9	10	9.17E+00	1.31E-01	3.97E+00	8.44E-02	1.02E-01	1.64E+01	9.31E+00	2.06E+01	5.41E-01	1.90E-01	1.75E-01	1.99E-01	1.73E-01	2.13E+01	1.26E+01

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	6	21	6.16E-01	2.99E-01	2.96E-01	1.04E-01	2.35E-01	3.81E-01	6.28E-01	1.75E+00	1.51E+00	1.71E+01	2.79E+00	3.17E+00	3.33E+00	6.14E-01	8.38E-01
2004	6	22	1.35E-01	9.56E-01	1.33E-01	8.55E-02	1.69E-01	9.67E-02	2.44E-02	2.40E-01	3.19E+00	3.15E+00	4.04E+00	1.85E-01	3.32E-01	5.99E-02	3.68E-01
2004	6	23	7.97E-01	4.76E-01	5.60E-01	1.47E-01	2.13E-01	6.56E-01	5.86E-01	1.05E+00	6.02E+00	1.02E+01	1.20E+00	2.25E+00	4.30E+00	6.74E-01	1.04E+00
2004	6	24	3.42E-01	2.23E-01	7.06E-02	2.41E-05	3.76E-05	7.91E-02	2.91E-03	1.26E-01	4.60E+00	6.19E-02	8.90E-01	5.18E-03	1.09E-02	4.07E-02	7.27E-01
2004	6	25	7.45E-01	1.75E-02	9.76E-01	1.67E-05	3.63E-05	9.48E-01	5.88E-02	3.62E-01	8.24E+00	7.58E-03	8.14E-04	6.93E-03	4.43E-03	2.76E-01	1.02E+00
2004	6	26	6.50E-01	7.31E-04	2.08E+00	1.13E-05	3.11E-05	1.79E+00	2.66E-02	2.52E-01	1.01E+01	6.25E-02	5.60E-03	1.12E-01	8.95E-02	1.84E-01	9.54E-01
2004	6	27	4.15E-01	9.79E-03	9.63E-02	1.79E-06	1.70E-05	7.75E-02	3.79E-04	3.80E-02	5.60E+00	1.25E-02	4.22E-02	1.07E-02	1.25E-02	1.94E-02	8.35E-01
2004	6	28	2.00E-01	5.88E-01	5.83E-02	7.51E-02	1.12E-01	7.73E-02	7.48E-02	7.29E-01	2.82E+00	1.55E+01	1.40E+00	1.12E+00	2.50E+00	1.59E-01	3.95E-01
2004	6	29	1.07E-01	1.55E+00	3.05E-02	9.11E-02	1.52E-01	5.07E-02	3.68E-02	4.06E-01	1.76E+00	1.64E+01	2.33E+00	1.06E+00	1.98E+00	6.96E-02	2.16E-01
2004	6	30	2.76E-01	3.66E-01	2.63E-01	1.16E-01	1.93E-01	2.77E-01	1.50E-01	7.24E-01	2.99E+00	8.92E+00	1.69E+00	1.04E+00	2.39E+00	2.64E-01	3.94E-01
2004	7	1	8.28E-02	4.66E-07	1.71E-09	4.92E-06	1.86E-03	2.16E-08	5.98E-02	7.83E-01	4.76E-02	1.09E+01	2.91E-01	8.66E-01	1.17E+00	7.87E-02	2.28E-01
2004	7	2	1.06E-01	0.00E+00	1.81E-03	0.00E+00	1.05E-04	5.18E-03	6.66E-02	1.08E+00	1.84E-02	1.21E+01	1.39E-01	1.23E+00	1.00E+00	9.20E-02	1.75E-01
2004	7	3	1.52E-01	1.46E-04	5.86E-03	4.60E-05	2.64E-02	1.70E-02	4.08E-02	7.62E-01	2.95E-02	7.84E+00	6.91E-01	7.64E-01	7.97E-01	1.37E-01	3.53E-01
2004	7	4	6.44E-01	1.10E-03	1.04E+00	1.06E-05	5.84E-05	9.76E-01	6.82E-01	1.05E+00	7.25E+00	2.87E+00	6.41E-03	2.10E+00	2.57E+00	5.58E-01	1.01E+00
2004	7	5	2.84E-01	2.06E+00	1.81E-01	2.62E-01	2.68E-01	1.70E-01	3.70E-02	3.54E-01	2.72E+00	7.31E+00	4.11E+00	4.15E-01	1.15E+00	8.17E-02	5.59E-01
2004	7	6	9.67E-02	0.00E+00	4.05E-03	0.00E+00	7.21E-05	9.91E-03	1.58E-02	2.56E-01	3.40E-02	3.93E+00	2.43E-01	3.56E-01	7.70E-01	2.89E-02	1.95E-01
2004	7	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-02	5.11E-01	1.38E-20	4.05E+00	1.02E-01	5.61E-01	5.49E-01	2.81E-03	0.00E+00
2004	7	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-02	1.01E+00	2.16E-15	2.61E+00	8.16E-02	2.11E-01	6.50E-01	2.74E-02	4.08E-05
2004	7	9	0.00E+00	0.00E+00	0.00E+00	1.01E-02	1.55E-01	0.00E+00	6.75E-02	6.40E-01	8.51E-16	1.01E+01	5.33E-01	9.84E-01	9.81E-01	7.75E-02	0.00E+00
2004	7	10	5.99E-04	1.36E-01	0.00E+00	2.03E-01	4.88E-01	0.00E+00	6.08E-02	7.97E-01	2.55E-04	9.39E+00	5.28E+00	1.17E+00	1.84E+00	3.08E-02	3.61E-03
2004	7	11	2.14E-02	0.00E+00	0.00E+00	0.00E+00	3.18E-03	0.00E+00	1.14E-02	7.73E-01	3.72E-04	3.00E+00	4.10E-01	2.17E-01	5.07E-01	2.35E-02	7.71E-02
2004	7	12	1.59E-02	1.00E+00	7.07E-05	7.36E-02	7.65E-02	4.67E-04	7.63E-02	9.98E-01	1.38E-02	1.29E+01	2.74E+00	1.15E+00	1.24E+00	1.06E-01	3.72E-02
2004	7	13	2.51E-01	1.52E+00	2.75E-01	3.27E-02	5.95E-02	3.26E-01	4.25E-01	6.91E-01	4.40E+00	9.26E+00	4.56E+00	3.76E+00	5.53E+00	2.52E-01	3.11E-01
2004	7	14	2.32E-01	2.15E-02	1.85E-01	2.73E-03	8.68E-03	1.75E-01	1.84E-01	1.18E+00	2.43E+00	1.24E+01	6.47E-02	1.53E+00	3.11E+00	2.03E-01	4.08E-01
2004	7	15	4.11E-01	5.09E-02	2.89E-01	1.23E-02	2.04E-02	2.44E-01	3.65E-01	5.75E-01	2.08E+00	1.47E+00	8.97E-02	1.62E+00	1.07E+00	2.84E-01	7.34E-01
2004	7	16	2.25E-01	1.12E-01	1.09E-01	6.81E-02	2.90E-01	1.06E-01	3.84E-01	8.25E-01	8.15E-01	1.44E+01	2.59E+00	1.62E+00	2.86E+00	3.06E-01	3.34E-01
2004	7	17	5.53E-02	2.61E-04	3.50E-03	3.62E-03	4.36E-02	7.24E-03	3.29E-02	6.92E-01	6.14E-02	1.36E+01	4.52E-01	7.62E-01	2.42E+00	6.87E-02	1.50E-01
2004	7	18	1.65E-03	7.50E-04	2.18E-05	1.62E-02	5.22E-02	9.98E-05	7.48E-02	9.56E-01	5.67E-04	1.95E+01	1.11E+00	1.46E+00	2.25E+00	1.15E-01	6.80E-03
2004	7	19	1.58E-02	7.68E-02	1.63E-04	2.73E-01	4.80E-01	1.05E-03	1.00E-02	3.02E-01	2.97E-02	6.93E+00	4.76E+00	2.70E-01	6.20E-01	3.12E-02	4.97E-02
2004	7	20	3.37E-02	2.29E-04	2.68E-04	2.42E-05	6.01E-03	2.70E-03	6.10E-03	8.85E-02	2.21E-02	5.63E+00	1.53E+00	1.58E-01	2.95E-01	1.21E-02	1.05E-01
2004	7	21	1.55E-02	1.51E-04	1.75E-03	7.77E-06	2.58E-03	8.95E-03	1.03E-01	1.25E+00	2.46E-01	2.23E+01	6.95E-01	1.64E+00	3.38E+00	1.27E-01	3.61E-02
2004	7	22	5.54E-01	1.60E-03	1.92E+00	2.63E-05	6.71E-05	1.73E+00	1.49E-01	5.62E-01	6.57E+00	1.76E+00	4.73E-03	2.39E+00	1.81E+00	2.62E-01	8.68E-01
2004	7	23	3.00E-01	1.34E-02	1.12E-01	3.18E-04	9.01E-04	1.31E-01	5.28E-01	7.89E-01	1.22E+00	9.32E+00	1.05E-01	4.22E+00	5.63E+00	3.36E-01	3.61E-01
2004	7	24	5.72E-02	1.29E+00	1.75E-02	1.89E-01	5.24E-01	2.96E-02	1.49E-02	4.21E-01	1.11E+00	9.54E+00	6.20E+00	5.40E-01	1.11E+00	8.45E-02	1.52E-01
2004	7	25	2.85E-02	2.98E-02	1.58E-03	2.61E-02	9.77E-02	6.19E-03	5.13E-02	1.14E+00	5.88E-02	1.16E+01	2.16E+00	8.62E-01	1.46E+00	9.24E-02	6.92E-02
2004	7	26	2.04E-01	4.55E-02	5.11E-01	4.82E-02	1.06E-01	4.85E-01	2.24E-01	1.16E+00	1.05E+00	1.18E+01	5.27E-01	2.10E+00	2.16E+00	2.32E-01	2.86E-01
2004	7	27	6.41E-01	1.46E+00	5.27E-01	2.04E-01	3.12E-01	4.51E-01	1.74E-01	6.02E-01	5.87E+00	4.60E+00	3.93E+00	6.69E-01	1.12E+00	2.95E-01	1.08E+00
2004	7	28	4.51E-01	9.29E-01	2.04E-01	3.23E-01	4.20E-01	1.94E-01	5.05E-02	4.07E-01	4.77E+00	6.52E+00	3.14E+00	4.62E-01	1.13E+00	1.23E-01	7.89E-01
2004	7	29	6.92E-02	7.17E-02	1.75E-02	3.17E-03	1.09E-02	3.17E-02	2.33E-01	5.28E-01	6.71E-01	2.15E+01	2.75E-01	2.19E+00	3.95E+00	1.37E-01	1.17E-01
2004	7	30	5.46E-03	1.18E-06	5.21E-05	4.00E-07	2.64E-06	1.77E-04	7.92E-02	1.30E+00	4.64E-03	1.37E+01	1.74E-02	1.53E+00	1.53E+00	7.14E-02	1.75E-02
2004	7	31	1.07E-02	8.97E-03	3.58E-04	3.41E-01	6.15E-01	7.32E-04	7.85E-02	1.10E+00	6.06E-02	1.10E+01	3.28E+00	1.02E+00	1.55E+00	8.56E-02	2.36E-02
2004	8	1	1.43E+00	1.70E-01	1.12E+00	4.69E-02	6.94E-02	1.36E+00	1.12E+00	1.95E+00	1.15E+01	1.96E+00	3.96E-01	2.49E+00	1.93E+00	1.35E+00	1.63E+00
2004	8	2	5.95E-01	1.35E+00	4.16E-01	4.61E-01	6.51E-01	4.97E-01	4.12E-01	7.48E-01	8.49E+00	1.51E+01	5.99E+00	2.04E+00	4.14E+00	4.14E-01	8.02E-01
2004	8	3	8.92E-02	6.30E-01	3.80E-02	2.18E-01	4.01E-01	5.13E-02	6.17E-02	9.72E-01	1.69E+00	1.49E+01	6.52E+00	1.33E+00	2.80E+00	1.10E-01	2.19E-01
2004	8	4	6.18E-03	5.69E-05	4.64E-04	8.83E-06	7.65E-05	1.11E-03	7.25E-02	1.47E+00	3.02E-03	1.43E+01	9.75E-02	1.28E+00	1.71E+00	1.90E-01	1.97E-02
2004	8	5	4.75E-01	7.15E-02	4.13E-01	7.82E-03	1.03E-02	5.66E-01	4.04E-01	1.86E+00	1.75E+00	1.30E+01	2.67E-01	2.35E+00	3.10E+00	4.91E-01	6.02E-01
2004	8	6	4.13E-02	7.18E-05	9.74E-04	1.54E-03	1.39E-01	2.95E-03	7.33E-02	1.45E+00	1.24E-03	6.52E+00	1.20E+00	6.09E-01	9.61E-01	9.33E-02	7.54E-02
2004	8	7	1.07E-02	1.69E+00	4.55E-02	3.35E-02	1.63E-02	3.13E-02	3.87E-02	9.30E-01	3.56E-01	4.64E+00	1.97E+00	2.84E-01	6.40E-01	3.75E-02	2.60E-02
2004	8	8	1.19E-01	4.07E-01	8.03E-02	1.06E-01	7.63E-02	1.16E-01	1.04E-01	4.15E-01	1.45E+00	1.06E+01	2.48E-01	1.66E+00	2.36E+00	1.31E-01	1.71E-01
2004	8	9	3.46E-02	3.71E-03	2.75E-02	0.00E+00	0.00E+00	6.29E-02	1.22E-06	2.91E-04	3.20E+00	1.86E-03	2.07E-04	1.82E-06	1.44E-06	6.60E-05	7.44E-02
2004	8	10	8.88E-02	2.58E+00	1.27E-01	6.71E-02	2.61E-02	8.03E-02	1.82E-04	8.68E-03	4.33E+00	3.34E-02	5.03E-01	1.26E-03	3.21E-03	5.02E-03	1.32E-01
2004	8	11	8.26E-02	3.79E-01	3.20E-01	1.01E-02	5.12E-03	2.32E-01	1.82E-03	1.47E-02	9.80E+00	4.24E-02	1.45E-01	1.06E-02	2.03E-02	1.57E-02	2.28E-01
2004	8	12	2.21E-01	1.39E+00	4.70E-02	2.38E-01	2.49E-01	7.73E-02	1.29E-01	7.78E-01	5.88E-01	1.43E+01	7.28E+00	1.29E+00	2.34E+00	2.40E-01	4.15E-01
2004	8	13	2.72E-01	7.09E-01	9.78E-02	5.43E-02	8.61E-02	1.51E-01	3.01E-01	1.11E+00	9.63E-01	1.26E+01	1.81E+00	1.79E+00	2.75E+00	3.64E-01	3.28E-01
2004	8	14	2.02E-01	2.45E-01	1.35E-01	5.07E-02	7.49E-02	1.70E-01	3.50E-01	1.13E+00	1.84E+00	1.44E+01	5.59E-01	3.19E+00	4.24E+00	3.10E-01	2.36E-01
2004	8	15	1.96E-01	1.95E-05	1.42E-01	0.00E+00	0.00E+00	8.16E-02	0.00E+00	8.57E-03	2.43E+00	1.06E-04	8.59E-07	0.00E+00	0.00E+00	8.06E-03	3.52E-01
2004	8	16	1.32E-01	1.08E-03	3.18E-01	0.00E+00	0.00E+00	2.94E-01	2.46E-02	9.38E-02	4.66E+00	5.98E-03	1.46E-03	1.18E-02	5.70E-03	8.03E-02	1.61E-01
2004	8	17	3.95E-01	3.46E-01	8.87E-01	8.97E-02	7.40E-02	4.89E-01	7.96E-02	2.49E-01	5.47E+00	1.62E+00	2.30E-01	2.51E-01	5.53E-01	2.47E-01	5.45E-01
2004	8	18	2.92E-01	1.58E+00	4.76E-01	4.21E-01	3.79E-01	2.84E-01	7.56E-03	2.93E-01	5.20E+00	5.82E+00	5.51E+00	1.25E-01	4.26E-01	5.39E-02	6.20E-01
2004	8	19	1.90E-01	9.37E-03	4.64E-02	1.86E-02	2.60E-02	3.28E-02	8.63E-01	1.71E+00	8.94E-01	2.24E+01	1.16E-01	5.70E+00	7.80E+00	3.96E-01	2.96E-01
2004	8	20	1.89E-01	1.23E-01	1.69E-01	6.84E-02	1.83E-01	1.25E-01	1.73E-01	1.23E+00	3.84E+00	1.14E+01	1.07E+00	1.53E+00	2.50E+00	2.11E-01	3.18E-01
2004	8	21	8.20E-02	3.47E-04	4.71E-02	2.22E-06	5.76E-06	5.07E-02	1.19E-01	1.26E+00	1.31E+00	1.39E+01	6.44E-03	1.90E+00	2.93E+00	2.42E-01	1.14E-01
2004	8	22	1.97E-01	9.43E-01	2.02E-02	1.15E+00	1.37E+00	1.93E-02	3.97E-03	3.56E-01	1.49E+00	2.44E+00	7.39E+00	6.04E-03	1.45E-01	3.73E-02	5.06E-01
2004	8	23	1.52E-01	1.05E+00	1.09E-01	6.62E-01	1.24E+00	1.24E-01	1.74E-01	1.70E+00	4.19E-01	1.50E+01	5.91E+00	1.58E+00	2.90E+00	2.58E-01	1.98E-01
2004	8	24	5.32E-03	2.15E-06	8.64E-05	4.52E-07	6.43E-03	1.41E-03	1.29E-02	1.16E+00	6.35E-03	3.63E+00	4.23E-01	6.97E-02	6.89E-01	3.18E-02	2.58E-02
2004	8	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-02	0.00E+00	1.54E-02	1.04E+00	0.00E+00	6.19E+00	3.55E-01	4.31E-01	9.36E-01	5.21E-02	0.00E+00
2004	8	26	7.83E-01	1.65E+00	1.79E-01	6.58E-02	7.83E-02	3.08E-01	1.37E+00	2.31E+00	3.02E+00	1.01E+01	2.04E+00	4.49E+00	4.32E+00	1.06E+00	9.60E-01
2004	8	27	1.84E-03	4.34E-02	7.20E-04	2.16E-02	5.41E-02	1.89E-03	2.15E-02	1.48E+00	1.29E-02	3.38E+00	8.70E-01	8.31E-02	8.80E-01	6.53E-02	3.67E-03
2004	8	28	2.19E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.13E-02	1.39E+00	9.17E-24	6.05E+00	1.31E-01	5.65E-01	6.94E-01	6.64E-02	5.33E-02
2004	8	29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-05	0.00E+00	7.86E-02	1.16E+00	9.64E-05	1.27E+01	1.82E-01	1.49E+00	7.44E-01	1.23E-01	1.56E-05
2004	8	30	4.10E-02	0.00E+00	4.70E-04	0.00E+00	4.66E-08	4.09E-03	6.50E-02	9.39E-01	4.30E-03	4.69E+00	1.74E-01	6.60E-01	1.07E+00	9.79E-02	1.36E-01
2004	8	31	5.96E-02	1.75E-03	1.48E-03	2.22E-02	2.04E-01	7.56E-03	4.92E-02	1.05E+00	1.62E-02	5.75E+00	2.64E+00	5.64E-01	1.43E+00	7.51E-02	1.76E-01
2004	9	1	2.33E-02	1.76E-02	2.16E-03	5.03E-02	7.08E-01	4.73E-03	5.25E-02	1.24E+00	8.44E-02	9.40E+00	2.75E+00	7.98E-01	1.70E+00	1.43E-01	5.84E-02
2004	9	2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-04	0.00E+00	9.16E-04	4.00E-01	6.88E-31	2.42E+00	3.84E-01	9.38E-02	7.17E-01	0.00E+00	0.00E+00
2004	9	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.07E-02	8.18E-01	4.85E-17	6.11E+00	2.99E-02	8.65E-01	7.13E-01	1.94E-02	3.13E-06
2004	9	4	1.08E-01	1.91E-05	5.08E-03	5.40E-08	9.69E-07	1.38E-02	5.78E-02	8.05E-01	1.41E-01	1.29E+01	1.30E-01	1.32E+00	7.12E-01	5.16E-02	2.46E-01
2004	9	5	8.49E-02	1.05E-01	1.65E-02	2.23E-03	5.73E-03	1.88E-02	1.67E-01	1.07E+00	5.03E-01	1.61E+01	9.31E-01	1.53E+00	3.12E+00	1.00E-01	1.68E-01
2004	9	6	4.65E-01	1.75E+00	9.60E-02	6.26E-01	1.15E+00	8.01E-02	3.18E-02	5.13E-01	3.56E+00	1.22E+01	1.40E+01	3.82E-01	1.40E+00	7.63E-02	9.39E-01
2004	9	7	7.07E-02	5.40E-01	4.58E-03	6.86E-01	1.16E+00	6.82E-03	5.18E-02	1.37E+00	1.45E-01	9.49E+00	1.57E+01	7.12E-01	1.79E+00	1.88E-01	2.11E-01
2004	9	8	4.30E-02	1.21E-04	2.61E-03	1.64E-04	2.74E-03	1.18E-02	8.11E-02	1.07E+00	4.01E-02	1.33E+01	4.90E-01	1.06E+00	1.34E+00	1.27E-01	1.18E-01
2004	9	9	7.10E-03	6.89E-05	1.84E-04	2.34E-05	1.29E-02	4.14E-04	5.61E-02	8.29E-01	1.83E-02	6.71E+00	3.34E+00	6.42E-01	9.78E-01	5.75E-02	2.01E-02
2004	9	10	1.23E-01	9.51E-01	8.98E-03	7.44E-01	1.29E+00	3.44E-02	5.13E-03	1.86E-01	3.58E-01	7.03E+00	1.52E+01	2.34E-01	7.87E-01	4.09E-02	2.61E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	9	11	3.14E+00	1.06E-01	6.80E-01	6.03E-02	3.53E-01	1.11E+01	3.68E+00	9.14E+00	3.58E-01	3.99E+00	3.49E+00	5.24E-01	6.14E-01	6.10E+00	4.69E+00
2004	9	12	5.04E+00	4.11E-01	2.04E+00	6.76E-02	2.08E-01	1.67E+01	1.11E+01	1.50E+01	1.37E+00	9.17E+00	5.34E+00	1.08E+00	1.71E+00	1.29E+01	6.80E+00
2004	9	13	4.43E+00	9.50E-01	1.19E+00	5.19E-01	1.01E+00	2.09E+01	1.61E+01	2.97E+01	7.70E-01	3.33E+01	1.18E+01	3.15E+00	4.35E+00	2.94E+01	6.07E+00
2004	9	14	1.91E+00	5.67E-04	9.95E-01	5.17E-05	5.37E-04	1.28E+01	4.93E+00	1.45E+01	3.06E-01	6.39E+00	7.01E-02	9.05E-01	1.05E+00	1.25E+01	3.12E+00
2004	9	15	3.42E+00	1.25E-06	1.08E+00	0.00E+00	2.35E-04	9.18E+00	4.90E+00	1.29E+01	2.74E-01	7.17E+00	2.33E-01	7.58E-01	1.39E+00	9.03E+00	5.08E+00
2004	9	16	1.43E+00	3.81E-04	6.91E-01	1.90E-05	3.02E-04	1.84E+01	4.34E+00	1.72E+01	3.37E-01	5.15E+00	2.71E-01	7.52E-01	1.35E+00	1.28E+01	3.49E+00
2004	9	17	5.17E+00	8.02E-01	1.56E+00	2.68E-01	3.92E-01	1.26E+01	6.74E+00	1.29E+01	3.73E-01	6.67E+00	7.33E+00	7.67E-01	1.04E+00	1.02E+01	7.06E+00
2004	9	18	8.40E+00	9.55E-01	1.74E+00	4.29E-01	5.33E-01	1.83E+01	9.40E+00	1.59E+01	6.08E-01	4.24E+00	1.42E+01	6.33E-01	5.45E-01	1.49E+01	1.03E+01
2004	9	19	1.05E+01	1.01E-03	6.48E+00	2.15E-05	1.32E-04	1.71E+01	4.07E+00	1.66E+01	2.51E+00	9.70E+00	6.30E-03	1.20E+00	1.57E+00	2.05E+01	1.22E+01
2004	9	20	9.91E+00	4.07E-01	5.16E+00	8.54E-02	1.07E-01	1.59E+01	6.13E+00	1.83E+01	7.45E+00	7.64E+00	9.57E-01	5.90E-01	1.00E+00	2.13E+01	1.42E+01
2004	9	21	5.24E-01	0.00E+00	7.56E-03	0.00E+00	0.00E+00	3.54E+00	2.84E+00	5.82E+00	4.32E-16	9.91E+00	1.42E-02	8.43E-01	5.66E-01	5.57E+00	7.63E-01
2004	9	22	9.13E-01	0.00E+00	3.71E-01	0.00E+00	0.00E+00	8.91E+00	4.71E+00	1.26E+01	8.81E-02	1.23E+01	2.47E-02	1.25E+00	1.21E+00	1.22E+01	1.18E+00
2004	9	23	2.63E+00	6.22E-03	4.03E+00	6.91E-04	2.84E-03	2.63E+01	1.15E+01	2.93E+01	3.44E-01	2.15E+01	6.85E-02	1.98E+00	1.04E+00	3.78E+01	4.25E+00
2004	9	24	2.45E+00	2.80E-03	1.52E+00	7.14E-04	1.59E-03	2.61E+01	1.39E+01	2.74E+01	3.29E-01	2.30E+01	7.03E-02	2.50E+00	1.27E+00	3.11E+01	3.91E+00
2004	9	25	5.46E+00	1.01E-03	2.36E+00	2.44E-05	3.56E-04	2.19E+01	1.07E+01	3.13E+01	4.01E-01	1.57E+01	7.72E-02	1.41E+00	1.36E+00	2.48E+01	7.71E+00
2004	9	26	1.42E+01	3.29E-03	8.69E+00	5.20E-04	1.06E-03	2.22E+01	4.51E+00	2.40E+01	6.71E+00	3.93E+00	8.16E-03	4.05E-01	6.00E-01	2.57E+01	1.72E+01
2004	9	27	1.67E+01	5.30E-01	9.43E+00	3.74E-02	5.59E-02	3.47E+01	6.50E+00	2.61E+01	4.58E+00	8.08E+00	6.96E-01	8.20E-01	8.39E-01	3.36E+01	2.04E+01
2004	9	28	1.15E+01	6.97E-03	6.11E+00	1.80E-03	3.62E-03	3.19E+01	7.76E+00	3.14E+01	3.58E+00	8.43E+00	1.70E-02	1.05E+00	9.94E-01	2.94E+01	1.40E+01
2004	9	29	1.64E+01	1.63E-02	9.52E+00	6.24E-04	3.11E-04	1.86E+01	9.77E-02	1.61E+01	7.14E+00	1.89E-02	6.83E-03	2.92E-02	2.29E-02	1.93E+01	1.83E+01
2004	9	30	7.92E+00	9.79E-03	6.27E+00	1.44E-03	2.89E-03	1.76E+01	4.32E+00	2.18E+01	9.60E+00	8.25E-02	2.11E-02	1.52E-01	9.36E-02	2.30E+01	1.05E+01
2004	10	1	1.72E+00	4.02E-01	9.95E-01	3.71E-02	6.33E-02	3.58E+00	2.03E+00	5.58E+00	1.91E+00	8.08E+00	2.02E+00	1.30E+00	6.51E-01	4.72E+00	2.39E+00
2004	10	2	4.37E-01	7.58E-03	5.22E-01	2.14E-02	7.55E-02	4.86E+00	2.51E+00	7.85E+00	1.20E-01	1.12E+01	3.29E-01	2.17E+00	2.85E+00	7.07E+00	6.77E-01
2004	10	3	3.09E+00	9.76E-01	1.96E+00	4.91E-01	3.88E-01	5.46E+00	1.82E+00	5.78E+00	3.41E+00	1.52E+00	4.25E+00	2.37E-01	3.17E-01	5.61E+00	4.07E+00
2004	10	4	2.50E-01	3.72E-03	3.94E-01	1.41E-03	3.77E-03	4.28E+00	2.25E+00	5.40E+00	7.05E-02	8.55E+00	2.61E-02	1.77E+00	3.87E-01	6.50E+00	2.86E-01
2004	10	5	1.02E-01	4.76E-05	1.75E-01	1.38E-06	8.42E-06	1.85E+00	8.29E-01	2.83E+00	1.31E-02	4.23E+00	4.40E-02	9.27E-01	3.38E-01	2.35E+00	2.09E-01
2004	10	6	2.23E-01	3.68E-06	1.26E-01	0.00E+00	2.52E-05	1.27E+00	3.86E-01	2.04E+00	9.81E-03	1.55E+00	1.43E-01	2.40E-01	3.98E-01	1.03E+00	3.29E-01
2004	10	7	3.37E-01	2.13E-03	2.98E-01	5.10E-04	1.90E-03	3.89E+00	2.14E+00	7.41E+00	1.50E-01	6.55E+00	1.03E-01	1.11E+00	1.81E+00	4.26E+00	6.27E-01
2004	10	8	1.23E+00	8.76E-03	4.47E-01	3.09E-01	2.24E-01	3.56E+00	1.86E+00	6.07E+00	2.14E-01	2.73E+00	6.24E+00	3.55E-01	9.02E-01	3.52E+00	1.74E+00
2004	10	9	5.19E-01	1.64E-03	2.18E-01	7.06E-04	5.44E-03	2.57E+00	1.40E+00	4.16E+00	1.36E-01	1.96E+00	2.00E-01	4.06E-01	1.02E+00	2.25E+00	8.09E-01
2004	10	10	1.85E-01	2.79E-06	1.68E-01	0.00E+00	1.15E-05	2.54E+00	9.35E-01	4.59E+00	6.50E-02	3.12E+00	5.04E-02	8.02E-01	5.80E-01	2.60E+00	3.07E-01
2004	10	11	4.52E-02	0.00E+00	2.67E-03	0.00E+00	0.00E+00	4.27E-01	3.21E-01	1.02E+00	3.35E-16	2.93E+00	2.77E-02	4.37E-01	2.50E-01	5.82E-01	6.40E-02
2004	10	12	9.70E-01	1.03E-01	5.15E-01	8.47E-03	2.04E-02	2.09E+00	1.47E+00	4.31E+00	1.71E+00	5.12E+00	6.41E-01	7.11E-01	1.16E+00	3.95E+00	1.38E+00
2004	10	13	7.22E-01	3.85E-01	4.60E-01	2.39E-01	3.48E-01	3.07E+00	1.59E+00	3.84E+00	3.32E-01	6.33E+00	3.85E+00	8.11E-01	8.53E-01	3.15E+00	1.03E+00
2004	10	14	2.70E+00	9.00E-01	1.35E+00	2.19E-01	3.61E-01	3.42E+00	1.04E+00	4.68E+00	2.23E+00	5.15E+00	2.02E+00	6.63E-01	5.10E-01	4.93E+00	3.66E+00
2004	10	15	3.62E+00	6.52E-01	2.14E+00	3.81E-01	7.10E-01	4.86E+00	1.24E+00	5.77E+00	4.27E+00	1.57E+00	6.57E+00	8.08E-02	2.23E-01	5.43E+00	4.38E+00
2004	10	16	1.07E+00	1.86E-05	1.49E+00	8.09E-07	2.92E-02	1.94E+00	2.57E-01	2.19E+00	3.24E+00	2.01E+00	1.36E+00	2.68E-01	5.68E-01	2.04E+00	1.32E+00
2004	10	17	8.25E-01	2.89E-06	5.63E-01	0.00E+00	0.00E+00	1.08E+00	3.62E-02	1.06E+00	1.99E+00	3.52E-06	5.19E-06	0.00E+00	4.01E-10	2.10E+00	1.05E+00
2004	10	18	1.23E+00	8.03E-02	6.62E-01	1.64E-02	2.40E-02	3.53E+00	1.09E+00	4.20E+00	2.00E+00	1.77E+00	2.57E-01	2.66E-01	4.98E-01	3.43E+00	1.53E+00
2004	10	19	1.01E+00	3.34E-01	4.53E-01	1.26E-01	2.05E-01	1.06E+00	4.20E-01	1.43E+00	1.85E+00	9.39E-01	2.58E+00	2.04E-02	3.68E-02	2.32E+00	1.26E+00
2004	10	20	5.28E+00	3.71E-02	3.41E+00	1.00E-01	4.60E-01	6.60E+00	2.27E+00	7.09E+00	4.45E+00	7.40E+00	2.20E+00	9.68E-01	1.95E+00	6.31E+00	6.30E+00
2004	10	21	1.68E+00	1.71E+00	6.48E-01	2.85E-01	5.83E-01	4.25E+00	2.22E+00	6.34E+00	6.06E-01	2.25E+00	6.06E+00	1.43E-01	5.90E-01	4.79E+00	2.54E+00
2004	10	22	5.75E-01	2.05E-03	1.68E-01	1.21E-02	7.57E-02	9.84E-01	4.66E-01	1.25E+00	2.72E-02	1.40E+00	9.42E-01	1.87E-01	4.71E-01	1.09E+00	7.78E-01
2004	10	23	3.18E-02	0.00E+00	4.85E-02	0.00E+00	0.00E+00	1.24E+00	4.55E-01	1.86E+00	4.02E-04	2.14E+00	9.39E-02	3.57E-01	4.88E-01	1.28E+00	1.42E-01
2004	10	24	1.63E-01	0.00E+00	6.45E-02	0.00E+00	0.00E+00	9.15E-01	4.70E-01	1.95E+00	9.07E-04	1.52E+00	6.50E-02	3.65E-01	4.65E-01	9.32E-01	3.74E-01
2004	10	25	7.02E-01	2.04E-01	5.35E-01	1.10E-02	2.13E-02	1.88E+00	1.84E+00	4.24E+00	6.07E-01	7.65E+00	9.83E-01	9.45E-01	5.93E-01	3.85E+00	1.13E+00
2004	10	26	3.16E+00	7.61E-01	2.29E+00	1.28E-01	2.43E-01	7.13E+00	3.64E+00	1.05E+01	4.48E+00	1.27E+01	1.90E+00	2.63E+00	3.55E+00	1.14E+01	4.60E+00
2004	10	27	1.83E+00	1.24E-01	2.09E+00	2.09E-01	3.98E-01	6.48E+00	2.85E+00	8.40E+00	1.84E+00	1.04E+01	3.50E+00	9.73E-01	1.38E+00	7.77E+00	2.42E+00
2004	10	28	2.76E+00	2.83E-01	1.95E+00	6.49E-02	1.16E-01	7.26E+00	3.00E+00	8.05E+00	3.19E+00	8.24E+00	1.05E+00	1.33E+00	1.54E+00	7.97E+00	4.13E+00
2004	10	29	1.31E+00	1.54E-01	9.94E-01	3.78E-02	7.62E-02	3.80E+00	2.20E+00	5.63E+00	1.46E+00	6.04E+00	6.74E-01	8.16E-01	1.23E+00	5.36E+00	1.74E+00
2004	10	30	6.85E-02	0.00E+00	2.36E-02	0.00E+00	1.15E-05	8.61E-01	4.69E-01	1.60E+00	4.05E-04	2.36E+00	8.38E-02	4.69E-01	3.10E-01	9.15E-01	1.57E-01
2004	10	31	2.91E-01	6.76E-05	2.33E-01	2.16E-06	4.26E-05	3.63E+00	1.62E+00	5.71E+00	5.22E-02	8.08E+00	2.69E-03	1.95E+00	4.29E-01	4.13E+00	5.21E-01
2004	11	1	5.78E-01	4.03E-04	2.52E-01	4.07E-05	1.60E-04	2.51E+00	1.40E+00	3.69E+00	3.35E-02	5.69E+00	6.37E-02	1.15E+00	4.99E-01	4.04E+00	7.38E-01
2004	11	2	3.66E-01	2.20E-04	1.44E-01	3.40E-05	1.20E-04	2.61E+00	7.38E-01	4.07E+00	2.38E-02	2.57E+00	9.92E-02	4.44E-01	4.86E-01	2.27E+00	7.60E-01
2004	11	3	1.96E+00	8.03E-04	1.11E+00	3.99E-05	1.39E-04	4.22E+00	1.88E+00	6.79E+00	1.06E+00	6.58E+00	3.66E-03	1.71E+00	8.85E-01	4.91E+00	2.37E+00
2004	11	4	5.53E-02	0.00E+00	7.59E-04	0.00E+00	0.00E+00	3.92E-01	3.48E-01	1.04E+00	1.67E-16	2.91E+00	5.37E-03	4.28E-01	1.61E-01	6.38E-01	8.43E-02
2004	11	5	1.34E-01	0.00E+00	8.36E-03	0.00E+00	3.53E-10	7.03E-01	3.57E-01	1.34E+00	7.19E-06	1.24E+00	6.66E-02	5.77E-01	1.77E-01	8.95E-01	1.42E-01
2004	11	6	2.01E-01	2.95E-01	1.15E-01	2.81E-02	4.54E-02	7.72E-01	9.10E-01	1.80E+00	1.61E-01	4.28E+00	1.05E+00	8.13E-01	9.29E-01	1.13E+00	2.86E-01
2004	11	7	3.06E+00	1.72E+00	1.64E+00	1.59E-01	1.19E-01	3.15E+00	1.09E+00	4.26E+00	2.07E+00	1.28E+00	2.25E+00	2.07E-01	3.47E-01	4.03E+00	3.96E+00
2004	11	8	9.56E-01	1.23E-03	8.24E-01	1.05E-04	4.21E-04	5.60E+00	1.85E+00	6.52E+00	1.06E-01	6.84E+00	1.16E-02	1.38E+00	3.86E-01	7.43E+00	1.29E+00
2004	11	9	1.93E+00	4.42E-04	1.69E+00	5.53E-05	1.38E-04	4.85E+00	1.47E+00	5.88E+00	3.63E+00	5.28E+00	2.21E-03	9.29E-01	4.99E-01	5.69E+00	2.54E+00
2004	11	10	2.76E+00	3.59E-01	1.50E+00	6.17E-02	1.02E-01	3.78E+00	1.43E+00	4.97E+00	4.05E+00	4.65E+00	1.15E+00	5.63E-01	6.22E-01	6.07E+00	3.32E+00
2004	11	11	3.33E+00	3.31E-02	2.61E+00	4.93E-03	8.75E-03	5.46E+00	2.01E+00	5.88E+00	5.52E+00	2.56E+00	1.66E-01	5.85E-01	7.46E-01	6.31E+00	4.24E+00
2004	11	12	3.87E-01	3.21E-02	5.17E-01	8.34E-03	3.52E-02	6.47E+00	3.13E+00	1.05E+01	2.10E-01	1.48E+01	1.24E-01	2.06E+00	2.81E+00	7.10E+00	5.21E-01
2004	11	13	3.29E-01	3.41E-04	2.63E-01	5.64E-05	1.44E-04	3.53E+00	1.64E+00	4.60E+00	2.53E-02	9.54E+00	3.50E-03	1.77E+00	1.07E+00	4.07E+00	4.13E-01
2004	11	14	2.80E-01	6.68E-05	1.91E-01	5.40E-06	3.38E-05	1.66E+00	1.04E+00	2.76E+00	7.11E-03	4.80E+00	1.78E-02	7.31E-01	2.31E-01	2.04E+00	3.75E-01
2004	11	15	7.68E-02	0.00E+00	7.03E-03	0.00E+00	2.67E-11	4.08E-01	4.32E-01	1.33E+00	9.72E-19	1.68E+00	5.56E-02	6.39E-01	2.29E-01	6.87E-01	1.14E-01
2004	11	16	6.55E-02	0.00E+00	7.66E-03	0.00E+00	0.00E+00	6.01E-01	7.21E-01	1.51E+00	5.93E-04	5.20E+00	3.85E-02	1.11E+00	3.67E-01	8.37E-01	9.62E-02
2004	11	17	5.43E-01	2.29E-04	3.99E-01	3.19E-05	2.58E-03	1.32E+00	1.16E+00	2.18E+00	2.81E-02	4.99E+00	9.90E-02	8.43E-01	6.08E-01	1.61E+00	8.21E-01
2004	11	18	8.93E-02	0.00E+00	1.42E-02	0.00E+00	0.00E+00	6.65E-01	5.39E-01	1.51E+00	9.90E-19	2.40E+00	5.31E-02	6.27E-01	3.41E-01	8.79E-01	1.75E-01
2004	11	19	2.02E+00	5.61E-01	8.04E-01	1.47E-01	2.03E-01	5.15E+00	2.25E+00	8.36E+00	2.77E+00	8.04E+00	1.42E+00	1.20E+00	1.02E+00	6.72E+00	3.03E+00
2004	11	20	3.63E-01	2.88E-03	2.08E-01	6.48E-04	1.55E-03	2.60E+00	1.22E+00	5.18E+00	4.11E-02	7.64E+00	6.48E-03	2.18E+00	3.08E+00	3.76E+00	6.39E-01
2004	11	21	5.47E-02	0.00E+00	1.03E-03	0.00E+00	0.00E+00	3.67E-01	4.04E-01	1.17E+00	8.83E-17	3.66E+00	1.35E-02	4.48E-01	2.44E-01	6.79E-01	8.28E-02
2004	11	22	1.81E+00	3.71E-01	9.79E-01	7.07E-02	9.77E-02	4.98E+00	1.97E+00	7.35E+00	1.90E+00	6.64E+00	2.37E+00	1.30E+00	1.30E+00	5.51E+00	2.54E+00
2004	11	23	2.79E-01	1.38E-03	3.96E-01	2.58E-04	5.30E-04	3.30E+00	1.86E+00	5.99E+00	5.33E-02	1.16E+01	5.50E-03	1.61E+00	4.14E-01	5.17E+00	5.78E-01
2004	11	24	4.44E-02	0.00E+00	1.13E-03	0.00E+00	0.00E+00	3.41E-01	3.67E-01	1.11E+00	1.54E-17	1.12E+00	1.67E-02	7.32E-01	2.11E-01	5.60E-01	6.85E-02
2004	11	25	1.21E+00	1.04E+00	3.55E-01	2.75E-01	3.41E-01	3.23E+00	2.49E+00	5.42E+00	3.65E-01	1.24E+01	3.15E+00	1.82E+00	1.91E+00	4.87E+00	1.57E+00
2004	11	26	7.77E-01	1.12E-04	3.61E-01	3.47E-05	9.24E-05	3.13E+00	1.51E+00	4.63E+00	3.93E-02	6.90E+00	5.34E-03	1.07E+00	1.01E+00	4.00E+00	9.77E-01
2004	11	27	2.03E+00	1.88E-03	1.32E+00	3.29E-04	8.40E-04	4.90E+00	2.44E+00	8.19E+00	2.50E+00	1.07E+01	1.14E-02	2.14E+00	1.52E+00	6.35E+00	2.87E+00
2004	11	28	3.23E-01	5.39E-03	3.27E-01	1.79E-03	3.11E-03	4.16E+00	2.81E+00	7.98E+00	9.90E-02	1.38E+01	9.86E-03	1.20E+00	2.01E+00	6.43E+00	3.83E-01
2004	11	29	6.84E-02	0.00E+00	3.56E-04	0.00E+00	0.00E+00	3.26E-01	3.77E-01	9.86E-01	3.87E-16	5.06E+00	2.03E-04	3.47E-01	2.39E-01	6.38E-01	1.04E-01
2004	11	30	8.23E-02	0.00E+00	5.70E-04	0.00E+00	0.00E+00	4.64E-01	6.46E-01	1.53E+00	7.16E-18	7.93E+00	1.36E-04	6.01E-01	3.07E-01	9.77E-01	1.31E-01
2004	12	1	9.36E-02	0.00E+00	2.41E-03	0.00E+00	0.00E+00	7.08E-01	8.25E-01	2.74E+00	3.90E-18	8.78E+00	2.05E-05	8.76E-01	3.52E-01	1.37E+00	1.74E-01

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	9	11	3.09E+00	1.72E-02	6.79E-01	1.12E-02	1.88E-02	1.11E+01	3.66E+00	8.62E+00	3.48E-01	9.71E-02	4.80E-02	1.82E-01	1.31E-01	6.00E+00	4.56E+00
2004	9	12	4.93E+00	1.66E-02	2.02E+00	5.41E-03	1.12E-02	1.66E+01	1.11E+01	1.44E+01	3.40E-01	9.08E-02	3.79E-02	2.00E-01	1.48E-01	1.29E+01	6.56E+00
2004	9	13	4.37E+00	3.06E-02	1.18E+00	2.12E-02	4.31E-02	2.08E+01	1.60E+01	2.78E+01	4.92E-01	2.11E-01	1.05E-01	3.91E-01	2.89E-01	2.93E+01	5.91E+00
2004	9	14	1.87E+00	5.64E-04	9.95E-01	5.15E-05	5.35E-04	1.28E+01	4.89E+00	1.37E+01	3.05E-01	3.82E-02	6.49E-03	1.36E-01	9.12E-02	1.25E+01	3.00E+00
2004	9	15	3.39E+00	1.25E-06	1.07E+00	0.00E+00	2.85E-05	9.17E+00	4.89E+00	1.23E+01	2.54E-01	2.84E-02	1.23E-03	9.39E-02	7.91E-02	9.02E+00	4.96E+00
2004	9	16	1.43E+00	3.81E-04	6.91E-01	1.90E-05	2.89E-04	1.84E+01	4.31E+00	1.61E+01	3.37E-01	4.64E-02	7.08E-03	1.28E-01	9.36E-02	1.27E+01	3.49E+00
2004	9	17	5.15E+00	2.28E-02	1.55E+00	1.53E-02	2.48E-02	1.26E+01	6.71E+00	1.20E+01	3.16E-01	1.09E-01	6.26E-02	1.82E-01	1.38E-01	1.02E+01	7.01E+00
2004	9	18	8.18E+00	7.72E-02	1.73E+00	5.00E-02	6.18E-02	1.83E+01	9.38E+00	1.51E+01	4.87E-01	2.17E-01	1.39E-01	2.98E-01	2.52E-01	1.49E+01	9.75E+00
2004	9	19	1.02E+01	1.01E-03	6.20E+00	2.15E-05	1.32E-04	1.70E+01	3.99E+00	1.61E+01	8.83E-02	8.50E-03	2.94E-03	2.59E-02	1.25E-02	2.04E+01	1.17E+01
2004	9	20	9.89E+00	1.44E-02	5.10E+00	4.82E-03	4.32E-03	1.59E+01	6.08E+00	1.78E+01	1.21E-01	1.62E-02	1.04E-02	3.79E-02	2.23E-02	2.12E+01	1.41E+01
2004	9	21	5.24E-01	0.00E+00	7.56E-03	0.00E+00	0.00E+00	3.54E+00	2.76E+00	5.06E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.57E+00	7.63E-01
2004	9	22	9.11E-01	0.00E+00	3.71E-01	0.00E+00	0.00E+00	8.91E+00	4.64E+00	1.17E+01	8.81E-02	1.00E-02	5.31E-04	5.44E-02	2.69E-02	1.22E+01	1.18E+00
2004	9	23	2.40E+00	5.99E-03	4.02E+00	6.61E-04	2.78E-03	2.63E+01	1.14E+01	2.83E+01	3.35E-01	5.84E-02	2.29E-02	1.48E-01	9.16E-02	3.77E+01	3.72E+00
2004	9	24	2.43E+00	2.80E-03	1.52E+00	7.14E-04	1.59E-03	2.61E+01	1.38E+01	2.58E+01	3.27E-01	6.32E-02	1.40E-02	2.14E-01	1.22E-01	3.09E+01	3.85E+00
2004	9	25	5.42E+00	1.01E-03	2.35E+00	2.44E-05	3.54E-04	2.19E+01	1.06E+01	3.04E+01	3.59E-01	6.19E-02	1.38E-02	1.76E-01	1.08E-01	2.48E+01	7.61E+00
2004	9	26	1.38E+01	3.29E-03	7.39E+00	5.20E-04	1.06E-03	2.12E+01	4.47E+00	2.36E+01	1.98E-01	2.15E-02	7.90E-03	5.82E-02	3.50E-02	2.56E+01	1.65E+01
2004	9	27	1.62E+01	3.66E-02	9.29E+00	1.47E-02	2.13E-02	3.46E+01	6.47E+00	2.55E+01	5.09E-01	1.30E-01	6.62E-02	2.21E-01	1.68E-01	3.35E+01	1.95E+01
2004	9	28	9.95E+00	5.36E-03	5.57E+00	1.66E-03	3.40E-03	3.11E+01	7.08E+00	2.93E+01	2.68E-01	4.11E-02	1.45E-02	1.10E-01	6.82E-02	2.82E+01	1.20E+01
2004	9	29	1.57E+01	6.63E-03	7.83E+00	4.51E-04	3.09E-04	1.73E+01	9.68E-02	1.61E+01	1.75E-01	1.80E-02	6.65E-03	2.81E-02	2.21E-02	1.93E+01	1.72E+01
2004	9	30	7.43E+00	9.36E-03	5.36E+00	1.44E-03	2.87E-03	1.64E+01	4.29E+00	2.12E+01	2.68E-01	5.23E-02	1.94E-02	1.36E-01	8.44E-02	2.29E+01	9.80E+00
2004	10	1	1.56E+00	4.90E-03	9.75E-01	1.26E-03	2.46E-03	3.55E+00	1.96E+00	4.39E+00	8.12E-02	2.36E-02	1.05E-02	5.10E-02	3.40E-02	4.61E+00	1.98E+00
2004	10	2	3.30E-01	1.33E-03	5.13E-01	3.27E-04	7.61E-04	4.85E+00	2.30E+00	6.34E+00	6.29E-02	8.35E-03	3.28E-03	2.95E-02	1.56E-02	6.84E+00	4.45E-01
2004	10	3	2.65E+00	1.79E-02	1.77E+00	9.90E-03	1.53E-02	5.33E+00	1.80E+00	5.25E+00	1.71E-01	6.03E-02	3.61E-02	9.41E-02	7.48E-02	5.52E+00	3.21E+00
2004	10	4	2.50E-01	3.65E-03	3.94E-01	1.06E-03	2.33E-03	4.27E+00	2.15E+00	3.60E+00	7.02E-02	2.07E-02	9.17E-03	5.34E-02	3.31E-02	6.32E+00	2.85E-01
2004	10	5	8.12E-02	3.04E-05	1.74E-01	8.59E-07	5.44E-06	1.85E+00	7.87E-01	2.28E+00	1.21E-02	1.97E-03	3.41E-04	8.80E-03	3.81E-03	2.32E+00	1.55E-01
2004	10	6	2.15E-01	3.68E-06	1.26E-01	0.00E+00	4.95E-06	1.26E+00	3.78E-01	1.45E+00	8.66E-03	1.54E-03	2.13E-04	7.81E-03	2.73E-03	1.03E+00	3.10E-01
2004	10	7	3.35E-01	2.13E-03	2.98E-01	5.10E-04	1.83E-03	3.89E+00	2.05E+00	5.68E+00	1.48E-01	3.28E-02	1.03E-02	7.00E-02	5.54E-02	4.18E+00	6.17E-01
2004	10	8	1.20E+00	7.53E-03	4.41E-01	4.77E-03	9.37E-03	3.54E+00	1.83E+00	4.70E+00	1.72E-01	5.53E-02	2.57E-02	9.69E-02	7.48E-02	3.42E+00	1.65E+00
2004	10	9	5.16E-01	1.56E-03	2.15E-01	6.85E-04	2.61E-03	2.55E+00	1.37E+00	3.17E+00	1.30E-01	3.24E-02	1.24E-02	4.94E-02	4.21E-02	2.22E+00	8.03E-01
2004	10	10	1.82E-01	2.79E-06	1.68E-01	0.00E+00	1.15E-05	2.54E+00	8.61E-01	3.36E+00	6.29E-02	7.95E-03	7.34E-04	3.02E-02	2.00E-02	2.55E+00	2.98E-01
2004	10	11	4.52E-02	0.00E+00	2.67E-03	0.00E+00	0.00E+00	4.27E-01	2.92E-01	6.29E-01	0.00E+00	0.00E+00	0.00E+00	5.03E-06	0.00E+00	5.75E-01	6.40E-02
2004	10	12	9.14E-01	5.92E-04	4.66E-01	5.78E-05	1.87E-04	2.03E+00	1.40E+00	3.35E+00	2.23E-02	5.19E-03	1.64E-03	1.74E-02	9.54E-03	3.87E+00	1.24E+00
2004	10	13	6.25E-01	1.15E-02	4.51E-01	4.72E-03	7.57E-03	3.06E+00	1.52E+00	3.12E+00	9.66E-02	3.68E-02	2.07E-02	6.15E-02	4.86E-02	3.06E+00	7.95E-01
2004	10	14	2.49E+00	7.41E-03	1.24E+00	3.62E-03	5.51E-03	3.30E+00	9.82E-01	4.34E+00	1.50E-01	3.46E-02	1.52E-02	7.12E-02	5.03E-02	4.90E+00	3.22E+00
2004	10	15	3.27E+00	1.47E-02	1.88E+00	6.22E-03	1.00E-02	4.68E+00	1.22E+00	5.13E+00	1.50E-01	4.35E-02	2.44E-02	6.98E-02	5.41E-02	5.38E+00	3.71E+00
2004	10	16	9.61E-01	1.85E-05	6.76E-01	8.09E-07	6.57E-05	1.31E+00	2.21E-01	2.05E+00	1.63E-02	8.58E-03	1.55E-03	1.32E-02	1.12E-02	1.96E+00	1.21E+00
2004	10	17	8.25E-01	0.00E+00	5.25E-01	0.00E+00	0.00E+00	1.02E+00	3.62E-02	1.06E+00	2.56E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E+00	1.05E+00
2004	10	18	1.22E+00	2.00E-03	6.27E-01	6.08E-04	1.13E-03	3.47E+00	1.05E+00	3.32E+00	5.98E-02	1.19E-02	4.31E-03	2.84E-02	1.98E-02	3.39E+00	1.50E+00
2004	10	19	1.00E+00	8.46E-03	4.27E-01	4.98E-03	1.10E-02	1.02E+00	4.19E-01	1.40E+00	2.29E-02	1.62E-02	1.84E-02	1.52E-02	1.58E-02	2.32E+00	1.25E+00
2004	10	20	4.14E+00	1.42E-02	2.63E+00	5.53E-03	1.14E-02	5.64E+00	1.98E+00	5.84E+00	2.11E-01	6.27E-02	3.43E-02	8.38E-02	7.20E-02	5.81E+00	4.59E+00
2004	10	21	1.59E+00	4.27E-02	6.31E-01	1.36E-02	1.64E-02	4.18E+00	2.18E+00	5.33E+00	1.76E-01	6.64E-02	4.35E-02	9.52E-02	7.69E-02	4.64E+00	2.38E+00
2004	10	22	5.58E-01	2.03E-03	1.66E-01	1.65E-03	3.35E-03	9.70E-01	4.60E-01	9.18E-01	2.54E-02	9.66E-03	5.39E-03	2.14E-02	1.39E-02	1.08E+00	7.42E-01
2004	10	23	3.18E-02	0.00E+00	4.85E-02	0.00E+00	0.00E+00	1.24E+00	4.41E-01	1.25E+00	4.02E-04	1.53E-05	0.00E+00	3.43E-03	3.02E-04	1.27E+00	1.42E-01
2004	10	24	1.10E-01	0.00E+00	6.45E-02	0.00E+00	0.00E+00	9.15E-01	4.64E-01	1.17E+00	9.07E-04	1.95E-05	0.00E+00	3.83E-03	4.67E-04	9.23E-01	2.55E-01
2004	10	25	6.59E-01	1.88E-03	5.29E-01	1.62E-04	4.53E-04	1.87E+00	1.77E+00	3.32E+00	5.40E-02	1.21E-02	4.54E-03	2.71E-02	1.79E-02	3.84E+00	9.89E-01
2004	10	26	2.42E+00	2.64E-02	2.05E+00	9.77E-03	1.43E-02	6.85E+00	3.33E+00	9.07E+00	2.36E-01	8.05E-02	4.38E-02	1.52E-01	1.07E-01	1.09E+01	3.29E+00
2004	10	27	1.49E+00	9.67E-03	1.23E+00	4.68E-03	7.94E-03	5.67E+00	2.78E+00	7.19E+00	1.27E-01	4.17E-02	2.02E-02	9.47E-02	6.37E-02	7.59E+00	1.84E+00
2004	10	28	1.65E+00	6.24E-03	1.35E+00	1.59E-03	2.96E-03	6.22E+00	2.71E+00	6.83E+00	1.09E-01	2.93E-02	1.31E-02	6.64E-02	4.29E-02	7.33E+00	2.66E+00
2004	10	29	1.10E+00	1.55E-02	8.77E-01	5.58E-03	9.22E-03	3.73E+00	2.12E+00	4.84E+00	1.36E-01	4.88E-02	2.67E-02	9.00E-02	6.59E-02	5.18E+00	1.27E+00
2004	10	30	6.85E-02	0.00E+00	2.36E-02	0.00E+00	0.00E+00	8.61E-01	4.39E-01	1.09E+00	4.05E-04	2.24E-05	0.00E+00	3.01E-03	6.66E-04	9.13E-01	1.57E-01
2004	10	31	2.54E-01	6.76E-05	2.33E-01	2.16E-06	4.26E-05	3.63E+00	1.50E+00	4.12E+00	5.21E-02	6.50E-03	9.78E-04	2.77E-02	1.47E-02	4.05E+00	4.26E-01
2004	11	1	5.66E-01	4.03E-04	2.52E-01	4.07E-05	1.60E-04	2.51E+00	1.31E+00	2.63E+00	3.18E-02	6.51E-03	1.68E-03	2.58E-02	1.38E-02	3.88E+00	6.96E-01
2004	11	2	3.65E-01	2.20E-04	1.44E-01	3.40E-05	1.20E-04	2.61E+00	7.01E-01	2.73E+00	2.38E-02	4.09E-03	9.93E-04	1.82E-02	8.56E-03	2.20E+00	7.57E-01
2004	11	3	1.74E+00	6.82E-04	1.08E+00	3.47E-05	1.23E-04	4.13E+00	1.66E+00	5.30E+00	9.39E-02	1.26E-02	2.78E-03	4.49E-02	2.55E-02	4.74E+00	2.00E+00
2004	11	4	5.53E-02	0.00E+00	7.59E-04	0.00E+00	0.00E+00	3.92E-01	3.08E-01	5.76E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.36E-01	8.43E-02
2004	11	5	1.34E-01	0.00E+00	8.36E-03	0.00E+00	0.00E+00	7.03E-01	3.32E-01	1.09E+00	7.19E-06	0.00E+00	0.00E+00	2.54E-04	4.33E-05	8.17E-01	1.42E-01
2004	11	6	1.91E-01	1.39E-03	1.06E-01	8.76E-04	1.10E-03	7.59E-01	8.48E-01	1.42E+00	2.23E-02	3.99E-03	2.04E-03	1.07E-02	6.23E-03	1.12E+00	2.75E-01
2004	11	7	3.03E+00	2.74E-02	1.58E+00	6.79E-03	7.27E-03	3.02E+00	1.07E+00	4.11E+00	1.09E-01	2.84E-02	2.09E-02	3.59E-02	2.97E-02	4.02E+00	3.88E+00
2004	11	8	8.80E-01	1.10E-03	8.11E-01	8.86E-05	3.64E-04	5.53E+00	1.75E+00	5.06E+00	9.49E-02	1.94E-02	5.22E-03	4.50E-02	3.04E-02	7.29E+00	1.07E+00
2004	11	9	1.64E+00	4.21E-04	1.35E+00	5.14E-05	1.30E-04	4.52E+00	1.29E+00	5.21E+00	4.26E-02	6.96E-03	1.91E-03	1.71E-02	1.15E-02	5.47E+00	2.01E+00
2004	11	10	2.38E+00	6.36E-03	1.42E+00	1.86E-03	3.76E-03	3.68E+00	1.37E+00	4.44E+00	9.33E-02	3.00E-02	1.40E-02	6.21E-02	4.27E-02	5.94E+00	2.65E+00
2004	11	11	2.77E+00	1.23E-02	2.19E+00	3.41E-03	6.04E-03	4.84E+00	1.96E+00	5.10E+00	1.69E-01	4.82E-02	2.30E-02	9.21E-02	6.69E-02	6.15E+00	3.24E+00
2004	11	12	3.63E-01	8.29E-03	5.06E-01	3.64E-03	5.85E-03	6.46E+00	2.96E+00	8.43E+00	1.14E-01	3.26E-02	1.59E-02	7.69E-02	5.18E-02	6.80E+00	4.78E-01
2004	11	13	3.14E-01	3.41E-04	2.63E-01	5.64E-05	1.44E-04	3.53E+00	1.48E+00	3.46E+00	2.53E-02	3.97E-03	1.01E-03	2.10E-02	1.00E-02	3.99E+00	3.74E-01
2004	11	14	2.38E-01	6.68E-05	1.91E-01	5.40E-06	3.38E-05	1.66E+00	9.97E-01	2.18E+00	6.97E-03	1.14E-03	3.23E-04	4.50E-03	2.13E-03	2.01E+00	3.02E-01
2004	11	15	7.68E-02	0.00E+00	7.03E-03	0.00E+00	0.00E+00	4.08E-01	4.14E-01	8.78E-01	0.00E+00	0.00E+00	0.00E+00	2.01E-04	2.19E-07	6.86E-01	1.14E-01
2004	11	16	6.55E-02	0.00E+00	7.66E-03	0.00E+00	0.00E+00	6.01E-01	6.78E-01	1.06E+00	5.93E-04	1.62E-05	0.00E+00	5.14E-03	1.34E-03	8.37E-01	9.62E-02
2004	11	17	4.85E-01	1.92E-04	3.92E-01	2.95E-05	1.33E-04	1.30E+00	1.15E+00	2.01E+00	2.19E-02	3.79E-03	1.08E-03	2.53E-02	8.15E-03	1.61E+00	6.82E-01
2004	11	18	8.93E-02	0.00E+00	1.42E-02	0.00E+00	0.00E+00	6.65E-01	4.87E-01	1.12E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-03	3.36E-05	8.42E-01	1.75E-01
2004	11	19	1.52E+00	8.85E-03	5.74E-01	2.79E-03	5.48E-03	4.80E+00	2.09E+00	6.55E+00	1.20E-01	3.76E-02	1.88E-02	7.79E-02	5.29E-02	6.39E+00	2.29E+00
2004	11	20	3.62E-01	2.88E-03	2.08E-01	6.48E-04	1.55E-03	2.60E+00	1.07E+00	4.34E+00	3.91E-02	1.26E-02	6.32E-03	2.53E-02	1.76E-02	3.62E+00	6.32E-01
2004	11	21	5.47E-02	0.00E+00	1.03E-03	0.00E+00	0.00E+00	3.67E-01	3.52E-01	4.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.79E-01	8.28E-02
2004	11	22	1.59E+00	1.20E-02	8.05E-01	3.84E-03	6.15E-03	4.82E+00	1.86E+00	5.77E+00	1.44E-01	3.63E-02	1.93E-02	7.05E-02	5.08E-02	5.31E+00	2.15E+00
2004	11	23	2.28E-01	1.38E-03	3.96E-01	2.58E-04	5.30E-04	3.30E+00	1.73E+00	4.21E+00	5.26E-02	8.70E-03	3.24E-03	2.53E-02	1.50E-02	5.02E+00	4.26E-01
2004	11	24	4.44E-02	0.00E+00	1.13E-03	0.00E+00	0.00E+00	3.41E-01	3.53E-01	5.63E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.60E-01	6.85E-02
2004	11	25	1.18E+00	8.33E-03	3.49E-01	6.66E-03	8.62E-03	3.20E+00	2.37E+00	4.03E+00	1.36E-01	4.49E-02	2.15E-02	7.57E-02	5.83E-02	4.75E+00	1.53E+00
2004	11	26	7.28E-01	1.10E-04	3.54E-01	3.47E-05	9.16E-05	3.10E+00	1.43E+00	3.65E+00	2.04E-02	2.95E-03	6.65E-04	1.29E-02	6.48E-03	3.92E+00	8.53E-01
2004	11	27	1.71E+00	1.87E-03	1.06E+00	3.29E-04	8.40E-04	4.35E+00	2.19E+00	7.09E+00	1.05E-01	2.04E-02	6.20E-03	4.15E-02	3.15E-02	6.05E+00	2.43E+00
2004	11	28	3.19E-01	5.39E-03	3.27E-01	1.79E-03	3.11E-03	4.16E+00	2.66E+00	6.19E+00	7.75E-02	2.05E-02	9.83E-03	4.64E-02	3.21E-02	6.18E+00	3.65E-01
2004	11	29	6.84E-02	0.00E+00	3.56E-04	0.00E+00	0.00E+00	3.26E-01	3.01E-01	6.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.37E-01	1.04E-01
2004	11	30	8.23E-02	0.00E+00	5.70E-04	0.00E+00	0.00E+00	4.64E-01	5.31E-01	7.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.77E-01	1.31E-01
2004	12	1	9.36E-02	0.00E+00	2.41E-03	0.00E+00	0.00E+00	7.08E-01	7.00E-01	1.64E+00	0.00E+00	0.00E+00	0.00E+00	4.89E-04	0.00E+00	1.37E+00	1.74E-01

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	9	11	5.10E-02	8.90E-02	1.24E-03	4.91E-02	3.34E-01	5.29E-03	2.10E-02	5.22E-01	1.04E-02	3.90E+00	3.44E+00	3.42E-01	4.83E-01	1.02E-01	1.25E-01
2004	9	12	1.10E-01	3.95E-01	1.65E-02	6.22E-02	1.97E-01	2.71E-02	3.27E-02	6.01E-01	1.03E+00	9.08E+00	5.30E+00	8.80E-01	1.56E+00	3.80E-02	2.43E-01
2004	9	13	6.18E-02	9.19E-01	1.05E-02	4.98E-01	9.67E-01	1.88E-02	1.88E-01	1.90E+00	2.78E-01	3.31E+01	1.17E+01	2.76E+00	4.06E+00	1.28E-01	1.57E-01
2004	9	14	4.41E-02	3.08E-06	5.28E-04	1.45E-07	1.84E-06	2.90E-03	4.01E-02	7.71E-01	1.54E-03	6.35E+00	6.36E-02	7.69E-01	9.63E-01	3.64E-02	1.14E-01
2004	9	15	3.05E-02	0.00E+00	1.58E-03	0.00E+00	2.06E-04	1.16E-02	1.41E-02	6.42E-01	1.94E-02	7.15E+00	2.32E-01	6.64E-01	1.31E+00	1.24E-02	1.24E-01
2004	9	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-05	0.00E+00	3.26E-02	1.12E+00	0.00E+00	5.11E+00	2.64E-01	6.25E-01	1.26E+00	7.10E-02	0.00E+00
2004	9	17	2.19E-02	7.79E-01	6.73E-03	2.53E-01	3.67E-01	2.26E-02	3.03E-02	8.97E-01	5.63E-02	6.57E+00	7.27E+00	5.85E-01	9.00E-01	1.34E-02	4.60E-02
2004	9	18	2.22E-01	8.77E-01	8.86E-03	3.79E-01	4.71E-01	1.99E-02	1.89E-02	8.37E-01	1.21E-01	4.02E+00	1.41E+01	3.35E-01	2.92E-01	7.70E-02	5.28E-01
2004	9	19	2.94E-01	2.47E-06	2.78E-01	0.00E+00	0.00E+00	1.76E-01	8.27E-02	5.23E-01	2.43E+00	9.69E+00	3.36E-03	1.17E+00	1.56E+00	9.57E-02	4.65E-01
2004	9	20	2.72E-02	3.92E-01	5.83E-02	8.06E-02	1.03E-01	6.58E-02	4.96E-02	5.22E-01	7.33E+00	7.62E+00	9.47E-01	5.52E-01	9.79E-01	2.19E-02	5.89E-02
2004	9	21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E-02	7.54E-01	4.32E-16	9.91E+00	1.42E-02	8.43E-01	5.66E-01	1.51E-03	0.00E+00
2004	9	22	1.22E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.82E-02	9.04E-01	4.49E-16	1.23E+01	2.42E-02	1.20E+00	1.18E+00	3.12E-02	3.31E-03
2004	9	23	2.26E-01	2.25E-04	7.44E-03	3.03E-05	6.81E-05	1.68E-02	5.72E-02	1.00E+00	9.64E-03	2.14E+01	4.56E-02	1.83E+00	9.48E-01	1.47E-01	5.30E-01
2004	9	24	2.04E-02	0.00E+00	4.58E-06	0.00E+00	0.00E+00	3.60E-05	1.40E-01	1.64E+00	1.62E-03	2.30E+01	5.63E-02	2.28E+00	1.15E+00	1.66E-01	5.77E-02
2004	9	25	4.39E-02	3.47E-06	4.88E-03	0.00E+00	1.90E-06	6.34E-02	6.34E-02	9.16E-01	4.21E-02	1.56E+01	6.34E-02	1.24E+00	1.25E+00	8.15E-02	9.57E-02
2004	9	26	4.07E-01	4.20E-06	1.30E+00	0.00E+00	4.10E-09	1.04E+00	4.32E-02	3.71E-01	6.51E+00	3.91E+00	2.65E-04	3.47E-01	5.65E-01	8.56E-02	7.30E-01
2004	9	27	4.75E-01	4.94E-01	1.41E-01	2.27E-02	3.47E-02	1.22E-01	3.26E-02	5.58E-01	4.07E+00	7.95E+00	6.30E-01	6.00E-01	6.70E-01	1.11E-01	8.59E-01
2004	9	28	1.54E+00	1.61E-03	5.40E-01	1.43E-04	2.23E-04	7.94E-01	6.80E-01	2.09E+00	3.31E+00	8.39E+00	2.44E-03	9.42E-01	9.26E-01	1.20E+00	2.01E+00
2004	9	29	7.11E-01	9.67E-03	1.69E+00	1.73E-04	2.31E-06	1.29E+00	8.82E-04	3.61E-02	6.97E+00	8.59E-04	1.79E-04	1.07E-03	8.11E-04	2.79E-02	1.17E+00
2004	9	30	4.89E-01	4.34E-04	9.10E-01	4.55E-06	1.50E-05	1.14E+00	2.73E-02	6.06E-01	9.33E+00	3.03E-02	1.70E-03	1.58E-02	9.26E-03	1.05E-01	6.56E-01
2004	10	1	1.69E-01	3.97E-01	2.03E-02	3.59E-02	6.09E-02	3.59E-02	7.19E-02	1.19E+00	1.83E+00	8.05E+00	2.01E+00	1.25E+00	6.17E-01	1.11E-01	4.13E-01
2004	10	2	1.07E-01	6.25E-03	8.84E-03	2.11E-02	7.47E-02	1.87E-02	2.16E-01	1.50E+00	5.70E-02	1.12E+01	3.26E-01	2.15E+00	2.83E+00	2.22E-01	2.32E-01
2004	10	3	4.39E-01	9.58E-01	1.89E-01	4.81E-01	3.73E-01	1.22E-01	1.89E-02	5.22E-01	3.24E+00	1.46E+00	4.22E+00	1.43E-01	2.42E-01	9.11E-02	8.56E-01
2004	10	4	3.11E-04	6.35E-05	1.89E-05	3.52E-04	1.44E-03	4.68E-05	9.66E-02	1.80E+00	2.60E-04	8.52E+00	1.69E-02	1.72E+00	3.54E-01	1.86E-01	5.14E-04
2004	10	5	2.09E-02	1.72E-05	9.22E-04	5.26E-07	2.98E-06	2.16E-03	4.22E-02	5.44E-01	9.91E-04	4.23E+00	4.36E-02	9.18E-01	3.34E-01	3.15E-02	5.34E-02
2004	10	6	8.23E-03	0.00E+00	7.42E-04	0.00E+00	2.02E-05	3.19E-03	7.25E-03	5.85E-01	1.15E-03	1.55E+00	1.43E-01	2.32E-01	3.95E-01	1.33E-03	1.88E-02
2004	10	7	2.21E-03	0.00E+00	0.00E+00	0.00E+00	6.48E-05	1.29E-06	8.94E-02	1.73E+00	1.79E-03	6.52E+00	9.31E-02	1.04E+00	1.75E+00	7.81E-02	1.03E-02
2004	10	8	3.44E-02	1.23E-03	5.83E-03	3.04E-01	2.14E-01	2.03E-02	3.28E-02	1.36E+00	4.22E-02	2.68E+00	6.22E+00	2.58E-01	8.27E-01	1.07E-01	9.40E-02
2004	10	9	2.78E-03	7.55E-05	2.63E-03	2.15E-05	2.82E-03	1.25E-02	3.52E-02	9.92E-01	6.37E-03	1.93E+00	1.87E-01	3.57E-01	9.79E-01	3.74E-02	5.75E-03
2004	10	10	3.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-06	7.36E-02	1.23E+00	2.12E-03	3.12E+00	4.96E-02	7.71E-01	5.60E-01	4.56E-02	8.87E-03
2004	10	11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E-02	3.90E-01	3.35E-16	2.93E+00	2.77E-02	4.37E-01	2.50E-01	6.85E-03	0.00E+00
2004	10	12	5.67E-02	1.03E-01	4.95E-02	8.41E-03	2.02E-02	6.11E-02	6.78E-02	9.55E-01	1.68E+00	5.12E+00	6.39E-01	6.94E-01	1.15E+00	7.51E-02	1.46E-01
2004	10	13	9.68E-02	3.73E-01	9.26E-03	2.35E-01	3.40E-01	1.43E-02	6.45E-02	7.29E-01	2.35E-01	6.29E+00	3.83E+00	7.49E-01	8.05E-01	8.12E-02	2.37E-01
2004	10	14	2.11E-01	8.93E-01	1.13E-01	2.15E-01	3.55E-01	1.15E-01	5.50E-02	3.38E-01	2.08E+00	5.12E+00	2.01E+00	5.92E-01	4.60E-01	3.44E-02	4.30E-01
2004	10	15	3.44E-01	6.37E-01	2.60E-01	3.75E-01	7.00E-01	1.81E-01	1.61E-02	6.44E-01	4.12E+00	1.52E+00	6.55E+00	1.10E-02	1.69E-01	5.21E-02	6.69E-01
2004	10	16	1.06E-01	7.65E-08	8.19E-01	0.00E+00	2.91E-02	6.33E-01	3.60E-02	1.35E-01	3.22E+00	2.00E+00	1.36E+00	2.55E-01	5.56E-01	7.85E-02	1.10E-01
2004	10	17	0.00E+00	2.89E-06	3.80E-02	0.00E+00	0.00E+00	6.28E-02	0.00E+00	0.00E+00	1.99E+00	3.52E-06	5.19E-06	0.00E+00	4.01E-10	0.00E+00	0.00E+00
2004	10	18	7.44E-03	7.83E-02	3.55E-02	1.58E-02	2.29E-02	5.71E-02	3.67E-02	8.83E-01	1.94E+00	1.76E+00	2.53E-01	2.37E-01	4.79E-01	4.43E-02	2.62E-02
2004	10	19	2.56E-03	3.25E-01	2.54E-02	1.21E-01	1.94E-01	4.16E-02	7.24E-04	2.61E-02	1.83E+00	9.23E-01	2.56E+00	5.19E-03	2.10E-02	1.83E-03	6.97E-03
2004	10	20	1.13E+00	2.29E-02	7.81E-01	9.49E-02	4.49E-01	9.61E-01	2.84E-01	1.24E+00	4.24E+00	7.33E+00	2.17E+00	8.84E-01	1.88E+00	5.00E-01	1.71E+00
2004	10	21	9.05E-02	1.67E+00	1.67E-02	2.72E-01	5.66E-01	6.55E-02	4.01E-02	1.02E+00	4.30E-01	2.19E+00	6.02E+00	4.80E-02	5.13E-01	1.53E-01	1.59E-01
2004	10	22	1.68E-02	1.80E-05	2.48E-03	1.05E-02	7.23E-02	1.40E-02	6.13E-03	3.32E-01	1.78E-03	1.39E+00	9.37E-01	1.66E-01	4.57E-01	8.97E-03	3.65E-02
2004	10	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-02	6.17E-01	0.00E+00	2.14E+00	9.39E-02	3.54E-01	4.88E-01	1.18E-02	0.00E+00
2004	10	24	5.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.53E-07	5.99E-03	7.82E-01	6.72E-28	1.52E+00	6.50E-02	3.61E-01	4.64E-01	9.22E-03	1.19E-01
2004	10	25	4.29E-02	2.02E-01	5.90E-03	1.08E-02	2.09E-02	1.01E-02	7.11E-02	9.28E-01	5.53E-01	7.63E+00	9.78E-01	9.18E-01	5.75E-01	1.52E-02	1.38E-01
2004	10	26	7.44E-01	7.35E-01	2.37E-01	1.18E-01	2.29E-01	2.72E-01	3.14E-01	1.45E+00	4.25E+00	1.26E+01	1.86E+00	2.47E+00	3.44E+00	4.53E-01	1.30E+00
2004	10	27	3.36E-01	1.14E-01	8.54E-01	2.04E-01	3.90E-01	8.10E-01	7.75E-02	1.21E+00	1.71E+00	1.03E+01	3.48E+00	8.78E-01	1.32E+00	1.80E-01	5.89E-01
2004	10	28	1.11E+00	2.77E-01	5.98E-01	6.33E-02	1.14E-01	1.04E+00	2.86E-01	1.21E+00	3.08E+00	8.21E+00	1.03E+00	1.26E+00	1.49E+00	6.45E-01	1.47E+00
2004	10	29	2.12E-01	1.38E-01	1.17E-01	3.22E-02	6.70E-02	7.03E-02	7.98E-02	7.94E-01	1.32E+00	5.99E+00	6.47E-01	7.26E-01	1.17E+00	1.81E-01	4.73E-01
2004	10	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-05	0.00E+00	2.98E-02	5.07E-01	4.26E-30	2.36E+00	8.38E-02	4.66E-01	3.09E-01	2.13E-03	0.00E+00
2004	10	31	3.75E-02	0.00E+00	2.57E-04	0.00E+00	0.00E+00	2.15E-03	1.29E-01	1.59E+00	1.02E-04	8.08E+00	1.71E-03	1.92E+00	4.14E-01	7.75E-02	9.48E-02
2004	11	1	1.14E-02	0.00E+00	4.32E-05	0.00E+00	9.93E-10	8.86E-04	9.80E-02	1.06E+00	1.69E-03	5.68E+00	6.20E-02	1.12E+00	4.85E-01	1.62E-01	4.26E-02
2004	11	2	5.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E-02	1.35E+00	7.61E-33	2.56E+00	9.82E-02	4.26E-01	4.77E-01	6.74E-02	3.08E-03
2004	11	3	2.26E-01	1.21E-04	3.41E-02	5.21E-06	1.65E-05	8.98E-02	2.26E-01	1.49E+00	9.62E-01	6.56E+00	8.74E-04	1.66E+00	8.60E-01	1.67E-01	3.79E-01
2004	11	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.06E-02	4.62E-01	1.67E-16	2.91E+00	5.37E-03	4.28E-01	1.61E-01	1.78E-03	0.00E+00
2004	11	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.53E-10	0.00E+00	2.45E-02	2.49E-01	2.32E-17	1.24E+00	6.66E-02	5.77E-01	1.77E-01	7.80E-02	0.00E+00
2004	11	6	1.01E-02	2.94E-01	9.20E-03	2.72E-02	4.43E-02	1.29E-02	6.14E-02	3.86E-01	1.39E-01	4.28E+00	1.05E+00	8.02E-01	9.22E-01	1.49E-02	1.11E-02
2004	11	7	2.31E-02	1.69E+00	6.05E-02	1.53E-01	1.12E-01	1.35E-01	1.06E-02	1.56E-01	1.96E+00	1.25E+00	2.23E+00	1.71E-01	3.17E-01	1.13E-02	7.22E-02
2004	11	8	7.62E-02	1.37E-04	1.35E-02	1.66E-05	5.75E-05	6.18E-02	1.01E-01	1.46E+00	1.14E-02	6.82E+00	6.37E-03	1.34E+00	3.55E-01	1.38E-01	2.20E-01
2004	11	9	2.95E-01	2.07E-05	3.41E-01	3.86E-06	7.87E-06	3.29E-01	1.87E-01	6.75E-01	3.59E+00	5.27E+00	3.04E-04	9.12E-01	4.88E-01	2.15E-01	5.32E-01
2004	11	10	3.80E-01	3.52E-01	8.29E-02	5.99E-02	9.81E-02	9.23E-02	5.91E-02	5.32E-01	3.96E+00	4.62E+00	1.14E+00	5.01E-01	5.79E-01	1.29E-01	6.75E-01
2004	11	11	5.52E-01	2.08E-02	4.13E-01	1.52E-03	2.71E-03	6.16E-01	5.71E-02	7.82E-01	5.35E+00	2.51E+00	1.43E-01	4.93E-01	6.79E-01	1.65E-01	9.96E-01
2004	11	12	2.38E-02	2.38E-02	1.09E-02	4.69E-03	2.93E-02	1.08E-02	1.73E-01	2.07E+00	9.61E-02	1.48E+01	1.08E-01	1.98E+00	2.75E+00	2.99E-01	4.27E-02
2004	11	13	1.49E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-01	1.14E+00	0.00E+00	9.53E+00	2.49E-03	1.75E+00	1.06E+00	7.18E-02	3.84E-02
2004	11	14	4.20E-02	0.00E+00	7.22E-05	0.00E+00	0.00E+00	3.64E-04	4.04E-02	5.79E-01	1.42E-04	4.80E+00	1.75E-02	7.26E-01	2.29E-01	3.09E-02	7.30E-02
2004	11	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.67E-11	0.00E+00	1.84E-02	4.47E-01	9.72E-19	1.68E+00	5.56E-02	6.39E-01	2.29E-01	3.28E-04	0.00E+00
2004	11	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.23E-02	4.53E-01	7.25E-19	5.20E+00	3.85E-02	1.10E+00	3.66E-01	0.00E+00	0.00E+00
2004	11	17	5.73E-02	3.71E-05	6.94E-03	2.37E-06	2.45E-03	1.42E-02	1.27E-02	1.66E-01	6.18E-03	4.98E+00	9.79E-02	8.18E-01	6.00E-01	4.33E-03	1.39E-01
2004	11	18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-02	3.92E-01	9.90E-19	2.40E+00	5.31E-02	6.25E-01	3.41E-01	3.72E-02	0.00E+00
2004	11	19	4.97E-01	5.52E-01	2.30E-01	1.44E-01	1.97E-01	3.47E-01	1.66E-01	1.82E+00	2.65E+00	8.01E+00	1.40E+00	1.12E+00	9.63E-01	3.33E-01	7.34E-01
2004	11	20	1.19E-03	0.00E+00	5.42E-11	0.00E+00	0.00E+00	8.82E-13	1.54E-01	8.38E-01	2.00E-03	7.63E+00	1.58E-04	2.16E+00	3.06E+00	1.44E-01	7.03E-03
2004	11	21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.21E-02	7.37E-01	8.83E-17	3.66E+00	1.35E-02	4.48E-01	2.44E-01	0.00E+00	0.00E+00
2004	11	22	2.23E-01	3.59E-01	1.73E-01	6.69E-02	9.16E-02	1.61E-01	1.08E-01	1.58E+00	1.76E+00	6.60E+00	2.35E+00	1.23E+00	1.25E+00	2.00E-01	3.98E-01
2004	11	23	5.16E-02	0.00E+00	2.99E-04	0.00E+00	0.00E+00	1.41E-03	1.23E-01	1.77E+00	7.05E-04	1.16E+01	2.26E-03	1.59E+00	3.99E-01	1.47E-01	1.52E-01
2004	11	24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-02	5.45E-01	1.54E-17	1.12E+00	1.67E-02	7.32E-01	2.11E-01	0.00E+00	0.00E+00
2004	11	25	2.57E-02	1.03E+00	6.01E-03	2.68E-01	3.33E-01	3.19E-02	1.27E-01	1.40E+00	2.28E-01	1.24E+01	3.13E+00	1.74E+00	1.85E+00	1.16E-01	3.81E-02
2004	11	26	4.93E-02	2.30E-06	7.25E-03	0.00E+00	8.31E-07	2.70E-02	7.87E-02	9.86E-01	1.89E-02	6.90E+00	4.67E-03	1.06E+00	1.00E+00	8.01E-02	1.25E-01
2004	11	27	3.20E-01	5.63E-06	2.62E-01	0.00E+00	1.05E-07	5.46E-01	2.50E-01	1.10E+00	2.40E+00	1.07E+01	5.19E-03	2.09E+00	1.49E+00	2.99E-01	4.42E-01
2004	11	28	4.41E-03	0.00E+00	5.44E-08	0.00E+00	0.00E+00	1.86E-07	1.57E-01	1.80E+00	2.15E-02	1.38E+01	3.65E-05	1.15E+00	1.98E+00	2.50E-01	1.80E-02
2004	11	29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.58E-02	3.86E-01	3.87E-16	5.06E+00	2.03E-04	3.47E-01	2.39E-01	6.04E-04	0.00E+00
2004	11	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-01	7.63E-01	7.16E-18	7.93E+00	1.36E-04	6.01E-01	3.07E-01	0.00E+00	0.00E+00
2004	12	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-01	1.10E+00	3.90E-18	8.78E+00	2.05E-05	8.76E-01	3.52E-01	1.50E-03	0.00E+00

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	12	2	1.15E-01	0.00E+00	2.57E-02	0.00E+00	0.00E+00	5.73E-01	4.07E-01	1.32E+00	6.87E-04	1.57E+00	7.81E-03	5.48E-01	2.19E-01	8.45E-01	2.37E-01
2004	12	3	4.95E-02	0.00E+00	8.90E-04	0.00E+00	7.18E-05	2.91E-01	3.10E-01	7.49E-01	9.10E-17	2.34E+00	2.16E-02	4.58E-01	1.97E-01	5.11E-01	7.04E-02
2004	12	4	1.15E+00	5.17E-03	3.67E-01	4.26E-02	3.83E-01	2.49E+00	2.15E+00	4.40E+00	1.17E-01	5.64E+00	3.39E+00	5.67E-01	1.07E+00	3.05E+00	1.95E+00
2004	12	5	1.92E+00	2.31E-01	5.59E-01	1.76E-01	1.84E-01	3.85E+00	1.54E+00	4.89E+00	1.94E-01	2.27E+00	3.75E+00	6.83E-02	5.13E-01	3.21E+00	2.77E+00
2004	12	6	2.61E+00	1.01E+00	8.23E-01	3.38E-01	9.00E-01	3.74E+00	2.76E+00	5.17E+00	5.29E-01	3.72E+00	6.84E+00	1.00E-01	2.14E-01	4.53E+00	3.69E+00
2004	12	7	3.43E+00	1.25E+00	2.10E+00	4.86E-01	7.07E-01	5.64E+00	2.76E+00	8.12E+00	3.50E+00	6.74E+00	5.42E+00	5.99E-01	1.23E+00	8.17E+00	4.62E+00
2004	12	8	4.41E+00	5.83E-01	1.63E+00	2.02E-01	3.90E-01	4.62E+00	1.27E+00	5.14E+00	4.21E+00	1.77E+00	6.13E+00	2.77E-01	3.03E-01	5.05E+00	5.61E+00
2004	12	9	1.24E-01	0.00E+00	6.43E-03	0.00E+00	0.00E+00	5.88E-01	8.73E-01	2.02E+00	1.12E-17	4.51E+00	1.29E-02	1.17E+00	2.66E-01	1.20E+00	1.96E-01
2004	12	10	2.60E-01	0.00E+00	5.08E-02	0.00E+00	1.92E-04	1.40E+00	5.95E-01	1.84E+00	2.73E-02	3.49E+00	1.40E-01	7.17E-01	5.55E-01	1.11E+00	5.39E-01
2004	12	11	3.10E-01	5.19E-04	1.54E-01	6.95E-05	1.87E-04	2.54E+00	1.31E+00	4.97E+00	5.58E-02	6.11E+00	7.07E-02	7.85E-01	1.22E+00	3.67E+00	4.72E-01
2004	12	12	1.70E+00	5.16E-01	1.02E+00	1.06E-01	1.72E-01	6.82E+00	4.34E+00	1.19E+01	1.47E+00	1.21E+01	1.61E+00	3.03E+00	2.21E+00	1.14E+01	2.23E+00
2004	12	13	1.74E+00	4.18E-01	9.52E-01	7.88E-02	8.84E-02	4.70E+00	2.19E+00	7.60E+00	1.05E+00	7.23E+00	2.21E+00	7.60E-01	7.14E-01	6.67E+00	2.74E+00
2004	12	14	7.32E-02	0.00E+00	1.35E-03	0.00E+00	0.00E+00	4.38E-01	6.00E-01	1.63E+00	5.82E-17	3.49E+00	1.06E-02	9.92E-01	2.27E-01	8.53E-01	1.21E-01
2004	12	15	5.51E-02	0.00E+00	8.73E-04	0.00E+00	0.00E+00	4.68E-01	6.11E-01	1.59E+00	1.28E-16	6.98E+00	6.96E-04	7.28E-01	5.18E-01	9.01E-01	9.05E-02
2004	12	16	7.96E-02	0.00E+00	5.32E-04	0.00E+00	0.00E+00	3.59E-01	3.93E-01	1.08E+00	3.29E-16	3.98E+00	2.21E-03	4.92E-01	2.35E-01	6.88E-01	1.12E-01
2004	12	17	1.65E-01	0.00E+00	3.57E-02	0.00E+00	0.00E+00	8.39E-01	5.74E-01	1.77E+00	2.74E-16	7.17E+00	7.28E-05	4.34E-01	2.67E-01	1.18E+00	2.50E-01
2004	12	18	6.34E-02	0.00E+00	4.49E-04	0.00E+00	0.00E+00	3.52E-01	3.38E-01	1.15E+00	3.17E-16	5.62E+00	1.63E-03	3.84E-01	2.64E-01	6.82E-01	1.04E-01
2004	12	19	6.11E-02	0.00E+00	1.13E-02	0.00E+00	4.65E-05	5.27E-01	2.50E-01	6.73E-01	6.82E-04	9.88E-01	8.25E-02	2.93E-01	2.85E-01	4.64E-01	1.62E-01
2004	12	20	1.26E-01	0.00E+00	1.93E-03	0.00E+00	0.00E+00	8.38E-01	7.63E-01	2.32E+00	6.99E-05	4.95E+00	9.31E-06	9.23E-01	2.26E-01	1.44E+00	1.87E-01
2004	12	21	1.71E+00	7.53E-01	8.74E-01	2.19E-01	2.17E-01	3.76E+00	2.44E+00	6.47E+00	1.98E+00	8.97E+00	5.72E+00	1.57E+00	1.85E+00	4.90E+00	2.48E+00
2004	12	22	4.30E+00	5.22E-01	3.04E+00	1.41E-01	2.24E-01	6.05E+00	2.98E+00	7.19E+00	7.90E+00	2.23E+00	2.13E+00	1.12E+00	1.17E+00	6.90E+00	5.72E+00
2004	12	23	1.97E-01	4.16E-03	1.70E-01	4.25E-03	6.84E-03	1.94E+00	1.02E+00	2.94E+00	4.56E-02	6.48E+00	9.92E-03	1.10E+00	2.76E-01	2.82E+00	2.58E-01
2004	12	24	1.29E-01	0.00E+00	3.65E-02	0.00E+00	0.00E+00	3.94E-01	3.79E-01	1.17E+00	1.35E-03	3.44E+00	8.30E-04	5.14E-01	2.27E-01	7.80E-01	1.86E-01
2004	12	25	1.50E+00	1.47E+00	3.59E-01	4.14E-01	5.93E-01	3.08E+00	4.09E+00	8.06E+00	7.78E-01	1.33E+01	7.36E+00	2.24E+00	1.60E+00	6.81E+00	2.14E+00
2004	12	26	2.79E+00	8.46E-01	1.33E+00	2.91E-01	3.40E-01	2.88E+00	6.77E-01	3.83E+00	3.09E+00	4.98E-01	1.66E+00	1.07E-01	1.63E-01	3.85E+00	3.70E+00
2004	12	27	9.74E-01	3.17E-01	6.43E-01	3.82E-02	6.04E-02	5.14E+00	2.78E+00	8.20E+00	7.04E-01	1.37E+01	1.09E+00	1.40E+00	1.29E+00	6.67E+00	1.25E+00
2004	12	28	2.43E-01	1.54E-04	4.63E-01	1.81E-05	8.02E-05	4.58E+00	1.97E+00	5.27E+00	4.10E-02	7.17E+00	8.12E-03	1.79E+00	2.96E-01	6.49E+00	3.89E-01
2004	12	29	1.51E+00	5.09E-02	6.84E-01	4.77E-01	1.32E+00	5.85E+00	3.48E+00	7.94E+00	3.38E-01	9.58E+00	1.33E+01	9.60E-01	7.59E-01	5.93E+00	2.10E+00
2004	12	30	4.51E-01	7.37E-02	2.87E-01	4.36E-03	1.51E-02	7.22E-01	2.63E-01	1.32E+00	5.89E-01	6.29E-02	1.66E-01	1.94E-02	2.85E-02	1.53E+00	5.90E-01
2004	12	31	7.58E-01	0.00E+00	6.55E-01	0.00E+00	0.00E+00	9.80E-01	4.13E-02	7.14E-01	2.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E+00	9.72E-01
2005	1	1	1.93E+00	1.91E-03	1.25E+00	1.25E-04	5.19E-04	3.08E+00	8.13E-01	4.88E+00	4.35E+00	3.25E-01	2.40E-02	3.07E-01	1.92E-01	5.08E+00	2.63E+00
2005	1	2	5.13E-01	7.11E-03	3.49E-01	1.46E-03	9.45E-03	7.10E+00	4.79E+00	1.17E+01	3.37E-01	1.92E+01	4.44E-01	1.65E+00	1.18E+00	1.09E+01	6.68E-01
2005	1	3	1.85E+00	3.41E-03	1.17E+00	9.98E-04	1.88E-03	5.05E+00	2.51E+00	8.21E+00	3.83E+00	9.02E+00	6.60E-03	1.13E+00	2.08E+00	7.19E+00	2.33E+00
2005	1	4	3.84E+00	1.05E-01	2.86E+00	4.78E-03	8.94E-03	5.19E+00	1.20E+00	5.91E+00	5.26E+00	1.52E+00	4.20E-01	5.40E-01	6.25E-01	6.51E+00	5.06E+00
2005	1	5	3.17E-01	2.78E-03	7.88E-02	5.96E-04	1.30E-03	3.21E+00	2.42E+00	5.72E+00	4.30E-02	9.78E+00	8.77E-03	1.26E+00	6.09E-01	5.61E+00	3.61E-01
2005	1	6	1.47E+00	6.80E-03	9.13E-01	3.07E-05	2.31E-04	1.74E+00	7.47E-01	2.14E+00	1.51E+00	4.65E+00	1.00E-01	7.23E-01	7.02E-01	2.05E+00	1.74E+00
2005	1	7	2.68E+00	1.58E-06	1.65E+00	0.00E+00	0.00E+00	2.70E+00	7.58E-03	1.96E+00	2.24E+00	1.64E-04	1.03E-05	5.46E-04	2.95E-04	2.48E+00	2.86E+00
2005	1	8	3.14E+00	6.97E-07	2.53E+00	0.00E+00	0.00E+00	3.15E+00	4.35E-02	2.58E+00	9.54E+00	2.03E-04	9.79E-06	2.26E-04	9.75E-05	3.69E+00	3.70E+00
2005	1	9	4.65E+00	2.24E-01	2.49E+00	9.46E-02	1.58E-01	5.59E+00	1.66E+00	5.57E+00	7.90E+00	8.58E+00	1.27E+00	5.05E-01	4.07E-01	6.76E+00	5.81E+00
2005	1	10	6.21E-01	2.21E-05	2.59E-01	4.82E-07	8.25E-06	1.89E+00	1.02E+00	3.20E+00	6.30E-02	6.53E+00	7.55E-03	1.33E+00	4.01E-01	2.34E+00	9.97E-01
2005	1	11	3.71E-02	0.00E+00	2.41E-02	0.00E+00	0.00E+00	1.11E+00	5.67E-01	2.95E+00	2.18E-02	3.27E+00	1.30E-02	1.13E+00	2.69E-01	1.33E+00	1.21E-01
2005	1	12	6.36E-01	1.10E-01	4.12E-01	2.09E-02	2.50E-02	1.20E+00	2.49E-01	1.29E+00	7.14E-01	4.26E-01	1.22E+00	1.14E-01	2.67E-01	1.87E+00	8.68E-01
2005	1	13	3.23E+00	9.38E-01	1.48E+00	3.78E-01	4.82E-01	7.24E+00	4.20E+00	1.03E+01	2.28E+00	1.07E+01	4.55E+00	4.50E+00	4.38E+00	1.04E+01	4.18E+00
2005	1	14	7.69E-01	4.04E-02	4.83E-01	1.25E-02	1.72E-02	5.94E+00	3.74E+00	1.00E+01	3.78E-01	1.71E+01	1.10E-01	3.30E+00	5.18E+00	9.08E+00	9.52E-01
2005	1	15	4.94E-01	2.96E-04	3.98E-01	4.16E-05	1.28E-04	5.55E+00	2.62E+00	7.60E+00	5.39E-02	1.34E+01	2.89E-03	1.36E+00	4.16E-01	6.91E+00	8.61E-01
2005	1	16	1.66E-01	0.00E+00	3.75E-03	0.00E+00	0.00E+00	6.63E-01	5.76E-01	1.78E+00	2.58E-05	4.70E+00	2.75E-03	8.58E-01	2.37E-01	1.04E+00	2.41E-01
2005	1	17	1.89E-02	0.00E+00	1.10E-02	0.00E+00	9.61E-12	5.19E-01	2.43E-01	1.22E+00	1.87E-05	1.30E+00	4.18E-02	3.57E-01	2.27E-01	4.89E-01	8.06E-02
2005	1	18	3.50E-02	0.00E+00	9.55E-03	0.00E+00	0.00E+00	4.82E-01	4.20E-01	1.21E+00	3.96E-20	2.75E+00	2.67E-02	6.02E-01	3.23E-01	6.63E-01	8.15E-02
2005	1	19	6.00E-02	0.00E+00	3.70E-02	0.00E+00	0.00E+00	1.03E+00	1.92E-01	6.79E-01	1.23E-02	8.63E-01	7.21E-02	6.52E-02	3.65E-01	6.00E-01	2.31E-01
2005	1	20	1.67E-01	1.64E-05	1.03E-01	4.37E-07	3.79E-05	1.26E+00	4.35E-01	2.10E+00	2.84E-02	1.41E+00	8.43E-02	4.03E-01	4.73E-01	1.08E+00	3.77E-01
2005	1	21	2.15E+00	9.29E-01	1.00E+00	2.30E-02	2.09E-02	2.97E+00	1.11E+00	4.41E+00	1.22E+00	1.49E+00	2.31E+00	2.41E-01	1.84E-01	4.36E+00	3.10E+00
2005	1	22	2.39E-01	3.75E-02	1.55E-01	4.44E-02	8.27E-02	1.86E+00	1.25E+00	3.61E+00	8.14E-02	5.40E+00	4.77E-01	9.60E-01	4.90E-01	3.18E+00	2.89E-01
2005	1	23	9.43E-02	0.00E+00	1.42E-03	0.00E+00	0.00E+00	4.53E-01	5.17E-01	1.33E+00	2.93E-17	5.05E+00	8.78E-03	7.73E-01	2.58E-01	9.36E-01	1.30E-01
2005	1	24	1.70E-01	0.00E+00	3.98E-02	0.00E+00	0.00E+00	1.37E+00	1.25E+00	3.25E+00	7.01E-04	5.23E+00	1.00E-02	1.20E+00	2.80E-01	2.36E+00	2.33E-01
2005	1	25	4.73E+00	1.74E+00	2.69E+00	6.36E-01	8.92E-01	7.08E+00	2.83E+00	9.06E+00	6.79E+00	1.37E+01	4.73E+00	1.46E+00	1.56E+00	9.41E+00	6.40E+00
2005	1	26	1.28E+00	3.31E-01	9.98E-01	1.37E-01	2.05E-01	9.24E+00	5.96E+00	1.22E+01	6.77E-01	3.42E+01	9.01E-01	4.93E+00	6.00E+00	1.33E+01	1.92E+00
2005	1	27	4.28E-01	1.93E-03	4.51E-01	4.45E-04	1.25E-03	5.06E+00	2.68E+00	7.08E+00	1.04E-01	9.38E+00	1.07E-02	2.08E+00	3.81E-01	6.31E+00	5.91E-01
2005	1	28	9.38E-01	1.35E-01	6.33E-01	3.15E-01	4.38E-01	6.33E+00	4.42E+00	8.11E+00	2.48E-01	2.07E+01	5.59E+00	2.29E+00	1.67E+00	1.01E+01	1.31E+00
2005	1	29	6.29E-02	0.00E+00	4.22E-03	0.00E+00	0.00E+00	5.80E-01	6.65E-01	1.66E+00	5.15E-06	2.72E+00	3.21E-02	1.11E+00	2.80E-01	8.74E-01	9.71E-02
2005	1	30	8.96E-02	0.00E+00	1.30E-03	0.00E+00	0.00E+00	4.95E-01	5.82E-01	1.69E+00	3.78E-17	3.76E+00	7.45E-03	8.45E-01	2.97E-01	8.48E-01	1.22E-01
2005	1	31	6.76E-02	0.00E+00	1.90E-03	0.00E+00	1.54E-10	4.51E-01	4.81E-01	1.35E+00	4.21E-18	2.26E+00	4.02E-02	5.94E-01	2.10E-01	7.47E-01	1.18E-01
2005	2	1	2.33E-02	0.00E+00	5.60E-03	0.00E+00	0.00E+00	4.64E-01	3.81E-01	1.21E+00	1.75E-17	2.27E+00	1.89E-02	5.92E-01	2.78E-01	6.05E-01	6.99E-02
2005	2	2	2.32E-01	2.13E-06	3.82E-02	1.03E-06	1.02E-04	1.24E+00	3.93E-01	2.84E+00	2.45E-02	1.27E+00	1.47E-01	3.02E-01	3.38E-01	1.30E+00	4.05E-01
2005	2	3	1.49E-02	0.00E+00	1.41E-02	0.00E+00	0.00E+00	4.51E-01	2.78E-01	1.02E+00	4.74E-19	1.09E+00	5.21E-02	2.96E-01	2.60E-01	4.59E-01	9.07E-02
2005	2	4	1.34E+00	8.18E-04	3.17E-01	7.94E-04	1.15E-01	2.23E+00	7.99E-01	3.25E+00	8.95E-02	1.92E+00	1.90E+00	1.66E-01	1.75E-01	2.42E+00	1.86E+00
2005	2	5	7.61E-01	1.06E-01	3.73E-01	8.21E-02	5.37E-02	1.14E+00	2.65E-01	2.78E+00	5.58E-01	1.46E-02	1.02E-01	8.06E-03	9.96E-03	2.34E+00	1.04E+00
2005	2	6	2.34E+00	4.76E-01	1.52E+00	5.97E-03	4.32E-03	2.74E+00	2.82E-01	3.82E+00	4.81E+00	3.05E-01	1.47E-01	2.57E-02	4.67E-02	3.75E+00	3.17E+00
2005	2	7	1.14E+00	1.81E-01	7.85E-01	1.98E-01	4.23E-01	4.88E+00	3.55E+00	8.13E+00	1.82E+00	1.24E+01	6.76E+00	4.02E+00	4.61E+00	7.41E+00	1.69E+00
2005	2	8	1.46E+00	4.49E-04	1.21E+00	4.71E-05	1.44E-04	4.27E+00	2.81E+00	6.50E+00	1.77E-01	1.45E+01	1.50E-02	1.74E+00	1.73E+00	6.39E+00	2.09E+00
2005	2	9	3.81E-01	6.18E-06	1.08E-01	7.97E-08	2.52E-06	1.05E+00	7.28E-01	1.98E+00	2.81E-02	6.31E+00	1.86E-03	7.53E-01	2.21E-01	1.32E+00	5.66E-01
2005	2	10	6.65E-02	0.00E+00	2.94E-02	0.00E+00	0.00E+00	1.32E+00	6.84E-01	2.76E+00	5.52E-03	5.19E+00	1.69E-03	7.50E-01	2.60E-01	1.54E+00	1.09E-01
2005	2	11	2.89E-01	1.61E-04	3.18E-01	8.66E-06	8.72E-05	4.97E+00	2.12E+00	7.00E+00	5.98E-02	7.48E+00	2.15E-02	1.52E+00	3.30E-01	6.51E+00	4.30E-01
2005	2	12	4.45E-01	4.48E-04	2.36E-01	1.06E-04	4.50E-04	1.62E+00	1.03E+00	2.78E+00	4.60E-02	1.99E+00	3.52E-02	7.93E-01	3.94E-01	2.04E+00	6.25E-01
2005	2	13	3.42E-01	0.00E+00	8.20E-02	0.00E+00	0.00E+00	2.19E+00	7.17E-01	3.59E+00	9.79E-03	1.78E+00	1.16E-01	5.16E-01	7.50E-01	1.70E+00	6.73E-01
2005	2	14	2.03E+00	1.53E-03	9.32E-01	1.27E-03	5.16E-03	6.39E+00	4.09E+00	8.07E+00	4.48E-01	2.01E+01	6.66E-02	1.55E+00	2.07E+00	8.20E+00	2.75E+00
2005	2	15	3.35E-01	1.34E-03	1.40E-01	1.86E-04	6.18E-04	5.37E+00	3.42E+00	8.10E+00	5.09E-02	1.42E+01	4.64E-03	1.49E+00	8.27E-01	8.24E+00	3.63E-01
2005	2	16	3.41E-01	3.40E-03	2.19E-01	8.39E-04	1.77E-03	4.55E+00	2.11E+00	7.07E+00	5.75E-02	9.62E+00	9.03E-03	8.87E-01	6.12E-01	5.40E+00	4.88E-01
2005	2	17	2.95E+00	8.62E-02	1.70E+00	5.07E-03	1.25E-02	6.26E+00	2.22E+00	8.27E+00	3.06E+00	1.04E+01	4.63E-01	1.19E+00	2.22E+00	7.19E+00	3.62E+00
2005	2	18	2.25E+00	1.57E-01	1.82E+00	1.97E-02	2.92E-02	5.47E+00	2.41E+00	6.73E+00	1.40E+00	1.41E+01	3.64E-01	1.87E+00	1.73E+00	5.76E+00	2.88E+00
2005	2	19	1.90E+00	3.06E-01	1.33E+00	5.40E-02	9.78E-02	3.01E+00	1.15E+00	3.28E+00	4.24E+00	4.53E+00	7.07E-01	3.37E-01	2.69E-01	5.30E+00	2.47E+00
2005	2	20	1.59E+00	2.04E-02	1.33E+00	1.39E-02	6.95E-02	4.81E+00	3.24E+00	7.24E+00	3.78E+00	1.03E+01	7.10E-01	2.74E+00	2.79E+00	7.82E+00	2.45E+00
2005	2	21	4.67E-01	7.35E-04	2.05E-01	1.26E-04	4.07E-04	5.93E+00	3.71E+00	8.06E+00	5.66E-02	1.82E+01	3.48E-03	1.45E+00	1.29E+00	8.06E+00	5.90E-01

Year	Month	Day	Baseline														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	12	2	1.14E-01	0.00E+00	2.57E-02	0.00E+00	0.00E+00	5.73E-01	3.70E-01	9.38E-01	6.27E-04	0.00E+00	0.00E+00	2.46E-04	1.98E-05	8.43E-01	2.36E-01
2004	12	3	4.95E-02	0.00E+00	8.90E-04	0.00E+00	0.00E+00	2.91E-01	2.71E-01	5.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.09E-01	7.04E-02
2004	12	4	1.05E+00	5.07E-03	3.66E-01	4.46E-03	1.24E-02	2.48E+00	2.06E+00	3.68E+00	9.55E-02	4.00E-02	2.71E-02	4.69E-02	4.19E-02	2.99E+00	1.68E+00
2004	12	5	1.86E+00	1.40E-02	5.35E-01	1.02E-02	1.59E-02	3.73E+00	1.53E+00	4.19E+00	1.68E-01	5.24E-02	3.47E-02	5.28E-02	4.87E-02	3.18E+00	2.61E+00
2004	12	6	2.57E+00	4.73E-02	8.19E-01	2.41E-02	3.95E-02	3.67E+00	2.75E+00	4.90E+00	2.09E-01	1.06E-01	8.34E-02	8.30E-02	8.82E-02	4.50E+00	3.56E+00
2004	12	7	3.32E+00	3.58E-02	2.02E+00	1.92E-02	2.88E-02	5.45E+00	2.71E+00	7.10E+00	2.26E-01	9.62E-02	6.19E-02	1.25E-01	1.12E-01	8.07E+00	4.26E+00
2004	12	8	4.04E+00	2.25E-02	1.58E+00	8.54E-03	1.01E-02	4.53E+00	1.27E+00	4.73E+00	1.54E-01	4.17E-02	2.91E-02	5.16E-02	4.58E-02	5.01E+00	4.92E+00
2004	12	9	1.24E-01	0.00E+00	6.43E-03	0.00E+00	0.00E+00	5.88E-01	8.07E-01	1.11E+00	0.00E+00	0.00E+00	0.00E+00	4.28E-06	0.00E+00	1.20E+00	1.96E-01
2004	12	10	2.60E-01	0.00E+00	5.08E-02	0.00E+00	1.24E-08	1.40E+00	5.61E-01	1.31E+00	2.48E-02	6.20E-03	3.78E-04	1.71E-02	8.27E-03	1.11E+00	5.39E-01
2004	12	11	3.06E-01	5.19E-04	1.54E-01	6.95E-05	1.80E-04	2.54E+00	1.25E+00	4.27E+00	4.69E-02	1.23E-02	1.79E-03	1.48E-02	1.06E-02	3.64E+00	4.54E-01
2004	12	12	1.07E+00	1.16E-02	8.35E-01	3.13E-03	6.67E-03	6.57E+00	3.78E+00	9.27E+00	1.70E-01	5.14E-02	2.51E-02	1.08E-01	7.48E-02	1.06E+01	1.44E+00
2004	12	13	1.43E+00	8.35E-03	9.36E-01	2.97E-03	4.54E-03	4.68E+00	2.12E+00	6.36E+00	1.02E-01	3.10E-02	1.55E-02	5.47E-02	4.10E-02	6.46E+00	2.00E+00
2004	12	14	7.32E-02	0.00E+00	1.35E-03	0.00E+00	0.00E+00	4.38E-01	5.52E-01	9.37E-01	0.00E+00	0.00E+00	0.00E+00	1.62E-05	0.00E+00	8.53E-01	1.21E-01
2004	12	15	5.51E-02	0.00E+00	8.73E-04	0.00E+00	0.00E+00	4.68E-01	5.26E-01	9.43E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.01E-01	9.05E-02
2004	12	16	7.96E-02	0.00E+00	5.32E-04	0.00E+00	0.00E+00	3.59E-01	3.33E-01	6.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-01	1.12E-01
2004	12	17	1.59E-01	0.00E+00	3.57E-02	0.00E+00	0.00E+00	8.39E-01	4.89E-01	1.23E+00	0.00E+00	0.00E+00	0.00E+00	9.84E-05	0.00E+00	1.17E+00	2.36E-01
2004	12	18	6.34E-02	0.00E+00	4.49E-04	0.00E+00	0.00E+00	3.52E-01	2.81E-01	7.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.74E-01	1.04E-01
2004	12	19	6.11E-02	0.00E+00	1.13E-02	0.00E+00	0.00E+00	5.27E-01	2.42E-01	5.47E-01	6.82E-04	1.84E-04	3.39E-07	3.88E-03	1.69E-03	4.60E-01	1.62E-01
2004	12	20	1.26E-01	0.00E+00	1.93E-03	0.00E+00	0.00E+00	8.38E-01	6.71E-01	1.44E+00	6.99E-05	0.00E+00	0.00E+00	2.70E-04	1.27E-05	1.44E+00	1.87E-01
2004	12	21	1.42E+00	1.78E-02	6.69E-01	7.51E-03	7.76E-03	3.50E+00	2.13E+00	5.08E+00	7.49E-02	2.28E-02	1.94E-02	2.47E-02	2.07E-02	4.61E+00	2.15E+00
2004	12	22	3.46E+00	1.66E-02	2.27E+00	5.74E-03	9.15E-03	5.31E+00	2.33E+00	6.08E+00	2.27E-01	6.22E-02	3.22E-02	1.09E-01	8.03E-02	6.24E+00	4.55E+00
2004	12	23	1.89E-01	3.81E-03	1.70E-01	1.33E-03	2.15E-03	1.94E+00	9.22E-01	1.74E+00	4.50E-02	1.35E-02	6.63E-03	2.58E-02	1.91E-02	2.75E+00	2.35E-01
2004	12	24	1.28E-01	0.00E+00	3.65E-02	0.00E+00	0.00E+00	3.94E-01	3.41E-01	6.79E-01	1.35E-03	2.37E-06	0.00E+00	1.78E-04	6.23E-05	7.79E-01	1.85E-01
2004	12	25	1.37E+00	1.37E-02	3.15E-01	1.12E-02	1.68E-02	3.02E+00	3.89E+00	6.51E+00	8.24E-02	4.46E-02	2.74E-02	9.19E-02	6.43E-02	6.58E+00	1.78E+00
2004	12	26	2.39E+00	1.78E-02	1.27E+00	8.93E-03	1.21E-02	2.83E+00	6.62E-01	3.73E+00	8.54E-02	3.39E-02	2.32E-02	5.74E-02	4.25E-02	3.81E+00	2.96E+00
2004	12	27	9.15E-01	7.69E-03	6.30E-01	2.29E-03	4.11E-03	5.12E+00	2.60E+00	6.43E+00	1.04E-01	3.20E-02	1.54E-02	6.37E-02	4.52E-02	6.42E+00	1.10E+00
2004	12	28	1.99E-01	1.54E-04	4.62E-01	1.81E-05	8.02E-05	4.58E+00	1.84E+00	3.67E+00	4.05E-02	6.89E-03	1.32E-03	2.72E-02	1.39E-02	6.39E+00	2.83E-01
2004	12	29	1.41E+00	2.25E-02	6.82E-01	1.53E-02	2.52E-02	5.84E+00	3.40E+00	6.31E+00	2.30E-01	9.73E-02	5.66E-02	1.35E-01	1.15E-01	5.70E+00	1.83E+00
2004	12	30	4.48E-01	2.90E-03	2.77E-01	1.61E-03	2.51E-03	6.92E-01	2.60E-01	1.32E+00	3.20E-03	2.79E-03	3.20E-03	2.78E-03	2.61E-03	1.53E+00	5.86E-01
2004	12	31	7.58E-01	0.00E+00	5.86E-01	0.00E+00	0.00E+00	8.94E-01	4.13E-02	7.14E-01	4.63E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E+00	9.72E-01
2005	1	1	1.84E+00	8.50E-04	1.18E+00	1.12E-04	4.53E-04	2.99E+00	7.53E-01	4.64E+00	3.75E-02	7.79E-03	2.61E-03	1.84E-02	1.20E-02	5.05E+00	2.44E+00
2005	1	2	4.78E-01	3.31E-03	3.47E-01	9.83E-04	2.24E-03	7.09E+00	4.57E+00	8.95E+00	9.61E-02	2.38E-02	9.72E-03	5.99E-02	3.76E-02	1.05E+01	5.68E-01
2005	1	3	1.74E+00	3.37E-03	1.01E+00	9.98E-04	1.88E-03	4.90E+00	2.23E+00	6.76E+00	5.87E-02	1.31E-02	6.35E-03	3.24E-02	2.07E-02	6.79E+00	2.16E+00
2005	1	4	2.90E+00	1.02E-02	2.51E+00	3.18E-03	5.11E-03	4.89E+00	1.13E+00	5.50E+00	1.34E-01	3.44E-02	1.78E-02	6.14E-02	4.45E-02	6.38E+00	3.47E+00
2005	1	5	3.16E-01	1.30E-03	7.81E-02	4.54E-04	9.26E-04	3.20E+00	2.27E+00	3.99E+00	3.59E-02	8.44E-03	3.29E-03	3.16E-02	1.66E-02	5.47E+00	3.60E-01
2005	1	6	1.35E+00	1.52E-03	7.31E-01	2.98E-05	2.02E-04	1.58E+00	6.94E-01	1.63E+00	3.98E-02	1.05E-02	4.67E-03	1.40E-02	1.21E-02	2.00E+00	1.57E+00
2005	1	7	2.34E+00	1.58E-06	1.48E+00	0.00E+00	0.00E+00	2.57E+00	7.58E-03	1.95E+00	6.62E-03	1.61E-04	1.03E-05	5.45E-04	2.95E-04	2.48E+00	2.36E+00
2005	1	8	3.10E+00	0.00E+00	1.96E+00	0.00E+00	0.00E+00	2.72E+00	4.35E-02	2.58E+00	1.78E-03	5.62E-05	2.86E-06	2.26E-04	9.74E-05	3.69E+00	3.60E+00
2005	1	9	4.33E+00	2.64E-03	2.28E+00	1.03E-03	1.98E-03	5.29E+00	1.62E+00	5.34E+00	7.58E-02	1.65E-02	6.64E-03	3.85E-02	2.61E-02	6.67E+00	5.16E+00
2005	1	10	5.32E-01	1.08E-05	2.43E-01	4.77E-07	5.54E-06	1.84E+00	9.68E-01	2.52E+00	2.32E-02	4.19E-03	5.32E-04	1.39E-02	8.23E-03	2.32E+00	7.35E-01
2005	1	11	3.71E-02	0.00E+00	2.41E-02	0.00E+00	0.00E+00	1.11E+00	5.41E-01	2.12E+00	2.18E-02	7.88E-04	2.04E-05	1.02E-02	3.11E-03	1.33E+00	1.21E-01
2005	1	12	6.14E-01	3.89E-03	3.79E-01	1.72E-03	2.16E-03	1.15E+00	2.30E-01	1.19E+00	8.23E-03	4.98E-03	5.36E-03	9.38E-03	5.47E-03	1.85E+00	8.27E-01
2005	1	13	2.50E+00	1.82E-02	1.16E+00	9.31E-03	1.57E-02	6.82E+00	3.07E+00	8.02E+00	1.69E-01	6.09E-02	3.38E-02	1.18E-01	8.35E-02	9.46E+00	3.06E+00
2005	1	14	6.67E-01	6.23E-03	4.02E-01	2.05E-03	3.97E-03	5.87E+00	3.35E+00	7.77E+00	9.28E-02	2.66E-02	1.31E-02	6.65E-02	4.21E-02	8.82E+00	7.96E-01
2005	1	15	4.36E-01	2.96E-04	3.93E-01	4.16E-05	1.28E-04	5.54E+00	2.45E+00	5.99E+00	5.25E-02	7.64E-03	1.76E-03	3.08E-02	1.59E-02	6.70E+00	7.16E-01
2005	1	16	1.66E-01	0.00E+00	3.75E-03	0.00E+00	0.00E+00	6.63E-01	5.16E-01	1.43E+00	2.58E-05	4.33E-07	0.00E+00	7.36E-04	4.97E-05	1.00E+00	2.41E-01
2005	1	17	1.89E-02	0.00E+00	1.10E-02	0.00E+00	0.00E+00	5.19E-01	2.38E-01	7.22E-01	1.87E-05	0.00E+00	0.00E+00	2.45E-03	3.23E-04	4.89E-01	8.06E-02
2005	1	18	3.50E-02	0.00E+00	9.55E-03	0.00E+00	0.00E+00	4.82E-01	3.96E-01	5.96E-01	0.00E+00	0.00E+00	0.00E+00	1.46E-03	3.79E-05	6.63E-01	8.15E-02
2005	1	19	6.00E-02	0.00E+00	3.70E-02	0.00E+00	0.00E+00	1.03E+00	1.92E-01	6.78E-01	1.23E-02	3.68E-04	5.41E-06	6.35E-03	2.86E-03	6.00E-01	2.31E-01
2005	1	20	1.52E-01	3.45E-06	9.78E-02	1.03E-07	2.84E-05	1.24E+00	4.30E-01	1.77E+00	2.50E-02	4.66E-03	9.20E-04	1.23E-02	6.20E-03	1.07E+00	3.56E-01
2005	1	21	2.04E+00	3.47E-03	9.76E-01	5.52E-04	9.28E-04	2.90E+00	1.09E+00	4.17E+00	5.68E-02	1.39E-02	6.15E-03	2.52E-02	1.79E-02	4.33E+00	2.82E+00
2005	1	22	2.30E-01	5.15E-03	1.54E-01	2.18E-03	3.86E-03	1.86E+00	1.15E+00	2.67E+00	4.97E-02	2.05E-02	1.06E-02	4.41E-02	3.01E-02	3.07E+00	2.75E-01
2005	1	23	9.43E-02	0.00E+00	1.42E-03	0.00E+00	0.00E+00	4.53E-01	4.64E-01	8.05E-01	0.00E+00	0.00E+00	0.00E+00	4.30E-06	0.00E+00	8.54E-01	1.30E-01
2005	1	24	1.69E-01	0.00E+00	3.98E-02	0.00E+00	0.00E+00	1.37E+00	1.17E+00	2.38E+00	7.01E-04	4.14E-04	0.00E+00	5.16E-03	1.47E-03	2.35E+00	2.27E-01
2005	1	25	4.28E+00	2.85E-02	2.55E+00	1.69E-02	2.31E-02	6.89E+00	2.71E+00	8.01E+00	2.76E-01	8.23E-02	4.69E-02	1.25E-01	1.01E-01	9.23E+00	5.44E+00
2005	1	26	1.05E+00	4.60E-02	9.77E-01	2.33E-02	3.43E-02	9.21E+00	5.65E+00	9.46E+00	3.21E-01	1.29E-01	7.55E-02	2.15E-01	1.66E-01	1.28E+01	1.34E+00
2005	1	27	3.89E-01	1.93E-03	4.51E-01	4.45E-04	1.25E-03	5.06E+00	2.55E+00	5.13E+00	1.01E-01	2.16E-02	7.67E-03	4.88E-02	3.35E-02	6.22E+00	4.96E-01
2005	1	28	8.77E-01	4.98E-03	6.31E-01	5.57E-03	8.58E-03	6.32E+00	4.28E+00	5.99E+00	1.36E-01	4.09E-02	1.61E-02	1.02E-01	6.82E-02	9.90E+00	1.16E+00
2005	1	29	6.29E-02	0.00E+00	4.22E-03	0.00E+00	0.00E+00	5.80E-01	6.40E-01	9.90E-01	5.15E-06	0.00E+00	0.00E+00	4.34E-04	2.22E-05	8.74E-01	9.71E-02
2005	1	30	8.96E-02	0.00E+00	1.30E-03	0.00E+00	0.00E+00	4.95E-01	5.27E-01	9.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.48E-01	1.22E-01
2005	1	31	6.76E-02	0.00E+00	1.90E-03	0.00E+00	0.00E+00	4.51E-01	4.38E-01	5.93E-01	0.00E+00	0.00E+00	0.00E+00	5.00E-05	0.00E+00	7.47E-01	1.18E-01
2005	2	1	2.33E-02	0.00E+00	5.60E-03	0.00E+00	0.00E+00	4.64E-01	3.63E-01	7.76E-01	0.00E+00	0.00E+00	0.00E+00	4.08E-04	3.11E-06	6.05E-01	6.99E-02
2005	2	2	2.32E-01	2.13E-06	3.82E-02	1.03E-06	4.86E-05	1.24E+00	3.91E-01	1.64E+00	2.45E-02	4.19E-03	3.93E-04	6.76E-03	9.23E-03	1.29E+00	4.05E-01
2005	2	3	1.49E-02	0.00E+00	1.41E-02	0.00E+00	0.00E+00	4.51E-01	2.77E-01	7.07E-01	0.00E+00	0.00E+00	0.00E+00	4.85E-03	8.54E-05	4.59E-01	9.07E-02
2005	2	4	1.27E+00	7.32E-04	3.11E-01	7.48E-04	7.43E-03	2.20E+00	7.95E-01	2.77E+00	6.48E-02	2.72E-02	2.13E-02	2.26E-02	2.69E-02	2.39E+00	1.68E+00
2005	2	5	7.57E-01	4.45E-03	3.60E-01	4.35E-03	3.56E-03	1.10E+00	2.62E-01	2.78E+00	4.91E-03	3.26E-03	5.20E-03	2.04E-03	2.34E-03	2.34E+00	1.03E+00
2005	2	6	2.20E+00	7.16E-03	1.41E+00	1.37E-03	1.18E-03	2.63E+00	2.80E-01	3.76E+00	3.19E-02	5.97E-03	4.79E-03	8.90E-03	6.51E-03	3.71E+00	2.93E+00
2005	2	7	6.12E-01	1.26E-02	6.45E-01	5.40E-03	9.04E-03	4.67E+00	2.60E+00	6.15E+00	1.48E-01	4.74E-02	2.29E-02	1.28E-01	8.01E-02	6.75E+00	8.52E-01
2005	2	8	1.28E+00	3.00E-04	1.18E+00	1.84E-05	8.27E-05	4.17E+00	2.67E+00	5.73E+00	3.67E-02	4.53E-03	1.14E-03	1.79E-02	8.72E-03	6.35E+00	1.66E+00
2005	2	9	3.66E-01	6.18E-06	1.06E-01	7.97E-08	2.52E-06	1.03E+00	6.51E-01	1.35E+00	2.42E-02	1.75E-03	1.24E-04	1.03E-02	4.92E-03	1.31E+00	5.25E-01
2005	2	10	6.65E-02	0.00E+00	2.94E-02	0.00E+00	0.00E+00	1.32E+00	6.01E-01	1.84E+00	5.52E-03	8.95E-05	0.00E+00	4.63E-03	1.26E-03	1.54E+00	1.09E-01
2005	2	11	2.69E-01	1.61E-04	3.17E-01	8.66E-06	8.71E-05	4.96E+00	2.00E+00	5.08E+00	5.79E-02	8.11E-03	1.37E-03	4.61E-02	2.15E-02	6.42E+00	3.67E-01
2005	2	12	3.95E-01	4.44E-04	2.34E-01	1.05E-04	4.41E-04	1.61E+00	9.99E-01	2.03E+00	3.41E-02	9.43E-03	2.81E-03	2.09E-02	1.53E-02	2.03E+00	5.17E-01
2005	2	13	3.35E-01	0.00E+00	8.20E-02	0.00E+00	0.00E+00	2.19E+00	7.01E-01	2.80E+00	9.79E-03	1.09E-03	2.32E-05	2.34E-02	7.36E-03	1.69E+00	6.35E-01
2005	2	14	1.80E+00	9.95E-04	9.15E-01	1.66E-04	6.22E-04	6.34E+00	3.99E+00	6.69E+00	7.41E-02	1.45E-02	3.81E-03	5.53E-02	2.87E-02	7.98E+00	2.30E+00
2005	2	15	3.35E-01	1.32E-03	1.40E-01	1.78E-04	5.95E-04	5.37E+00	3.27E+00	5.84E+00	5.08E-02	1.10E-02	4.37E-03	3.36E-02	1.88E-02	8.00E+00	3.62E-01
2005	2	16	3.07E-01	3.40E-03	2.19E-01	8.39E-04	1.77E-03	4.55E+00	2.00E+00	5.46E+00	5.75E-02	1.43E-02	6.85E-03	3.33E-02	2.19E-02	5.32E+00	3.52E-01
2005	2	17	2.64E+00	2.00E-03	1.61E+00	2.72E-04	7.28E-04	6.10E+00	2.07E+00	7.39E+00	7.03E-02	1.20E-02	4.92E-03	2.95E-02	1.81E-02	6.97E+00	3.03E+00
2005	2	18	1.85E+00	7.58E-03	1.77E+00	2.43E-03	4.45E-03	5.43E+00	2.33E+00	5.91E+00	1.80E-01	4.25E-02	1.70E-02	8.55E-02	6.38E-02	5.62E+00	2.17E+00
2005	2	19	1.85E+00	7.47E-03	1.20E+00	3.27E-03	5.55E-03	2.88E+00	1.13E+00	3.03E+00	5.43E-02	2.11E-02	1.29E-02	3.36E-02	2.64E-02	5.26E+00	2.37E+00
2005	2	20	1.39E+00	1.11E-02	1.16E+00	3.81E-03	6.17E-03	4.67E+00	2.93E+00	6.38E+00	1.45E-01	3.89E-02	1.95E-02	8.09E-02	5.33E-02	7.69E+00	1.86E+00
2005	2	21	4.52E-01	6.93E-04	2.04E-01	1.19E-04	3.78E-04	5.93E+00	3.54E+00	6.06E+00	5.49E-02	1.00E-02	3.18E-03	3.47E-02	1.84E-02	7.82E+00	5.53E-01

Year	Month	Day	Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2004	12	2	1.11E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.85E-04	3.65E-02	3.85E-01	5.98E-05	1.57E+00	7.81E-03	5.47E-01	2.19E-01	1.73E-03	2.19E-04
2004	12	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-05	0.00E+00	3.85E-02	2.22E-01	9.10E-17	2.34E+00	2.16E-02	4.58E-01	1.97E-01	1.89E-03	0.00E+00
2004	12	4	9.41E-02	1.04E-04	6.77E-04	3.81E-02	3.71E-01	8.37E-03	8.22E-02	7.19E-01	2.18E-02	5.60E+00	3.36E+00	5.20E-01	1.03E+00	6.81E-02	2.71E-01
2004	12	5	6.32E-02	2.17E-01	2.33E-02	1.65E-01	1.68E-01	1.13E-01	8.35E-03	6.99E-01	2.64E-02	2.21E+00	3.72E+00	1.55E-02	4.64E-01	2.23E-02	1.53E-01
2004	12	6	4.03E-02	9.66E-01	4.24E-03	3.14E-01	8.61E-01	7.14E-02	7.56E-03	2.76E-01	3.20E-01	3.62E+00	6.76E+00	1.74E-02	1.26E-01	3.32E-02	1.27E-01
2004	12	7	1.09E-01	1.21E+00	7.54E-02	4.67E-01	6.78E-01	1.90E-01	5.10E-02	1.02E+00	3.28E+00	6.64E+00	5.36E+00	4.73E-01	1.12E+00	9.72E-02	3.61E-01
2004	12	8	3.66E-01	5.61E-01	5.00E-02	1.93E-01	3.80E-01	8.94E-02	6.34E-03	4.16E-01	4.05E+00	1.73E+00	6.10E+00	2.25E-01	2.58E-01	3.35E-02	6.90E-01
2004	12	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-02	9.10E-01	1.12E-17	4.51E+00	1.29E-02	1.17E+00	2.66E-01	2.69E-03	0.00E+00
2004	12	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-04	0.00E+00	3.37E-02	5.32E-01	2.53E-03	3.48E+00	1.39E-01	7.00E-01	5.46E-01	8.33E-05	0.00E+00
2004	12	11	3.44E-03	0.00E+00	0.00E+00	0.00E+00	7.33E-06	0.00E+00	5.10E-02	6.97E-01	8.95E-03	6.10E+00	6.89E-02	7.71E-01	1.21E+00	3.26E-02	1.75E-02
2004	12	12	6.34E-01	5.05E-01	1.83E-01	1.03E-01	1.65E-01	2.52E-01	5.57E-01	2.65E+00	1.30E+00	1.20E+01	1.58E+00	2.92E+00	2.13E+00	8.45E-01	7.82E-01
2004	12	13	3.10E-01	4.10E-01	1.67E-02	7.59E-02	8.39E-02	2.46E-02	6.72E-02	1.25E+00	9.51E-01	7.19E+00	2.20E+00	7.06E-01	6.73E-01	2.03E-01	7.34E-01
2004	12	14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.82E-02	6.95E-01	5.82E-17	3.49E+00	1.06E-02	9.91E-01	2.27E-01	0.00E+00	0.00E+00
2004	12	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.57E-02	6.45E-01	1.28E-16	6.98E+00	6.96E-04	7.28E-01	5.18E-01	0.00E+00	0.00E+00
2004	12	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.02E-02	4.03E-01	3.29E-16	3.98E+00	2.21E-03	4.92E-01	2.35E-01	1.26E-02	0.00E+00
2004	12	17	5.67E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.56E-02	5.35E-01	2.74E-16	7.17E+00	7.28E-05	4.33E-01	2.67E-01	1.40E-02	1.40E-02
2004	12	18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.76E-02	3.78E-01	3.17E-16	5.62E+00	1.63E-03	3.84E-01	2.64E-01	7.75E-03	0.00E+00
2004	12	19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.65E-05	0.00E+00	7.97E-03	1.27E-01	1.95E-18	9.88E-01	8.25E-02	2.89E-01	2.83E-01	3.74E-03	0.00E+00
2004	12	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.21E-02	8.76E-01	4.68E-18	4.95E+00	9.31E-06	9.23E-01	2.26E-01	3.99E-03	0.00E+00
2004	12	21	2.87E-01	7.35E-01	2.05E-01	2.12E-01	2.09E-01	2.60E-01	3.06E-01	1.39E+00	1.90E+00	8.95E+00	5.70E+00	1.54E+00	1.83E+00	2.89E-01	3.35E-01
2004	12	22	8.40E-01	5.05E-01	7.65E-01	1.35E-01	2.15E-01	7.38E-01	6.50E-01	1.11E+00	7.67E+00	2.17E+00	2.09E+00	1.01E+00	1.09E+00	6.54E-01	1.16E+00
2004	12	23	7.97E-03	3.52E-04	3.52E-04	2.92E-03	4.69E-03	4.86E-04	9.86E-02	1.21E+00	6.76E-04	6.46E+00	3.29E-03	1.08E+00	2.57E-01	7.23E-02	2.33E-02
2004	12	24	1.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E-04	3.73E-02	4.91E-01	2.10E-16	3.44E+00	8.30E-04	5.14E-01	2.27E-01	6.53E-04	8.39E-04
2004	12	25	1.37E-01	1.45E+00	4.39E-02	4.03E-01	5.76E-01	5.45E-02	2.00E-01	1.56E+00	6.96E-01	1.33E+01	7.33E+00	2.15E+00	1.53E+00	2.30E-01	3.57E-01
2004	12	26	4.10E-01	8.28E-01	6.42E-02	2.82E-01	3.28E-01	5.35E-02	1.48E-02	1.00E-01	3.00E+00	4.64E-01	1.64E+00	4.98E-02	1.21E-01	3.94E-02	7.34E-01
2004	12	27	5.85E-02	3.09E-01	1.32E-02	3.59E-02	5.63E-02	1.75E-02	1.78E-01	1.78E+00	6.01E-01	1.36E+01	1.08E+00	1.34E+00	1.25E+00	2.42E-01	1.51E-01
2004	12	28	4.39E-02	0.00E+00	1.17E-03	0.00E+00	0.00E+00	3.61E-03	1.26E-01	1.60E+00	4.28E-04	7.16E+00	6.80E-03	1.76E+00	2.82E-01	9.48E-02	1.06E-01
2004	12	29	1.03E-01	2.84E-02	1.87E-03	4.62E-01	1.29E+00	7.61E-03	7.35E-02	1.63E+00	1.09E-01	9.48E+00	1.33E+01	8.25E-01	6.44E-01	2.31E-01	2.72E-01
2004	12	30	3.21E-03	7.08E-02	1.03E-02	2.75E-03	1.26E-02	3.04E-02	3.15E-03	3.57E-03	5.85E-01	6.01E-02	1.63E-01	1.66E-02	2.59E-02	3.00E-03	3.38E-03
2004	12	31	0.00E+00	0.00E+00	6.96E-02	0.00E+00	0.00E+00	8.60E-02	0.00E+00	0.00E+00	2.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2005	1	1	9.27E-02	1.06E-03	7.05E-02	1.29E-05	6.68E-05	8.91E-02	5.98E-02	2.44E-01	4.31E+00	3.17E-01	2.14E-02	2.89E-01	1.80E-01	3.16E-02	1.89E-01
2005	1	2	3.55E-02	3.79E-03	1.89E-03	4.80E-04	7.21E-03	4.31E-03	2.17E-01	2.72E+00	2.41E-01	1.91E+01	4.34E-01	1.59E+00	1.14E+00	3.87E-01	1.00E-01
2005	1	3	1.16E-01	3.29E-05	1.59E-01	0.00E+00	0.00E+00	1.50E-01	2.77E-01	1.45E+00	3.77E+00	9.01E+00	2.54E-04	1.10E+00	2.06E+00	4.00E-01	1.74E-01
2005	1	4	9.48E-01	9.43E-02	3.47E-01	1.59E-03	3.82E-03	2.93E-01	7.94E-02	4.07E-01	5.12E+00	1.49E+00	4.02E-01	4.78E-01	5.81E-01	1.24E-01	1.58E+00
2005	1	5	6.85E-04	1.48E-03	7.34E-04	1.42E-04	3.75E-04	5.10E-04	1.47E-01	1.72E+00	7.12E-03	9.77E+00	5.47E-03	1.23E+00	5.92E-01	1.38E-01	7.51E-04
2005	1	6	1.18E-01	5.28E-03	1.82E-01	8.62E-07	2.91E-05	1.66E-01	5.32E-02	5.13E-01	1.47E+00	4.64E+00	9.55E-02	7.09E-01	6.90E-01	4.93E-02	1.72E-01
2005	1	7	3.42E-01	0.00E+00	1.71E-01	0.00E+00	0.00E+00	1.34E-01	7.07E-06	1.10E-02	2.24E+00	3.00E-06	0.00E+00	8.47E-07	2.93E-08	3.88E-03	5.05E-01
2005	1	8	4.07E-02	6.97E-07	5.64E-01	0.00E+00	0.00E+00	4.34E-01	0.00E+00	1.25E-06	9.54E+00	1.47E-04	6.93E-06	4.87E-09	2.52E-08	4.30E-07	1.00E-01
2005	1	9	3.18E-01	2.21E-01	2.15E-01	9.36E-02	1.56E-01	3.05E-01	3.23E-02	2.30E-01	7.82E+00	8.56E+00	1.26E+00	4.67E-01	3.81E-01	9.19E-02	6.43E-01
2005	1	10	8.95E-02	1.13E-05	1.65E-02	5.13E-09	2.71E-06	4.89E-02	5.40E-02	6.87E-01	3.99E-02	6.53E+00	7.02E-03	1.31E+00	3.93E-01	2.44E-02	2.62E-01
2005	1	11	4.69E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E-02	8.28E-01	3.60E-18	3.27E+00	1.30E-02	1.12E+00	2.66E-01	3.21E-03	5.95E-04
2005	1	12	2.16E-02	1.06E-01	3.30E-02	1.92E-02	2.29E-02	5.48E-02	1.91E-02	1.04E-01	7.06E-01	4.21E-01	1.22E+00	1.05E-01	2.62E-01	1.54E-02	4.09E-02
2005	1	13	7.35E-01	9.20E-01	3.21E-01	3.69E-01	4.66E-01	4.23E-01	1.14E+00	2.29E+00	2.11E+00	1.06E+01	4.51E+00	4.38E+00	4.29E+00	9.28E-01	1.12E+00
2005	1	14	1.02E-01	3.42E-02	8.08E-02	1.05E-02	1.33E-02	7.85E-02	3.89E-01	2.24E+00	2.85E-01	1.71E+01	9.66E-02	3.24E+00	5.14E+00	2.64E-01	1.56E-01
2005	1	15	5.72E-02	0.00E+00	5.55E-03	0.00E+00	0.00E+00	1.56E-02	1.63E-01	1.61E+00	1.36E-03	1.34E+01	1.13E-03	1.33E+00	4.01E-01	2.10E-01	1.45E-01
2005	1	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-02	3.44E-01	9.91E-17	4.70E+00	2.75E-03	8.57E-01	2.37E-01	3.52E-02	0.00E+00
2005	1	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.61E-12	0.00E+00	5.05E-03	4.94E-01	2.87E-17	1.30E+00	4.18E-02	3.55E-01	2.26E-01	2.98E-06	0.00E+00
2005	1	18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E-02	6.14E-01	3.96E-20	2.75E+00	2.67E-02	6.01E-01	3.23E-01	0.00E+00	0.00E+00
2005	1	19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E-04	0.00E+00	1.33E-03	3.59E-05	8.63E-01	7.21E-02	5.89E-02	3.62E-01	0.00E+00	0.00E+00
2005	1	20	1.46E-02	1.29E-05	5.26E-03	3.34E-07	9.49E-06	1.72E-02	5.02E-03	3.25E-01	3.42E-03	1.40E+00	8.34E-02	3.91E-01	4.67E-01	6.33E-03	2.12E-02
2005	1	21	1.14E-01	9.26E-01	2.75E-02	2.24E-02	2.00E-02	6.34E-02	2.75E-02	2.39E-01	1.17E+00	1.48E+00	2.30E+00	2.16E-01	1.66E-01	2.64E-02	2.89E-01
2005	1	22	9.03E-03	3.24E-02	1.25E-03	4.22E-02	7.88E-02	1.73E-03	1.02E-01	9.35E-01	3.17E-02	5.38E+00	4.67E-01	9.16E-01	4.60E-01	1.07E-01	1.45E-02
2005	1	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-02	5.23E-01	2.93E-17	5.05E+00	8.78E-03	7.73E-01	2.58E-01	8.15E-02	0.00E+00
2005	1	24	1.24E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.74E-02	8.69E-01	4.35E-18	5.23E+00	1.00E-02	1.19E+00	2.79E-01	1.33E-02	5.70E-03
2005	1	25	4.53E-01	1.71E+00	1.37E-01	6.20E-01	8.69E-01	1.88E-01	1.26E-01	1.04E+00	6.52E+00	1.36E+01	4.68E+00	1.33E+00	1.46E+00	1.81E-01	9.64E-01
2005	1	26	2.31E-01	2.85E-01	2.16E-02	1.14E-01	1.71E-01	3.61E-02	3.12E-01	2.73E+00	3.57E-01	3.41E+01	8.26E-01	4.71E+00	5.83E+00	4.80E-01	5.78E-01
2005	1	27	3.86E-02	0.00E+00	2.65E-06	0.00E+00	0.00E+00	3.56E-04	1.22E-01	1.95E+00	3.47E-03	9.36E+00	3.05E-03	2.03E+00	3.47E-01	8.95E-02	9.54E-02
2005	1	28	6.10E-02	1.30E-01	2.34E-03	3.09E-01	4.30E-01	8.64E-03	1.44E-01	2.12E+00	1.12E-01	2.06E+01	5.57E+00	2.19E+00	1.61E+00	2.39E-01	1.49E-01
2005	1	29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.54E-02	6.73E-01	3.93E-21	2.72E+00	3.21E-02	1.11E+00	2.80E-01	0.00E+00	0.00E+00
2005	1	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-02	7.65E-01	3.78E-17	3.76E+00	7.45E-03	8.45E-01	2.97E-01	3.92E-04	0.00E+00
2005	1	31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-10	0.00E+00	4.29E-02	7.53E-01	4.21E-18	2.26E+00	4.02E-02	5.94E-01	2.10E-01	0.00E+00	0.00E+00
2005	2	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-02	4.37E-01	1.75E-17	2.27E+00	1.89E-02	5.91E-01	2.78E-01	0.00E+00	0.00E+00
2005	2	2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-05	0.00E+00	2.69E-03	1.20E+00	1.66E-21	1.26E+00	1.46E-01	2.95E-01	3.28E-01	9.26E-03	0.00E+00
2005	2	3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E-03	3.16E-01	4.74E-19	1.09E+00	5.21E-02	2.91E-01	2.60E-01	0.00E+00	0.00E+00
2005	2	4	7.12E-02	8.60E-05	6.01E-03	4.61E-05	1.08E-01	3.26E-02	3.68E-03	4.74E-01	2.46E-02	1.89E+00	1.88E+00	1.44E-01	1.48E-01	2.91E-02	1.75E-01
2005	2	5	3.38E-03	1.01E-01	1.31E-02	7.78E-02	5.01E-02	4.22E-02	3.13E-03	3.44E-03	5.53E-01	1.13E-02	9.72E-02	6.03E-03	7.62E-03	3.25E-03	7.81E-03
2005	2	6	1.36E-01	4.69E-01	1.07E-01	4.59E-03	3.14E-03	1.15E-01	1.54E-03	5.66E-02	4.78E+00	2.99E-01	1.42E-01	1.68E-02	4.02E-02	3.82E-02	2.42E-01
2005	2	7	5.28E-01	1.68E-01	1.40E-01	1.93E-01	4.14E-01	2.06E-01	9.43E-01	1.98E+00	1.67E+00	1.23E+01	6.74E+00	3.90E+00	4.53E+00	6.61E-01	8.34E-01
2005	2	8	1.71E-01	1.49E-04	3.73E-02	2.87E-05	6.09E-05	9.47E-02	1.40E-01	7.75E-01	1.40E-01	1.45E+01	1.39E-02	1.72E+00	1.72E+00	4.05E-02	4.26E-01
2005	2	9	1.52E-02	0.00E+00	2.72E-03	0.00E+00	0.00E+00	2.15E-02	7.70E-02	6.31E-01	3.93E-03	6.31E+00	1.73E-03	7.43E-01	2.16E-01	1.53E-02	4.08E-02
2005	2	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.27E-02	9.19E-01	1.90E-15	5.19E+00	1.69E-03	7.46E-01	2.58E-01	7.20E-03	0.00E+00
2005	2	11	1.99E-02	4.74E-08	1.18E-03	0.00E+00	3.32E-08	1.14E-02	1.21E-01	1.92E+00	1.89E-03	7.48E+00	2.01E-02	1.47E+00	3.08E-01	8.74E-02	6.28E-02
2005	2	12	4.99E-02	4.36E-06	1.90E-03	5.14E-07	8.13E-06	1.36E-02	2.86E-02	7.53E-01	1.19E-02	1.98E+00	3.24E-02	7.73E-01	3.79E-01	1.45E-02	1.08E-01
2005	2	13	7.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-02	7.87E-01	0.00E+00	1.78E+00	1.16E-01	4.93E-01	7.43E-01	4.41E-03	3.82E-02
2005	2	14	2.25E-01	5.38E-04	1.68E-02	1.10E-03	4.53E-03	4.97E-02	1.04E-01	1.38E+00	3.74E-01	2.01E+01	6.28E-02	1.49E+00	2.04E+00	2.23E-01	4.49E-01
2005	2	15	1.13E-04	2.10E-05	7.29E-05	8.41E-06	2.22E-05	8.63E-05	1.52E-01	2.26E+00	9.44E-05	1.42E+01	2.69E-04	1.46E+00	8.08E-01	2.42E-01	1.33E-04
2005	2	16	3.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.38E-04	1.11E-01	1.61E+00	1.59E-05	9.61E+00	2.18E-03	8.54E-01	5.90E-01	8.34E-02	1.36E-01
2005	2	17	3.10E-01	8.42E-02	9.62E-02	4.80E-03	1.18E-02	1.56E-01	1.45E-01	8.79E-01	2.99E+00	1.04E+01	4.58E-01	1.16E+00	2.21E+00	2.22E-01	5.95E-01
2005	2	18	3.95E-01	1.49E-01	5.12E-02	1.73E-02	2.48E-02	4.17E-02	8.87E-02	8.29E-01	1.22E+00	1.40E+01	3.47E-01	1.78E+00	1.67E+00	1.42E-01	7.14E-01
2005	2	19	4.78E-02	2.98E-01	1.30E-01	5.07E-02	9.22E-02	1.38E-01	1.62E-02	2.45E-01	4.19E+00	4.50E+00	6.94E-01	3.03E-01	2.43E-01	4.19E-02	1.02E-01
2005	2	20	1.99E-01	9.26E-03	1.70E-01	1.01E-02	6.33E-02	1.40E-01	3.04E-01	8.65E-01	3.64E+00	1.03E+01	6.91E-01	2.66E+00	2.74E+00	1.25E-01	5.85E-01
2005	2	21	1.44E-02	4.20E-05	1.05E-03	7.32E-06	2.93E-05	1.28E-03	1.69E-01	2.01E+00	1.65E-03	1.82E+01	2.92E-04	1.42E+00	1.28E+00	2.36E-01	3.70E-02

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	2	22	1.21E+00	1.82E-01	5.02E-01	1.01E-01	1.91E-01	5.64E+00	3.39E+00	5.69E+00	1.93E-01	1.58E+01	1.58E+00	2.09E+00	1.20E+00	8.24E+00	1.56E+00	1.13E+00	9.46E-04	4.95E-01	1.24E-04	5.20E-04	5.61E+00	3.23E+00	3.94E+00	6.18E-02	1.26E-02	3.98E-03	4.55E-02	2.42E-02	8.06E+00	1.38E+00	8.10E-02	1.82E-01	6.83E-03	1.01E-01	1.90E-01	2.83E-02	1.59E-01	1.75E+00	1.31E-01	1.58E+01	1.57E+00	2.04E+00	1.17E+00	1.84E-01	1.76E-01
2005	2	23	4.34E-01	1.24E-03	1.17E-01	1.47E-04	5.53E-04	5.13E+00	2.59E+00	7.41E+00	5.18E-02	1.23E+01	6.58E-03	1.21E+00	1.45E+00	6.16E+00	5.21E-01	4.14E-01	1.24E-03	1.17E-01	1.47E-04	5.53E-04	5.13E+00	2.42E+00	5.40E+00	5.18E-02	1.31E-02	4.91E-03	3.20E-02	2.02E-02	6.03E+00	4.39E-01	2.07E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-01	2.00E+00	0.00E+00	1.23E+01	1.66E-03	1.18E+00	1.43E+00	1.35E-01	8.20E-02
2005	2	24	2.53E-01	1.04E-03	1.39E-01	1.03E-04	4.47E-04	4.89E+00	2.37E+00	7.13E+00	3.89E-02	8.64E+00	1.19E-02	1.07E+00	5.05E-01	6.21E+00	3.53E-01	2.53E-01	1.04E-03	1.39E-01	1.03E-04	4.47E-04	4.89E+00	2.24E+00	5.26E+00	3.89E-02	1.07E-02	4.16E-03	2.37E-02	1.57E-02	6.09E+00	3.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-01	1.86E+00	0.00E+00	8.63E+00	7.76E-03	1.05E+00	4.90E-01	1.23E-01	0.00E+00
2005	2	25	7.54E-01	6.58E-04	3.54E-01	5.37E-05	2.26E-04	5.91E+00	3.01E+00	6.39E+00	7.57E-02	1.14E+01	3.57E-03	1.77E+00	3.38E-01	8.78E+00	9.43E-01	7.20E-01	6.57E-04	3.51E-01	5.37E-05	2.25E-04	5.89E+00	2.87E+00	4.44E+00	7.34E-02	1.31E-02	3.35E-03	3.89E-02	2.31E-02	8.63E+00	8.62E-01	3.45E-02	3.79E-07	2.57E-03	0.00E+00	7.92E-07	2.40E-02	1.44E-01	1.95E+00	2.33E-03	1.14E+01	2.16E-04	1.73E+00	3.14E-01	1.55E-01	8.04E-02
2005	2	26	3.23E+00	3.75E-01	1.78E+00	1.65E-01	1.11E-01	5.27E+00	1.98E+00	7.54E+00	4.46E+00	2.39E+00	4.70E-01	4.16E-01	4.65E-01	7.18E+00	4.13E+00	2.56E+00	1.24E-02	1.55E+00	7.36E-03	1.00E-02	4.97E+00	1.76E+00	6.54E+00	1.10E-01	2.89E-02	1.89E-02	4.49E-02	3.50E-02	6.86E+00	3.16E+00	6.72E-01	3.63E-01	2.37E-01	1.58E-01	1.01E-01	3.06E-01	2.23E-01	9.95E-01	4.35E+00	2.36E+00	4.51E-01	3.71E-01	4.30E-01	3.26E-01	9.63E-01
2005	2	27	1.39E+00	1.29E-01	1.09E+00	3.24E-01	6.31E-01	6.42E+00	4.00E+00	8.87E+00	2.08E+00	1.45E+01	4.98E+00	1.58E+00	2.26E+00	8.88E+00	2.01E+00	1.18E+00	1.50E-02	9.74E-01	5.98E-03	9.81E-03	6.32E+00	3.77E+00	7.08E+00	1.71E-01	5.12E-02	2.70E-02	1.01E-01	7.12E-02	8.56E+00	1.59E+00	2.15E-01	1.14E-01	1.15E-01	3.18E-01	6.21E-01	9.71E-02	2.31E-01	1.79E+00	1.91E+00	1.44E+01	4.95E+00	1.48E+00	2.19E+00	3.17E-01	4.19E-01
2005	2	28	6.84E-01	3.18E-03	3.69E-01	7.49E-04	1.85E-03	5.55E+00	3.46E+00	6.76E+00	7.94E-02	1.31E+01	8.93E-02	1.46E+00	8.38E-01	8.64E+00	8.34E-01	6.42E-01	3.18E-03	3.68E-01	7.49E-04	1.81E-03	5.54E+00	3.35E+00	4.80E+00	7.43E-02	1.97E-02	8.50E-03	5.94E-02	3.35E-02	8.45E+00	7.37E-01	4.20E-02	0.00E+00	1.25E-03	0.00E+00	3.81E-05	5.25E-03	1.13E-01	1.95E+00	5.19E-03	1.30E+01	8.08E-02	1.40E+00	8.04E-01	1.96E-01	9.63E-02
2005	3	1	3.04E-01	1.74E-05	1.60E-01	0.00E+00	2.50E-05	2.41E+00	1.84E+00	4.77E+00	4.50E-02	7.64E+00	2.72E-03	1.66E+00	2.79E-01	3.87E+00	4.46E-01	2.88E-01	1.74E-05	1.60E-01	0.00E+00	2.50E-05	2.41E+00	1.77E+00	3.57E+00	4.41E-02	6.60E-03	9.94E-04	3.57E-02	1.80E-02	3.84E+00	3.85E-01	1.56E-02	0.00E+00	1.98E-04	0.00E+00	0.00E+00	1.45E-03	7.33E-02	1.21E+00	9.02E-04	7.63E+00	1.73E-03	1.63E+00	2.61E-01	2.70E-02	6.12E-02
2005	3	2	1.25E+00	6.27E-04	9.81E-01	9.10E-05	2.74E-04	4.83E+00	2.62E+00	4.71E+00	7.14E-02	1.27E+01	6.35E-03	1.47E+00	3.85E-01	4.77E+00	1.72E+00	1.04E+00	3.88E-04	9.56E-01	6.35E-05	2.02E-04	4.77E+00	2.52E+00	3.79E+00	6.06E-02	1.29E-02	3.17E-03	4.02E-02	2.29E-02	4.69E+00	1.30E+00	2.04E-01	2.40E-04	2.52E-02	2.75E-05	7.13E-05	5.43E-02	9.64E-02	9.20E-01	1.09E-02	1.27E+01	3.19E-03	1.43E+00	3.62E-01	7.21E-02	4.14E-01
2005	3	3	6.00E-01	9.96E-02	4.08E-01	7.28E-02	1.20E-01	6.96E+00	4.46E+00	1.11E+01	3.58E-01	1.44E+01	7.89E-01	1.68E+00	2.36E+00	1.01E+01	7.40E-01	5.49E-01	5.73E-03	3.92E-01	1.54E-03	3.41E-03	6.93E+00	4.25E+00	8.84E+00	1.13E-01	2.92E-02	1.36E-02	6.91E-02	4.46E-02	9.77E+00	6.20E-01	5.12E-02	9.39E-02	1.57E-02	7.13E-02	1.17E-01	2.81E-02	2.08E-01	2.25E+00	2.45E-01	1.43E+01	7.75E-01	1.61E+00	2.31E+00	3.24E-01	1.19E-01
2005	3	4	3.73E-01	5.12E-03	1.68E-01	1.39E-03	2.82E-03	3.81E+00	3.15E+00	6.18E+00	6.64E-02	1.09E+01	4.18E-02	1.44E+00	3.63E-01	6.62E+00	4.77E-01	3.73E-01	5.12E-03	1.68E-01	1.39E-03	2.82E-03	3.81E+00	3.00E+00	4.13E+00	6.64E-02	1.99E-02	1.03E-02	4.36E-02	2.91E-02	6.47E+00	4.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-01	2.05E+00	5.89E-38	1.09E+01	3.14E-02	1.40E+00	3.34E-01	1.52E-01	9.84E-06
2005	3	5	3.29E-02	0.00E+00	7.62E-03	0.00E+00	0.00E+00	4.20E-01	4.29E-01	8.82E-01	2.38E-19	3.62E+00	4.21E-02	3.78E-01	2.59E-01	6.32E-01	4.59E-02	3.29E-02	0.00E+00	7.62E-03	0.00E+00	0.00E+00	4.20E-01	3.84E-01	5.11E-01	0.00E+00	0.00E+00	0.00E+00	4.39E-04	1.63E-07	6.32E-01	4.59E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.51E-02	3.70E-01	2.38E-19	3.62E+00	4.21E-02	3.78E-01	2.59E-01	0.00E+00	0.00E+00
2005	3	6	6.08E-01	7.09E-02	4.36E-01	3.17E-03	1.43E-02	2.08E+00	1.76E+00	2.69E+00	1.66E+00	1.17E+01	2.39E-01	1.34E+00	1.75E+00	2.95E+00	7.31E-01	4.88E-01	7.93E-05	3.86E-01	2.48E-06	1.71E-05	2.00E+00	1.58E+00	2.20E+00	2.16E-02	3.22E-03	6.57E-04	1.39E-02	7.02E-03	2.79E+00	5.78E-01	1.20E-01	7.08E-02	5.01E-02	3.17E-03	1.43E-02	7.61E-02	1.76E-01	4.92E-01	1.64E+00	1.17E+01	2.38E-01	1.32E+00	1.75E+00	1.63E-01	1.53E-01
2005	3	7	3.37E-01	1.94E-03	2.10E-01	3.41E-04	8.03E-04	2.29E+00	1.61E+00	3.98E+00	4.71E-02	9.66E+00	9.58E-03	8.09E-01	3.46E-01	2.48E+00	4.77E-01	3.05E-01	1.93E-03	2.10E-01	3.22E-04	7.50E-04	2.29E+00	1.52E+00	2.93E+00	4.45E-02	1.07E-02	4.53E-03	2.15E-02	1.52E-02	2.43E+00	4.10E-01	3.28E-02	1.27E-05	4.60E-05	1.88E-05	5.33E-05	2.80E-04	9.86E-02	1.05E+00	2.55E-03	9.65E+00	5.04E-03	7.88E-01	3.31E-01	5.18E-02	6.78E-02
2005	3	8	2.37E-01	1.19E-03	1.16E-01	2.13E-04	5.45E-04	2.76E+00	1.75E+00	5.59E+00	2.77E-02	8.66E+00	3.00E-02	1.19E+00	2.15E+00	3.88E+00	3.00E-01	2.32E-01	1.19E-03	1.16E-01	2.13E-04	5.45E-04	2.76E+00	1.64E+00	4.44E+00	2.76E-02	7.59E-03	3.24E-03	1.59E-02	1.10E-02	3.80E+00	2.83E-01	4.46E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-01	1.15E+00	9.21E-05	8.65E+00	2.68E-02	1.17E+00	2.14E+00	7.53E-02	1.77E-02
2005	3	9	9.35E-01	0.00E+00	2.67E-01	0.00E+00	0.00E+00	2.07E+00	1.87E+00	4.30E+00	6.14E-01	1.13E+01	4.44E-03	1.22E+00	1.20E+00	3.32E+00	1.05E+00	9.17E-01	0.00E+00	2.63E-01	0.00E+00	0.00E+00	2.04E+00	1.75E+00	3.59E+00	2.31E-02	2.37E-03	8.41E-05	1.96E-02	7.72E-03	3.19E+00	1.01E+00	1.81E-02	0.00E+00	3.79E-03	0.00E+00	0.00E+00	3.46E-02	1.17E-01	7.06E-01	5.90E-01	1.13E+01	4.35E-03	1.20E+00	1.19E+00	1.23E-01	3.47E-02
2005	3	10	5.22E-01	4.26E-03	2.50E-01	1.17E-03	2.21E-03	3.88E+00	2.58E+00	8.13E+00	6.78E-02	1.13E+01	8.96E-03	2.46E+00	3.31E+00	5.79E+00	8.75E-01	4.94E-01	4.26E-03	2.47E-01	1.17E-03	2.21E-03	3.87E+00	2.46E+00	6.62E+00	6.26E-02	1.65E-02	8.38E-03	3.78E-02	2.42E-02	5.59E+00	7.91E-01	2.89E-02	2.29E-08	2.08E-03	0.00E+00	3.32E-09	1.15E-02	1.23E-01	1.51E+00	5.13E-03	1.13E+01	5.87E-04	2.43E+00	3.29E+00	1.98E-01	8.45E-02
2005	3	11	2.54E-01	7.37E-07	7.25E-02	0.00E+00	0.00E+00	5.81E-01	9.54E-01	1.26E+00	6.26E-02	6.52E+00	1.16E-02	5.43E-01	4.95E-01	8.64E-01	3.25E-01	2.54E-01	0.00E+00	7.25E-02	0.00E+00	0.00E+00	5.80E-01	9.23E-01	1.09E+00	1.18E-02	4.14E-04	1.09E-05	3.19E-03	1.14E-03	8.52E-01	3.25E-01	5.97E-05	7.37E-07	1.26E-07	0.00E+00	0.00E+00	8.89E-04	3.09E-02	1.68E-01	5.08E-02	6.52E+00	1.16E-02	5.40E-01	4.94E-01	1.22E-02	1.08E-04
2005	3	12	2.82E+00	1.36E-03	1.04E+00	1.44E-04	5.12E-04	4.84E+00	2.28E+00	7.02E+00	4.03E+00	5.55E+00	9.11E-03	1.40E+00	1.21E+00	5.88E+00	3.72E+00	2.00E+00	1.33E-03	9.39E-01	1.44E-04	4.99E-04	4.61E+00	1.61E+00	5.60E+00	8.00E-02	1.64E-02	4.56E-03	4.75E-02	2.99E-02	5.01E+00	2.70E+00	8.22E-01	2.63E-05	9.82E-02	5.65E-08	1.29E-05	2.31E-01	6.62E-01	1.42E+00	3.95E+00	5.54E+00	4.54E-03	1.35E+00	1.18E+00	8.70E-01	1.02E+00
2005	3	13	2.16E+00	4.21E-03	8.78E-01	7.95E-04	1.87E-03	5.42E+00	2.97E+00	9.10E+00	1.20E+00	4.70E+00	9.37E-03	1.13E+00	1.15E+00	8.40E+00	2.50E+00	1.23E+00	4.20E-03	7.33E-01	7.95E-04	1.87E-03	5.08E+00	2.26E+00	7.10E+00	7.69E-02	1.92E-02	8.85E-03	4.44E-02	2.91E-02	7.49E+00	1.29E+00	9.35E-01	7.19E-06	1.45E-01	5.65E-08	2.20E-06	3.44E-01	7.14E-01	1.99E+00	1.13E+00	4.68E+00	5.24E-04	1.09E+00	1.12E+00	9.15E-01	1.21E+00
2005	3	14	1.22E+00	2.33E-02	8.72E-01	2.77E-03	5.23E-03	5.02E+00	3.21E+00	8.54E+00	2.07E+00	9.25E+00	3.34E-02	1.58E+00	2.12E+00	8.35E+00	1.62E+00	1.09E+00	6.21E-03	7.48E-01	1.81E-03	3.25E-03	4.82E+00	2.94E+00	7.29E+00	8.06E-02	2.13E-02	1.11E-02	4.41E-02	3.11E-02	8.00E+00	1.43E+00	1.29E-01	1.71E-02	1.24E-01	9.59E-04	1.99E-03	1.95E-01	2.74E-01	1.25E+00	1.99E+00	9.23E+00	2.23E-02	1.53E+00	2.08E+00	3.42E-01	1.85E-01
2005	3	15	4.42E+00	1.49E+00	2.36E+00	3.59E-01	2.35E-01	5.10E+00	1.87E+00	7.85E+00	6.28E+00	4.18E+00	4.37E+00	1.04E+00	6.87E-01	8.05E+00	6.18E+00	3.84E+00	3.12E-02	2.31E+00	1.96E-02	2.33E-02	5.03E+00	1.80E+00	7.07E+00	1.80E-01	5.57E-02	3.77E-02	8.08E-02	6.57E-02	8.01E+00	5.04E+00	5.79E-01	1.46E+00	5.10E-02	3.40E-01	2.12E-01	6.80E-02	6.28E-02	7.82E-01	6.10E+00	4.12E+00	4.33E+00	9.60E-01	6.21E-01	4.45E-02	1.14E+00
2005	3	16	5.61E-01	1.51E+00	3.47E-01	1.57E-01	9.77E-02	3.74E+00	2.14E+00	5.48E+00	5.10E-01	5.24E+00	1.25E+00	8.42E-01	6.62E-01	4.59E+00	6.73E-01	5.54E-01	2.09E-02	3.22E-01	4.53E-03	5.91E-03	3.72E+00	2.06E+00	4.33E+00	5.73E-02	1.81E-02	1.45E-02	4.67E-02	2.79E-02	4.49E+00	6.66E-01	6.93E-03	1.49E+00	2.47E-02	1.53E-01	9.17E-02	2.12E-02	8.14E-02	1.16E+00	4.52E-01	5.22E+00	1.23E+00	7.95E-01	6.34E-01	9.21E-02	6.86E-03
2005	3	17	2.08E+00	3.49E-02	1.85E+00	4.67E-07	5.15E-06	2.55E+00	3.86E-01	3.00E+00	4.10E+00	1.59E-02	8.90E-02	2.78E-03	1.66E-03	3.99E+00	2.73E+00	1.93E+00	1.93E-05	1.39E+00	1.56E-08	1.54E-07	2.12E+00	3.86E-01	2.99E+00	9.29E-03	5.65E-04	6.93E-05	2.48E-03	1.02E-03	3.99E+00	2.50E+00	1.51E-01	3.49E-02	4.56E-01	4.51E-07	5.00E-06	4.32E-01	5.86E-05	1.29E-02	4.09E+00	1.53E-02	8.89E-02	2.93E-04	6.45E-04	6.34E-03	2.33E-01
2005	3	18	3.02E+00	1.38E+00	1.77E+00	8.98E-02	9.71E-02	3.64E+00	7.16E-01	3.07E+00	9.57E+00	1.10E+00	1.16E+00	2.85E-01	3.66E-01	4.70E+00	4.34E+00	2.79E+00	2.84E-02	1.54E+00	6.85E-03	8.99E-03	3.40E+00	6.75E-01	2.87E+00	1.51E-01	4.86E-02	3.15E-02	6.72E-02	5.52E-02	4.62E+00	3.88E+00	2.28E-01	1.35E+00	2.33E-01	8.29E-02	8.81E-02	2.37E-01	4.03E-02	2.01E-01	9.42E+00	1.05E+00	1.13E+00	2.17E-01	3.11E-01	7.92E-02	4.54E-01
2005	3	19	3.12E+00	2.73E-05	2.25E+00	0.00E+00	4.27E-07	3.17E+00	2.29E-02	1.72E+00	2.50E+00	4.58E-04	9.98E-05	7.78E-04	5.57E-04	3.16E+00	3.38E+00	2.71E+00	2.73E-05	2.07E+00	0.00E+00	4.27E-07	3.04E+00	2.29E-02	1.72E+00	1.05E-02	4.58E-04	9.98E-05	7.78E-04	5.57E-04	3.16E+00	2.71E+00	4.05E-01	0.00E+00	1.73E-01	0.00E+00	0.00E+00	1.28E-01	0.00E+00	9.92E-06	2.49E+00	4.62E-08	0.00E+00	0.00E+00	0.00E+00	5.19E-06	6.65E-01
2005	3	20	3.02E+00	9.34E-01	1.74E+00	4.37E-01	9.72E-01	4.05E+00	2.22E+00	4.81E+00	3.78E+00	7.05E+00	8.67E+00	2.16E+00	2.78E+00	4.34E+00	4.44E+00	2.43E+00	1.96E-02	1.47E+00	1.74E-02	2.74E-02	3.80E+00	1.90E+00	3.89E+00	1.50E-01	7.35E-02	4.49E-02	1.07E-01	8.79E-02	3.95E+00	3.40E+00	5.90E-01	9.15E-01	2.61E-01	4.20E-01	9.45E-01	2.44E-01	3.17E-01	9.22E-01	3.63E+00	6.98E+00	8.63E+00	2.05E+00	2.69E+00	3.94E-01	1.04E+00
2005	3	21	5.43E-01	4.08E-03	5.72E-01	3.64E-03	1.48E-01	4.37E+00	2.72E+00	6.64E+00	1.51E-01	1.03E+01	9.02E-01	1.25E+00	1.02E+00	5.36E+00	1.07E+00	4.54E-01	3.99E-03	5.72E-01	1.84E-03	4.73E-03	4.37E+00	2.66E+00	5.34E+00	1.36E-01	4.49E-02	1.75E-02	8.14E-02	6.15E-02	5.19E+00	8.76E-01	8.86E-02	9.75E-05	1.55E-05	1.79E-03	1.43E-01	2.13E-04	6.50E-02	1.29E+00	1.47E-02	1.03E+01	8.84E-01	1.17E+00	9.61E-01	1.73E-01	1.97E-01
2005	3	22	1.36E+00	5.59E-02	9.33E-01	8.57E-03	1.56E-02	4.36E+00	2.00E+00	5.03E+00	2.34E+00	7.18E+00	2.35E-01	1.20E+00	1.30E+00	6.50E+00	1.87E+00	1.23E+00	3.10E-03	8.25E-01	8.30E-04	1.48E-03	4.24E+00	1.87E+00	4.16E+00	8.20E-02	2.07E-02	7.40E-03	4.55E-02	3.10E-02	6.33E+00	1.60E+00	1.38E-01	5.28E-02	1.08E-01	7.74E-03	1.41E-02	1.26E-01	1.34E-01	8.71E-01	2.26E+00	7.16E+00	2.28E-01	1.16E+00	1.27E+00	1.72E-01	2.66E-01
2005	3	23	2.44E+00	1.47E-06	1.80E+00	0.00E+00	0.00E+00	2.32E+00	4.33E-03	1.61E+00	4.04E+00	7.83E-05	1.67E-05	3.27E-05	3.85E-05	2.76E+00	2.66E+00	2.30E+00	0.00E+00	1.54E+00	0.00E+00	0.00E+00	2.12E+00	4.30E-03	1.61E+00	4.04E-03	3.92E-07	0.00E+00	4.84E-06	2.13E-06	2.76E+00	2.46E+00	1.32E-01	1.47E-06	2.59E-01	0.00E+00	0.00E+00	1.95E-01	2.95E-05	4.56E-03	4.04E+00	7.79E-05	1.67E-05	2.78E-05	3.63E-05	1.23E-03	2.01E-01
2005	3	24	2.51E+00	3.01E-01	1.50E+00	2.69E-02	4.43E-02	3.19E+00	6.14E-01	3.33E+00	5.48E+00	5.76E-01	8.66E-01	1.35E-01	2.03E-01	3.85E+00	3.37E+00	2.20E+00	2.86E-03	1.40E+00	6.14E-04	1.12E-03	3.09E+00	6.08E-01	3.19E+00	4.68E-02	1.10E-02	5.11E-03	2.09E-02	1.50E-02	3.83E+00	2.75E+00	3.18E-01	2.98E-01	1.05E-01	2.63E-02	4.31E-02	9.96E-02	5.72E-03	1.47E-01	5.43E+00	5.65E-01	8.61E-01	1.14E-01	1.88E-01	2.04E-02	6.29E-01
2005	3	25	1.64E-01	2.00E-02	1.49E-01	1.77E-02	2.79E-02	3.18E+00	1.39E+00	3.80E+00	5.57E-02	4.72E+00	6.28E-02	1.27E+00	4.10E-01	4.48E+00	1.91E-01	1.60E-01	2.61E-03	1.47E-01	9.04E-04	2.00E-03	3.17E+00	1.31E+00	2.57E+00	4.82E-02	1.54E-02	7.12E-03	3.48E-02	2.31E-02	4.39E+00	1.88E-01	3.53E-03	1.74E-02	1.78E-03	1.68E-02	2.59E-02	2.40E-03	8.84E-02	1.24E+00	7.50E-03	4.71E+00	5.56E-02	1.23E+00	3.87E-01	8.94E-02	3.96E-03
2005	3	26	5.14E-02	0.00E+00	3.20E-02	0.00E+00	4.30E-03	9.16E-01	3.18E-01	1.59E+00	8.51E-04	1.11E+00	1.09E-01	2.34E-01	2.87E-01	6.67E-01	1.32E-01	5.14E-02	0.00E+00	3.20E-02	0.00E+00	0.00E+00	9.16E-01	3.15E-01	1.11E+00	8.51E-04	4.50E-05	0.00E+00	5.87E-03	6.94E-04	6.66E-01	1.32E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.30E-03	0.00E+00	3.44E-03	4.78E-01	2.05E-22	1.11E+00	1.09E-01	2.28E-01	2.86E-01	1.53E-03	0.00E+00
2005	3	27	5.23E-01	1.26E-01	5.54E-01	2.15E-01	6.45E-01	4.49E+00	2.04E+00	6.16E+00	1.37E-01	4.60E+00	4.96E+00	5.66E-01	1.17E+00	4.33E+00	8.99E-01	5.06E-01	6.11E-03	5.53E-01	1.02E-02	1.74E-02	4.49E+00	2.01E+00	4.55E+00	1.27E-01	4.48E-02	2.19E-02	8.01E-02	6.11E-02	4.21E+00	8.30E-01	1.70E-02	1.20E-01	5.14E-04	2.05E-01	6.28E-01	1.42E-03	3.74E-02	1.61E+00	9.19E-03	4.56E+00	4.94E+00	4.86E-01	1.11E+00	1.23E-01	6.86E-02
2005	3	28	6.28E-01	2.66E-03	4.53E-01	7.71E-04	2.62E-03	5.74E+00	2.42E+00	7.59E+00	1.67E-01	3.18E+00	2.49E-01	9.37E-01	8.01E-01	4.69E+00	8.73E-01	6.28E-01	2.66E-03	4.53E-01	7.71E-04	2.31E-03	5.74E+00	2.33E+00	5.79E+00	1.67E-01	3.74E-02	1.14E-02	1.08E-01	6.98E-02	4.56E+00	8.73E-01	1.01E-07	4.57E-08	3.51E-08	8.02E-08	3.17E-04	5.20E-08	9.34E-02	1.80E+00	7.09E-05	3.14E+00	2.37E-01	8.29E-01	7.31E-01	1.35E-01	1.08E-07
2005	3	29	1.29E-01	0.00E+00	8.65E-02	0.00E+00	1.49E-07	1.96E+00	9.38E-01	3.29E+00	1.71E-02	1.92E+00	7.09E-02	7.65E-01	6.97E-01	1.64E+00	2.84E-01	1.29E-01	0.00E+00	8.65E-02	0.00E+00	1.45E-07	1.96E+00	8.99E-01	2.45E+00	1.71E-02	1.43E-03	1.91E-05	1.76E-02	5.89E-03	1.63E+00	2.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.36E-09	0.00E+00	3.94E-02	8.41E-01	5.89E-20	1.92E+00	7.09E-02	7.47E-01	6.92E-01	7.60E-03	0.00E+00
2005	3	30	2.23E-01	9.74E-04	9.23E-02	1.22E-03	6.40E-03	1.87E+00	1.84E+00	5.21E+00	9.81E-02	8.11E+00	1.32E-01	2.06E+00	2.56E+00	2.82E+00	4.66E-01	1.70E-01	3.47E-08	8.97E-02	3.43E-08	5.27E-05	1.87E+00	1.55E+00	3.89E+00	2.20E-02	5.95E-03	6.42E-04	4.72E-02	1.94E-02	2.71E+00	4.05E-01	5.22E-02	9.74E-04	2.60E-03	1.22E-03	6.35E-03	6.54E-03	2.87E-01	1.32E+00	7.61E-02	8.10E+00	1.31E-01	2.01E+00	2.54E+00	1.10E-01	6.10E-02
2005	3	31	4.80E-01	4.55E-04	4.90E-01	6.58E-05	2.73E-04	3.52E+00	2.46E+00	4.70E+00	6.06E-02	1.10E+01	9.06E-02	1.06E+00	4.52E-01	5.48E+00	7.68E-01	4.22E-01	2.69E-04	4.86E-01	2.13E-05	1.57E-04	3.51E+00	2.39E+00	3.64E+00	5.34E-02	8.51E-03	2.01E-03	3.20E-02	1.70E-02	5.36E+00	6.23E-01	5.71E-02	1.86E-04	3.32E-03	4.45E-05	1.16E-04	8.99E-03	7.00E-02	1.07E+00	7.21E-03	1.10E+01	8.86E-02	1.03E+00	4.35E-01	1.17E-01	1.45E-01
2005	4	1	2.57E-01	0.00E+00	2.37E-02	0.00E+00	2.38E-04	8.24E-01	1.93E-01	5.66E-01	1.28E-02	1.28E+00	1.46E-01	1.48E-01	3.17E-01	6.45E-01	4.60E-01	2.57E-01	0.00E+00	2.37E-02	0.00E+00	2.09E-07	8.24E-01	1.87E-01	4.81E-01	1.28E-02	1.69E-03	8.37E-05	9.27E-03	7.20E-03	6.45E-01	4.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-04	0.00E+00	5.93E-03	8.57E-02	2.67E-18	1.28E+00	1.46E-01	1.39E-01	3.10E-01	1.28E-04	0.00E+00
2005	4	2	1.16E-01	0.00E+00	7.90E-02	2.91E-07	5.39E-04	9.44E-01	1.52E+00	2.39E+00	1.15E-04	6.86E+00	1.12E-01	1.35E+00	4.31E-01	1.76E+00	2.08E-01	1.16E-01	0.00E+00	7.90E-02	2.91E-07	2.24E-06	9.44E-01	1.44E+00	1.72E+00	1.15E-04	5.65E-06	9.64E-07	4.62E-03	4.41E-04	1.76E+00	2.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.37E-04	0.00E+00	7.31E-02	6.79E-01	8.16E-34	6.86E+00	1.12E-01	1.34E+00	4.30E-01	6.49E-03	0.00E+00
2005	4	3	2.10E+00	8.90E-01	1.62E+00	7.97E-02	1.51E-01	4.48E+00	3.43E+00	7.05E+00	1.98E+00	8.11E+00	3.61E+00	1.99E+00	2.35E+00	6.77E+00	2.68E+00	1.84E+00	1.88E-02	1.49E+00	3.07E-03	5.76E-03	4.37E+00	3.34E+00	6.09E+00	1.64E-01	5.75E-02	2.83E-02	1.20E-01	8.09E-02	6.69E+00	2.19E+00	2.55E-01	8.71E-01	1.37E-01	7.66E-02	1.45E-01	1.06E-01	9.30E-02	9.55E-01	1.82E+00	8.05E+00	3.58E+00	1.87E+00	2.26E+00	8.00E-02	4.99E-01
2005	4	4	8.39E-02	3.04E-03	4.40E-02	1.17E-02	3.47E-02	1.06E+00	7.48E-01	3.06E+00	4.03E-04	5.84E+00	1.13E-01	1.32E+00	7.60E-01	1.28E+00	1.51E-01	8.39E-02	3.40E-05	4.39E-02	7.16E-05	1.52E-04	1.06E+00	6.94E-01	2.18E+00	7.64E-05	1.78E-04	1.22E-04	1.20E-03	2.86E-04	1.25E+00	1.51E-01	2.23E-05	3.01E-03	1.07E-05	1.17E-02	3.45E-02	1.76E-05	5.36E-02	8.83E-01	3.26E-04	5.84E+00	1.13E-01	1.32E+00	7.60E-01	2.65E-02	9.30E-05
2005	4	5	2.33E-02	0.00E+00	5.87E-02	0.00E+00	0.00E+00	7.84E-01	6.32E-01	2.12E+00	2.96E-03	2.35E+00	6.15E-02	7.66E-01	3.91E-01	8.79E-01	8.41E-02	2.33E-02	0.00E+00	5.87E-02	0.00E+00	0.00E+00	7.84E-01	6.12E-01	1.61E+00	2.96E-03	2.81E-04	0.00E+00	1.19E-02	3.65E-03	8.79E-01	8.41E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E-02	5.07E-01	3.38E-17	2.35E+00	6.15E-02	7.54E-01	3.88E-01	0.00E+00	0.00E+00
2005	4	6	1.71E+00	4.51E-01	1.29E+00	2.38E-02	3.62E-02	2.69E+00	1.50E+00	4.70E+00	1.66E+00	3.52E+00	1.35E+00	4.25E-01	4.76E-01	3.39E+00	2.31E+00	1.51E+00	3.25E-03	1.27E+00	1.06E-03	1.46E-03	2.67E+00	1.48E+00	3.97E+00	9.06E-02	1.58E-02	5.62E-03	3.90E-02	2.38E-02	3.32E+00	1.84E+00	1.93E-01	4.47E-01	1.71E-02	2.27E-02	3.47E-02	2.07E-02	2.59E-02	7.27E-01	1.57E+00	3.50E+00	1.35E+00	3.86E-01	4.52E-01	6.37E-02	4.75E-01
2005	4	7	1.33E+00	3.80E-01	3.43E-01	4.45E-01	2.63E-01	3.49E+00	1.37E+00	3.83E+00	2.42E-01	2.69E+00	6.25E+00	3.62E-01	6.28E-01	3.12E+00	1.76E+00	1.15E+00	2.35E-02	3.37E-01	1.69E-02	1.78E-02	3.48E+00	1.35E+00	3.18E+00	1.69E-01	7.56E-02	4.70E-02	8.92E-02	8.18E-02	3.00E+00	1.31E+00	1.82E-01	3.56E-01	5.38E-03	4.28E-01	2.46E-01	1.01E-02	1.88E-02	6.44E-01	7.24E-02	2.61E+00	6.21E+00	2.73E-01	5.46E-01	1.13E-01	4.50E-01
2005	4	8	7.65E-02	1.68E-05	1.69E-01	2.61E-08	1.73E-05	2.49E+00	5.44E-01	2.48E+00	1.39E-02	2.33E+00	9.48E-02	4.17E-01	3.92E-01	1.93E+00	2.13E-01	7.65E-02	1.68E-05	1.69E-01	2.61E-08	2.69E-06	2.49E+00	5.13E-01	2.02E+00	1.39E-02	1.48E-03	2.09E-04	1.08E-02	3.64E-03	1.89E+00	2.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-05	0.00E+00	3.09E-02	4.60E-01	2.13E-18	2.33E+00	9.46E-02	4.06E-01	3.88E-01	3.66E-02	0.00E+00
2005	4	9	5.59E-01	2.17E-03	6.19E-01	2.59E-04	7.14E-04	5.14E+00	2.26E+00	6.86E+00	1.32E-01	1.36E+01	1.32E-02	1.94E+00	2.39E+00	6.81E+00	8.83E-01	4.66E-01	2.16E-03	6.16E-01	2.57E-04	7.03E-04	5.13E+00	2.16E+00	5.18E+00	8.06E-02	1.66E-02	5.87E-03	3.79E-02	2.53E-02	6.59E+00	6.48E-01	9.29E-02	1.30E-05	2.83E-03	1.87E-06	1.13E-05	6.80E-03	1.00E-01	1.69E+00	5.18E-02	1.35E+01	7.29E-03	1.90E+00	2.36E+00	2.20E-01	2.35E-01
2005	4	10	1.01E+00	1.75E-02	7.34E-01	3.56E-02	1.13E-01	6.64E+00	3.08E+00	6.91E+00	2.53E-01	1.44E+01	6.01E-01	1.87E+00	2.60E+00	6.97E+00	1.39E+00	9.09E-01	1.11E-02	7.30E-01	4.17E-03	7.16E-03	6.63E+00	2.98E+00	5.52E+00	1.88E-01	5.26E-02	2.39E-02	1.06E-01	7.52E-02	6.74E+00	1.14E+00	1.01E-01	6.38E-03	4.01E-03	3.14E-02	1.06E-01	7.80E-03	1.01E-01	1.39E+00	6.51E-02	1.43E+01	5.77E-01	1.76E+00	2.52E+00	2.27E-01	2.53E-01
2005	4	11	7.41E-01	5.83E-03	4.17E-01	3.05E-02	3.69E-01	4.19E+00	1.33E+00	4.47E+00	1.33E-01	2.79E+00	1.96E+00	2.32E-01	8.53E-01	2.76E+00	1.08E+00	7.26E-01	5.67E-03	4.17E-01	4.07E-03	8.08E-03	4.19E+00	1.29E+00	3.19E+00	1.21E-01	4.06E-02	1.94E-02	8.17E-02	6.32E-02	2.62E+00	1.03E+00	1.47E-02	1.63E-04	1.07E-04	2.64E-02	3.61E-01	4.60E-04	3.81E-02	1.29E+00	1.14E-02	2.75E+00	1.94E+00	1.50E-01	7.90E-01	1.44E-01	4.88E-02
2005	4	12	1.47E+00	4.46E-01	9.96E-01	9.01E-02	1.88E-01	3.55E+00	1.97E+00	5.16E+00	1.19E+00	8.07E+00	4.43E+00	1.60E+00	3.62E+00	3.70E+00	2.08E+00	1.21E+00	1.37E-03	8.68E-01	1.08E-03	1.85E-03	3.37E+00	1.81E+00	4.27E+00	8.89E-02	1.94E-02	4.82E-03	5.87E-02	4.37E-02	3.54E+00	1.64E+00	2.65E-01	4.45E-01	1.28E-01	8.90E-02	1.86E-01	1.79E-01	1.62E-01	8.88E-01	1.11E+00	8.05E+00	4.42E+00	1.54E+00	3.58E+00	1.57E-01	4.39E-01
2005	4	13	1.34E+00	2.61E-02	8.89E-01	1.09E-03	2.66E-03	4.16E+00	1.85E+00	6.55E+00	1.57E+00	5.11E+00	5.52E-02	1.07E+00	1.12E+00	5.10E+00	1.97E+00	1.15E+00	1.00E-03	6.84E-01	4.26E-05	2.28E-04	3.97E+00	1.64E+00	5.45E+00	1.13E-01	1.85E-02	4.33E-03	4.52E-02	3.17E-02	4.88E+00	1.67E+00	1.87E-01	2.51E-02	2.05E-01	1.04E-03	2.44E-03	1.87E-01	2.07E-01	1.09E+00	1.46E+00	5.10E+00	5.08E-02	1.02E+00	1.09E+00	2.21E-01	2.94E-01
2005	4	14	2.80E-01	5.36E-05	4.56E-02	1.20E-08	5.71E-07	2.40E+00	8.99E-01	3.77E+00	5.20E-02	4.71E+00	2.67E-02	8.95E-01	1.01E+00	2.70E+00	4.34E-01	2.63E-01	1.93E-06	3.40E-02	1.20E-08	5.41E-07	2.39E+00	8.08E-01	2.80E+00	4.09E-02	2.47E-03	1.39E-04	1.58E-02	7.70E-03	2.65E+00	4.16E-01	1.72E-02	5.17E-05	1.15E-02	0.00E+00	3.03E-08	1.11E-02	9.08E-02	9.72E-01	1.11E-02	4.71E+00	2.65E-02	8.79E-01	9.98E-01	5.93E-02	1.76E-02
2005	4	15	9.03E-02	0.00E+00	7.83E-02	0.00E+00	1.67E-04	1.20E+00	3.37E-01	1.81E+00	1.21E-02	1.23E+00	1.34E-01	2.09E-01	4.27E-01	1.11E+00	4.25E-01	7.53E-02	0.00E+00	7.83E-02	0.00E+00	7.96E-08	1.20E+00	3.31E-01	1.34E+00	1.21E-02	7.77E-04	2.97E-06	9.74E-03	4.82E-03	1.11E+00	3.86E-01	1.50E-02	0.00E+00	0.00E+00	0.00E+00	1.67E-04	0.00E+00	5.30E-03	4.68E-01	7.27E-21	1.23E+00	1.34E-01	1.99E-01	4.22E-01	4.57E-03	3.84E-02
2005	4	16	3.98E-01	9.76E-05	9.67E-02	2.31E-03	1.04E-01	2.83E+00	5.52E-01	3.60E+00	9.46E-02	1.53E+00	7.10E-01	6.19E-02	6.28E-01	1.83E+00	6.54E-01	3.93E-01	9.76E-05	9.67E-02	6.28E-05	6.20E-04	2.83E+00	5.26E-01	2.58E+00	9.42E-02	2.13E-02	4.02E-03	4.80E-02	4.03E-02	1.77E+00	6.44E-01	5.06E-03	0.00E+00	0.00E+00	2.25E-03	1.03E-01	0.00E+00	2.60E-02	1.01E+00	4.58E-04	1.51E+00	7.06E-01	1.40E-02	5.87E-01	5.89E-02	1.04E-02
2005	4	17	1.04E-01	1.10E-05	7.31E-02	0.00E+00	1.87E-05	2.04E+00	5.26E-01	2.52E+00	3.71E-02	1.71E+00	7.98E-02	4.85E-01	4.53E-01	1.25E+00	2.96E-01	1.04E-01	1.10E-05	7.31E-02	0.00E+00	9.22E-06	2.04E+00	4.88E-01	1.85E+00	3.71E-02	3.71E-03	4.70E-04	2.12E-02	1.11E-02	1.16E+00	2.96E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.52E-06	0.00E+00	3.76E-02	6.77E-01	3.19E-26	1.71E+00	7.93E-02	4.64E-01	4.42E-01	9.30E-02	0.00E+00
2005	4	18	2.52E+00	6.79E-04	1.34E+00	2.52E-05	9.01E-05	4.21E+00	1.12E+00	6.09E+00	2.97E+00	3.39E+00	1.30E-02	6.44E-01	4.33E-01	4.38E+00	3.16E+00	1.83E+00	6.79E-04	1.24E+00	2.52E-05	9.01E-05	4.12E+00	9.66E-01	4.94E+00	7.15E-02	1.04E-02	2.73E-03	2.97E-02	1.78E-02	3.91E+00	2.22E+00	6.90E-01	2.88E-09	1.04E-01	0.00E+00	0.00E+00	8.83E-02	1.49E-01	1.15E+00	2.90E+00	3.38E+00	1.02E-02	6.15E-01	4.15E-01	4.74E-01	9.39E-01
2005	4	19	2.98E+00	9.76E-04	1.97E+00	6.44E-05	1.63E-04	3.43E+00	3.08E-01	3.40E+00	2.09E+00	1.58E-02	3.30E-03	2.38E-02	1.68E-02	4.31E+00	3.54E+00	2.51E+00	9.76E-04	1.63E+00	6.44E-05	1.63E-04	3.10E+00	2.92E-01	3.27E+00	6.64E-02	1.12E-02	3.30E-03	2.37E-02	1.68E-02	4.24E+00	2.79E+00	4.69E-01	0.00E+00	3.33E-01	0.00E+00	0.00E+00	3.32E-01	1.62E-02	1.26E-01	2.02E+00	4.60E-03	0.00E+00	2.05E-05	2.07E-05	7.80E-02	7.51E-01
2005	4	20	2.80E+00	4.82E-03	2.31E+00	9.69E-04	1.98E-03	3.45E+00	4.11E-01	3.80E+00	3.46E+00	4.41E-02	9.18E-03	7.56E-02	4.09E-02	4.53E+00	3.81E+00	2.43E+00	4.82E-03	1.84E+00	9.69E-04	1.98E-03	3.01E+00	3.94E-01	3.58E+00	8.35E-02	1.92E-02	9.16E-03	3.63E-02	2.63E-02	4.46E+00	3.20E+00	3.72E-01	1.64E-06	4.67E-01	0.00E+00	0.00E+00	4.44E-01	1.61E-02	2.18E-01	3.38E+00	2.49E-02	1.88E-05	3.92E-02	1.46E-02	6.78E-02	6.14E-01
2005	4	21	3.65E+00	4.04E-02	2.16E+00	7.73E-04	1.24E-03	3.76E+00	5.69E-01	5.51E+00	5.88E+00	4.12E-02	3.72E-02	3.58E-02	2.49E-02	5.91E+00	5.02E+00	3.29E+00	3.13E-03	1.90E+00	7.68E-04	1.23E-03	3.43E+00	5.60E-01	5.33E+00	9.88E-02	1.54E-02	6.12E-03	3.33E-02	2.23E-02	5.85E+00	4.40E+00	3.58E-01	3.73E-02	2.65E-01	4.84E-06	1.21E-05	3.22E-01	8.87E-03	1.75E-01	5.78E+00	2.58E-02	3.11E-02	2.50E-03	2.61E-03	6.02E-02	6.19E-01
2005	4	22	2.57E+00	2.85E-01	1.74E+00	5.70E-02	8.77E-02	5.01E+00	2.09E+00	7.36E+00	2.37E+00	7.16E+00	5.67E-01	1.35E+00	2.11E+00	7.24E+00	3.56E+00	2.22E+00	1.29E-02	1.68E+00	4.55E-03	7.71E-03	4.94E+00	1.99E+00	6.55E+00	1.64E-01	5.20E-02	2.54E-02	9.24E-02	7.05E-02	7.07E+00	2.94E+00	3.44E-01	2.72E-01	6.43E-02	5.25E-02	7.99E-02	6.40E-02	1.00E-01	8.04E-01	2.21E+00	7.11E+00	5.42E-01	1.26E+00	2.04E+00	1.73E-01	6.18E-01
2005	4	23	1.90E+00	1.93E-01	1.00E+00	4.08E-02	6.49E-02	4.38E+00	1.55E+00	5.95E+00	1.50E+00	5.52E+00	6.83E-01	8.79E-01	9.42E-01	5.63E+00	2.49E+00	1.39E+00	1.24E-02	6.71E-01	4.98E-03	7.07E-03	4.03E+00	1.39E+00	4.96E+00	1.07E-01	3.61E-02	1.98E-02	6.31E-02	4.69E-02	5.29E+00	1.70E+00	5.15E-01	1.80E-01	3.30E-01	3.58E-02	5.79E-02	3.51E-01	1.61E-01	9.88E-01	1.39E+00	5.48E+00	6.64E-01	8.16E-01	8.95E-01	3.32E-01	7.89E-01
2005	4	24	3.19E+00	1.54E-03	2.28E+00	1.27E-04	3.23E-04	3.71E+00	4.30E-02	2.77E+00	1.45E+00	6.45E-03	2.91E-03	1.26E-02	9.18E-03	3.21E+00	3.57E+00	2.71E+00	1.53E-03	1.44E+00	1.27E-04	3.23E-04	2.76E+00	4.25E-02	2.65E+00	3.65E-02	6.40E-03	2.89E-03	1.25E-02	9.11E-03	3.11E+00	2.81E+00	4.84E-01	5.93E-06	8.38E-01	6.58E-09	1.70E-07	9.51E-01	5.20E-04	1.26E-01	1.42E+00	5.25E-05	1.53E-05	1.12E-04	7.36E-05	1.07E-01	7.65E-01
2005	4	25	3.34E+00	9.35E-02	1.50E+00	2.31E-03	9.98E-03	3.91E+00	1.40E+00	5.38E+00	3.68E+00	2.02E+00	4.08E-01	3.60E-01	5.31E-01	6.22E+00	4.10E+00	2.33E+00	4.02E-03	1.21E+00	4.58E-04	1.32E-03	3.58E+00	1.28E+00	4.50E+00	1.28E-01	2.67E-02	1.11E-02	5.44E-02	3.76E-02	5.56E+00	2.87E+00	1.01E+00	8.94E-02	2.95E-01	1.85E-03	8.66E-03	3.32E-01	1.17E-01	8.74E-01	3.56E+00	2.00E+00	3.97E-01	3.05E-01	4.93E-01	6.62E-01	1.23E+00
2005	4	26	2.74E+00	8.58E-03	1.08E+00	1.04E-03	3.36E-03	2.76E+00	5.58E-01	3.83E+00	1.50E+00	2.98E-01	2.12E-02	2.95E-01	1.88E-01	3.88E+00	3.34E+00	1.66E+00	1.46E-03	7.37E-01	2.63E-04	7.15E-04	2.57E+00	4.86E-01	3.43E+00	4.59E-02	1.24E-02	4.87E-03	2.67E-02	1.84E-02	3.70E+00	2.12E+00	1.08E+00	7.12E-03	3.43E-01	7.81E-04	2.65E-03	1.86E-01	7.26E-02	3.98E-01	1.45E+00	2.86E-01	1.63E-02	2.69E-01	1.69E-01	1.84E-01	1.22E+00
2005	4	27	1.70E+00	0.00E+00	9.38E-01	0.00E+00	0.00E+00	1.48E+00	5.75E-02	1.47E+00	2.67E+00	2.97E-05	0.00E+00	7.82E-05	2.55E-05	2.72E+00	2.10E+00	1.58E+00	0.00E+00	8.34E-01	0.00E+00	0.00E+00	1.41E+00	5.74E-02	1.47E+00	1.76E-03	8.55E-06	0.00E+00	7.38E-05	2.37E-05	2.71E+00	1.91E+00	1.18E-01	0.00E+00	1.03E-01	0.00E+00	0.00E+00	6.63E-02	4.13E-05	9.52E-03	2.67E+00	2.11E-05	0.00E+00	4.45E-06	1.81E-06	7.14E-03	1.89E-01
2005	4	28	3.25E+00	2.31E-01	2.18E+00	4.82E-03	1.12E-02	3.82E+00	1.14E+00	3.95E+00	5.34E+00	7.44E-01	5.61E-01	2.39E-01	2.82E-01	4.96E+00	4.08E+00	2.90E+00	1.15E-02	1.85E+00	1.41E-03	3.03E-03	3.54E+00	1.11E+00	3.80E+00	1.57E-01	4.07E-02	2.07E-02	7.07E-02	5.25E-02	4.90E+00	3.45E+00	3.47E-01	2.20E-01	3.22E-01	3.41E-03	8.14E-03	2.82E-01	2.17E-02	1.47E-01	5.19E+00	7.04E-01	5.41E-01	1.68E-01	2.29E-01	5.50E-02	6.31E-01
2005	4	29	2.38E+00	5.92E-01	1.11E+00	1.04E-01	1.88E-01	3.56E+00	1.79E+00	4.23E+00	3.35E+00	5.91E+00	4.01E+00	1.10E+00	1.86E+00	3.94E+00	3.40E+00	1.96E+00	1.77E-02	1.00E+00	6.26E-03	9.05E-03	3.40E+00	1.45E+00	3.70E+00	1.37E-01	4.79E-02	2.75E-02	8.34E-02	6.19E-02	3.64E+00	2.64E+00	4.19E-01	5.74E-01	1.04E-01	9.80E-02	1.79E-01	1.69E-01	3.41E-01	5.34E-01	3.21E+00	5.86E+00	3.98E+00	1.01E+00	1.80E+00	3.00E-01	7.59E-01
2005	4	30	5.45E-01	2.94E-06	3.82E-01	0.00E+00	0.00E+00	7.51E-01	3.78E-01	1.45E+00	1.35E+00	2.27E-04	3.34E-05	5.11E-05	1.13E-05	2.18E+00	7.16E-01	5.45E-01	0.00E+00	3.54E-01	0.00E+00	0.00E+00	7.11E-01	3.78E-01	1.45E+00	2.71E-03	0.00E+00	0.00E+00	5.00E-05	1.06E-06	2.18E+00	7.16E-01	1.26E-05	2.94E-06	2.86E-02	0.00E+00	0.00E+00	3.98E-02	0.00E+00	3.40E-06	1.35E+00	2.27E-04	3.34E-05	1.15E-06	1.02E-05	2.93E-06	3.26E-04
2005	5	1	5.05E+00	6.71E-03	2.82E+00	0.00E+00	0.00E+00	6.92E+00	1.23E+00	9.01E+00	2.30E+00	2.49E-03	1.07E-01	1.56E-04	1.20E-04	1.27E+01	6.50E+00	5.00E+00	0.00E+00	2.80E+00	0.00E+00	0.00E+00	6.89E+00	1.23E+00	9.01E+00	7.70E-02	4.75E-05	0.00E+00	1.47E-04	9.25E-05	1.27E+01	6.40E+00	5.55E-02	6.71E-03	1.93E-02	0.00E+00	0.00E+00	3.22E-02	0.00E+00	1.47E-03	2.22E+00	2.44E-03	1.07E-01	8.82E-06	2.80E-05	5.75E-04	1.07E-01
2005	5	2	1.16E+01	5.41E-01	7.84E+00	5.56E-03	8.75E-03	1.79E+01	3.48E+00	1.94E+01	3.38E+00	4.05E-01	1.29E+00	2.28E-01	2.03E-01	2.32E+01	1.43E+01	1.12E+01	3.21E-02	7.64E+00	4.46E-03	7.77E-03	1.78E+01	3.47E+00	1.92E+01	6.75E-01	1.03E-01	4.77E-02	1.93E-01	1.37E-01	2.31E+01	1.37E+01	3.31E-01	5.09E-01	2.03E-01	1.10E-03	9.82E-04	1.59E-01	4.33E-03	2.59E-01	2.71E+00	3.02E-01	1.24E+00	3.44E-02	6.66E-02	5.86E-02	5.53E-01
2005	5	3	1.59E+00	1.61E-01	9.91E-01	9.03E-02	1.71E-01	1.85E+01	6.92E+00	2.30E+01	5.72E-01	6.01E+00	2.43E+00	6.73E-01	1.72E+00	1.81E+01	1.99E+00	1.58E+00	3.03E-02	9.90E-01	1.60E-02	2.64E-02	1.85E+01	6.88E+00	2.18E+01	5.52E-01	1.57E-01	6.97E-02	2.67E-01	2.34E-01	1.80E+01	1.97E+00	1.09E-02	1.30E-01	1.22E-03	7.43E-02	1.45E-01	2.44E-03	4.53E-02	1.18E+00	2.07E-02	5.85E+00	2.36E+00	4.06E-01	1.48E+00	1.49E-01	2.06E-02
2005	5	4	5.33E+00	1.49E+00	1.93E+00	3.69E-01	2.57E-01	2.84E+01	1.11E+01	3.00E+01	9.37E-01	1.42E+01	9.91E+00	2.08E+00	2.15E+00	2.75E+01	8.94E+00	5.18E+00	5.75E-02	1.90E+00	2.79E-02	3.76E-02	2.83E+01	1.08E+01	2.87E+01	7.01E-01	2.05E-01	1.12E-01	3.88E-01	2.81E-01	2.72E+01	8.71E+00	1.57E-01	1.43E+00	3.48E-02	3.41E-01	2.19E-01	5.66E-02	3.13E-01	1.24E+00	2.36E-01	1.40E+01	9.80E+00	1.69E+00	1.87E+00	3.22E-01	2.30E-01
2005	5	5	6.45E+00	4.73E-01	2.80E+00	2.44E-01	3.62E-01	2.87E+01	1.17E+01	2.73E+01	2.85E+00	2.15E+01	3.46E+00	1.87E+00	2.05E+00	3.12E+01	7.83E+00	6.28E+00	3.65E-02	2.66E+00	2.36E-02	3.81E-02	2.86E+01	1.16E+01	2.62E+01	5.94E-01	1.84E-01	9.10E-02	3.51E-01	2.50E-01	3.10E+01	7.54E+00	1.79E-01	4.36E-01	1.46E-01	2.20E-01	3.24E-01	1.37E-01	8.48E-02	1.12E+00	2.26E+00	2.13E+01	3.37E+00	1.52E+00	1.80E+00	2.40E-01	2.96E-01
2005	5	6	3.54E+00	1.81E-01	1.25E+00	1.03E-01	2.21E-01	2.17E+01	1.25E+01	2.71E+01	9.12E-01	2.60E+01	1.96E+00	2.71E+00	3.28E+00	3.08E+01	6.09E+00	3.41E+00	1.12E-02	1.15E+00	5.47E-03	1.09E-02	2.16E+01	1.23E+01	2.58E+01	3.71E-01	9.42E-02	3.62E-02	2.45E-01	1.53E-01	3.05E+01	5.89E+00	1.32E-01	1.69E-01	1.02E-01	9.74E-02	2.10E-01	1.06E-01	2.04E-01	1.31E+00	5.42E-01	2.59E+01	1.92E+00	2.47E+00	3.13E+00	2.45E-01	2.00E-01
2005	5	7	1.37E+01	4.09E-01	6.83E+00	3.85E-02	8.11E-02	2.16E+01	7.50E+00	2.48E+01	7.79E+00	2.73E+00	1.11E+00	1.15E+00	1.37E+00	2.29E+01	1.68E+01	1.27E+01	4.05E-02	6.32E+00	1.18E-02	2.09E-02	2.10E+01	7.22E+00	2.39E+01	5.96E-01	1.57E-01	7.92E-02	2.92E-01	2.13E-01	2.23E+01	1.53E+01	9.87E-01	3.68E-01	5.12E-01	2.66E-02	6.02E-02	5.62E-01	2.75E-01	8.47E-01	7.20E+00	2.58E+00	1.03E+00	8.57E-01	1.16E+00	5.21E-01	1.49E+00
2005	5	8	1.16E+01	1.82E-03	5.99E+00	7.62E-06	3.73E-05	1.32E+01	4.78E-02	1.41E+01	5.56E+00	1.30E-02	4.68E-03	1.59E-02	1.48E-02	1.84E+01	1.38E+01	1.13E+01	1.82E-03	5.92E+00	7.62E-06	3.73E-05	1.31E+01	4.78E-02	1.41E+01	8.85E-02	1.30E-02	4.68E-03	1.59E-02	1.48E-02	1.84E+01	1.32E+01	2.62E-01	0.00E+00	6.29E-02	0.00E+00	0.00E+00	8.72E-02	7.72E-08	1.93E-04	5.47E+00	2.80E-06	0.00E+00	1.83E-05	2.94E-05	4.10E-05	5.14E-01
2005	5	9	1.41E+01	2.80E-03	8.09E+00	2.30E-04	5.18E-04	1.79E+01	8.93E-02	1.38E+01	3.92E+00	1.12E-02	4.22E-03	1.86E-02	1.36E-02	1.79E+01	1.50E+01	1.33E+01	2.78E-03	7.59E+00	2.30E-04	5.18E-04	1.75E+01	8.88E-02	1.38E+01	1.55E-01	1.05E-02	4.05E-03	1.71E-02	1.26E-02	1.79E+01	1.37E+01	7.56E-01	1.41E-05	5.06E-01	0.00E+00	5.67E-10	3.26E-01	4.92E-04	4.52E-02	3.77E+00	7.81E-04	1.74E-04	1.47E-03	9.52E-04	2.85E-02	1.27E+00
2005	5	10	1.05E+01	3.17E-05	5.84E+00	0.00E+00	1.79E-07	1.57E+01	2.05E-02	1.26E+01	2.73E+00	2.64E-03	3.49E-04	8.06E-03	5.04E-03	1.40E+01	1.13E+01	1.00E+01	3.17E-05	5.55E+00	0.00E+00	1.79E-07	1.53E+01	2.05E-02	1.26E+01	3.81E-02	2.64E-03	3.49E-04	8.06E-03	5.04E-03	1.40E+01	1.02E+01	5.49E-01	0.00E+00	2.94E-01	0.00E+00	0.00E+00	3.63E-01	0.00E+00	4.06E-02	2.69E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.76E-02	1.04E+00
2005	5	11	1.21E+01	6.21E-01	7.39E+00	7.92E-02	1.32E-01	2.22E+01	8.13E+00	2.55E+01	4.91E+00	1.37E+01	1.39E+00	3.70E+00	5.85E+00	2.83E+01	1.52E+01	1.15E+01	1.99E-02	7.12E+00	4.00E-03	8.43E-03	2.20E+01	7.69E+00	2.46E+01	4.57E-01	1.09E-01	4.44E-02	2.36E-01	1.61E-01	2.79E+01	1.40E+01	6.45E-01	6.01E-01	2.69E-01	7.53E-02	1.23E-01	2.37E-01	4.33E-01	9.17E-01	4.45E+00	1.36E+01	1.34E+00	3.47E+00	5.69E+00	3.68E-01	1.18E+00
2005	5	12	6.05E+00	9.32E-01	2.89E+00	1.04E-01	1.64E-01	2.59E+01	1.11E+01	2.62E+01	2.66E+00	1.18E+01	3.88E+00	1.79E+00	1.44E+00	3.68E+01	8.58E+00	5.86E+00	3.42E-02	2.80E+00	9.70E-03	1.85E-02	2.57E+01	1.10E+01	2.50E+01	5.43E-01	1.62E-01	7.25E-02	3.46E-01	2.39E-01	3.65E+01	8.28E+00	1.95E-01	8.98E-01	9.16E-02	9.47E-02	1.46E-01	1.07E-01	1.13E-01	1.18E+00	2.12E+00	1.16E+01	3.81E+00	1.44E+00	1.20E+00	2.66E-01	3.07E-01
2005	5	13	1.25E+01	1.01E-01	6.01E+00	5.15E-02	8.30E-02	2.54E+01	7.36E+00	2.94E+01	7.67E+00	5.66E+00	4.13E-01	1.11E+00	1.29E+00	3.39E+01	1.62E+01	1.02E+01	1.61E-02	5.04E+00	5.85E-03	1.08E-02	2.37E+01	6.78E+00	2.73E+01	4.04E-01	8.54E-02	3.85E-02	1.71E-01	1.18E-01	3.24E+01	1.35E+01	2.34E+00	8.54E-02	9.68E-01	4.57E-02	7.22E-02	1.70E+00	5.83E-01	2.07E+00	7.26E+00	5.58E+00	3.75E-01	9.37E-01	1.17E+00	1.48E+00	2.75E+00
2005	5	14	6.68E+00	4.71E-01	3.98E+00	9.26E-02	1.75E-01	2.03E+01	5.45E+00	1.93E+01	2.51E+00	6.30E+00	1.78E+00	7.23E-01	1.54E+00	1.78E+01	8.74E+00	6.52E+00	3.27E-02	3.94E+00	1.03E-02	1.62E-02	2.03E+01	5.43E+00	1.85E+01	4.17E-01	1.08E-01	5.49E-02	2.16E-01	1.45E-01	1.77E+01	8.43E+00	1.61E-01	4.38E-01	4.09E-02	8.23E-02	1.58E-01	2.77E-02	2.59E-02	7.82E-01	2.09E+00	6.19E+00	1.73E+00	5.07E-01	1.39E+00	7.19E-02	3.12E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	5	15	5.27E+00	9.65E-01	2.01E+00	1.08E-01	1.63E-01	1.80E+01	4.49E+00	1.78E+01	3.86E-01	6.64E+00	3.23E+00	7.07E-01	9.02E-01	1.56E+01	7.81E+00
2005	5	16	1.73E+00	4.37E-03	6.82E-01	8.09E-04	8.21E-03	1.45E+01	3.52E+00	1.49E+01	2.28E-01	8.00E+00	4.30E-01	7.90E-01	1.20E+00	1.27E+01	2.91E+00
2005	5	17	1.97E-01	0.00E+00	5.75E-02	0.00E+00	2.42E-11	4.17E+00	1.58E+00	5.41E+00	6.75E-07	2.58E+00	1.62E-01	3.95E-01	5.12E-01	3.35E+00	3.65E-01
2005	5	18	7.25E-01	5.40E-06	6.43E-01	9.29E-03	9.76E-02	7.15E+00	2.86E+00	8.00E+00	3.49E-02	5.06E+00	4.54E-01	5.07E-01	7.75E-01	6.52E+00	1.31E+00
2005	5	19	1.17E+00	0.00E+00	3.78E-01	0.00E+00	2.68E-04	6.77E+00	1.62E+00	7.68E+00	2.86E-02	2.16E+00	3.24E-01	1.56E-01	5.99E-01	5.11E+00	2.26E+00
2005	5	20	5.02E-01	8.73E-02	7.05E-02	5.72E-02	8.87E-02	4.66E+00	2.16E+00	6.53E+00	3.26E-03	4.65E+00	1.01E+00	6.22E-01	5.53E-01	4.59E+00	7.92E-01
2005	5	21	1.63E+00	2.04E-03	7.31E-01	2.14E-04	1.48E-03	9.85E+00	4.08E+00	1.07E+01	1.92E-01	3.98E+00	2.26E-01	5.47E-01	1.16E+00	9.75E+00	2.98E+00
2005	5	22	4.14E-01	4.14E-04	5.92E-02	3.04E-04	1.40E-03	3.63E+00	1.43E+00	3.75E+00	2.01E-02	2.72E+00	2.62E-01	4.20E-01	5.28E-01	3.07E+00	8.69E-01
2005	5	23	1.13E-01	7.09E-05	4.16E-01	1.33E-06	2.89E-05	1.05E+01	2.63E+00	1.17E+01	1.52E-01	5.46E+00	6.89E-02	6.39E-01	7.72E-01	6.81E+00	8.26E-01
2005	5	24	2.69E+00	7.92E-03	1.17E+00	1.50E-04	5.60E-03	1.98E+01	5.62E+00	2.09E+01	7.24E-01	1.70E+01	4.17E-01	2.04E+00	3.02E+00	1.93E+01	4.26E+00
2005	5	25	4.66E+00	2.20E-01	1.64E+00	1.52E-02	2.95E-02	2.51E+01	1.07E+01	3.18E+01	2.82E+00	1.87E+01	9.34E-01	3.60E+00	6.26E+00	2.42E+01	6.68E+00
2005	5	26	1.11E+01	6.27E-02	4.74E+00	7.08E-03	1.36E-02	1.89E+01	2.67E+00	2.27E+01	5.02E+00	6.70E-01	1.83E-01	7.84E-01	6.51E-01	2.22E+01	1.39E+01
2005	5	27	8.56E+00	3.86E-01	4.28E+00	8.01E-02	2.24E-01	2.28E+01	1.03E+01	2.91E+01	3.80E+00	1.52E+01	2.19E+00	1.55E+00	2.51E+00	3.71E+01	1.26E+01
2005	5	28	1.11E+01	9.61E-04	6.52E+00	2.49E-06	1.28E-05	1.44E+01	2.07E-01	1.09E+01	2.32E+00	1.11E-02	2.71E-03	1.97E-02	1.48E-02	1.67E+01	1.25E+01
2005	5	29	1.26E+01	6.03E-03	6.56E+00	1.24E-05	5.98E-05	1.68E+01	5.58E-01	1.83E+01	2.18E+00	1.02E-01	7.43E-02	1.98E-02	1.43E-02	2.38E+01	1.61E+01
2005	5	30	8.48E+00	1.45E+00	4.60E+00	3.99E-01	5.42E-01	2.70E+01	9.78E+00	3.30E+01	2.71E+00	9.43E+00	4.78E+00	9.97E-01	1.59E+00	3.95E+01	1.20E+01
2005	5	31	4.15E+00	2.88E-01	1.71E+00	7.16E-01	1.36E+00	2.03E+01	9.18E+00	1.41E+01	6.00E-01	9.65E+00	1.09E+01	6.90E-01	1.19E+00	1.48E+01	5.10E+00
2005	6	1	2.50E+00	9.27E-06	1.47E+00	2.84E-08	2.94E-07	1.57E+01	2.54E+00	1.58E+01	1.33E+00	5.70E+00	1.25E-02	9.77E-01	1.28E+00	1.67E+01	6.22E+00
2005	6	2	4.21E+00	1.11E-03	1.45E+00	1.50E-04	3.98E-04	1.63E+01	2.15E+00	2.46E+01	9.76E-02	1.67E+00	3.16E-03	2.66E+00	1.80E+00	1.42E+01	7.64E+00
2005	6	3	2.58E+00	3.80E-03	1.30E+00	9.79E-04	1.82E-02	2.06E+01	5.18E+00	3.09E+01	3.72E-01	8.14E+00	1.22E+00	1.29E+00	1.02E+00	2.39E+01	6.57E+00
2005	6	4	4.10E+00	3.58E-01	1.40E+00	5.68E-03	1.03E-02	1.35E+01	3.50E+00	1.38E+01	1.40E+00	9.59E+00	4.70E-01	9.34E-01	1.61E+00	1.54E+01	5.34E+00
2005	6	5	3.61E+00	7.55E-01	1.95E+00	2.45E-01	3.36E-01	2.02E+01	8.40E+00	2.08E+01	2.16E+00	1.66E+01	1.98E+00	2.18E+00	3.40E+00	2.43E+01	4.48E+00
2005	6	6	6.63E-01	0.00E+00	2.36E-01	0.00E+00	0.00E+00	1.07E+01	3.47E+00	1.48E+01	1.10E-02	1.29E+01	6.98E-03	1.92E+00	2.16E+00	1.30E+01	1.05E+00
2005	6	7	1.32E+00	0.00E+00	2.34E-01	0.00E+00	0.00E+00	1.13E+01	2.46E+00	1.20E+01	8.01E-03	3.96E+00	7.21E-02	6.16E-01	7.34E-01	8.23E+00	2.67E+00
2005	6	8	8.65E-01	2.14E-03	1.55E+00	1.25E-04	5.26E-04	2.02E+01	4.52E+00	2.16E+01	3.07E-01	8.50E+00	1.01E-01	8.36E-01	1.26E+00	2.08E+01	2.87E+00
2005	6	9	3.88E+00	2.42E-02	1.59E+00	1.96E-02	9.58E-02	1.55E+01	4.72E+00	1.99E+01	5.11E-01	7.05E+00	2.43E+00	4.77E-01	1.52E+00	1.23E+01	8.01E+00
2005	6	10	1.38E+00	3.40E-04	6.28E-01	3.56E-05	1.64E-04	1.47E+01	4.64E+00	1.40E+01	1.15E-01	9.80E+00	7.92E-02	1.42E+00	7.73E-01	1.45E+01	1.83E+00
2005	6	11	1.93E+00	3.59E-03	1.77E+00	5.20E-04	2.46E-03	2.23E+01	5.44E+00	1.62E+01	4.52E-01	1.09E+01	2.17E-01	9.46E-01	1.10E+00	2.15E+01	3.10E+00
2005	6	12	1.24E+00	2.22E-03	8.46E-01	2.19E-04	9.10E-04	1.83E+01	3.77E+00	1.64E+01	2.45E-01	4.43E+00	1.43E-01	4.68E-01	1.08E+00	1.25E+01	2.29E+00
2005	6	13	4.63E-01	9.54E-04	7.71E-01	1.21E-04	7.83E-04	1.12E+01	2.11E+00	1.11E+01	2.78E-01	2.96E+00	2.23E-01	3.74E-01	7.52E-01	7.74E+00	1.64E+00
2005	6	14	2.73E+00	7.50E-01	1.47E+00	1.30E-01	1.92E-01	1.90E+01	5.89E+00	1.63E+01	3.78E-01	1.03E+01	2.98E+00	1.06E+00	8.87E-01	2.51E+01	3.84E+00
2005	6	15	1.69E+00	4.58E-04	4.23E-01	1.48E-04	1.04E-03	9.11E+00	4.87E+00	1.04E+01	2.56E-01	7.71E+00	1.87E-01	6.90E-01	1.29E+00	8.35E+00	2.87E+00
2005	6	16	6.37E+00	1.30E-01	4.64E+00	2.95E-02	1.16E-01	1.71E+01	6.43E+00	1.83E+01	3.77E+00	7.49E+00	1.25E+00	1.01E+00	1.65E+00	2.14E+01	7.92E+00
2005	6	17	6.48E+00	2.75E-03	3.52E+00	1.00E-03	2.98E-03	1.15E+01	6.61E-01	1.22E+01	4.62E+00	1.32E+00	2.40E-01	4.65E-02	1.79E-01	1.19E+01	9.08E+00
2005	6	18	7.66E-01	1.19E-06	9.15E-02	4.19E-07	3.14E-04	7.47E+00	9.97E-01	6.34E+00	2.78E-01	1.84E+00	3.23E-01	8.25E-02	5.37E-01	3.58E+00	2.22E+00
2005	6	19	5.06E-01	2.00E-03	5.57E-01	1.36E-04	8.83E-04	1.10E+01	3.82E+00	1.08E+01	1.82E-01	2.97E+00	2.02E-01	4.18E-01	9.99E-01	1.02E+01	1.74E+00
2005	6	20	6.25E+00	1.57E+00	3.22E+00	4.02E-02	1.16E-01	2.41E+01	8.73E+00	2.65E+01	5.45E-01	1.46E+01	1.81E+00	1.35E+00	1.65E+00	2.97E+01	8.69E+00
2005	6	21	3.23E+00	6.61E-01	1.84E+00	1.05E-01	2.07E-01	2.29E+01	7.60E+00	2.77E+01	1.48E+00	8.73E+00	2.50E+00	2.70E+00	3.88E+00	2.76E+01	4.68E+00
2005	6	22	3.18E-01	5.94E-04	1.76E-01	8.71E-03	1.57E-02	3.98E+00	1.03E+00	3.23E+00	1.63E-03	1.98E+00	4.14E-01	5.14E-02	6.05E-01	2.70E+00	1.47E+00
2005	6	23	1.70E+00	0.00E+00	7.40E-01	0.00E+00	0.00E+00	7.96E+00	5.46E+00	1.28E+01	4.02E-02	1.13E+01	1.58E-02	1.16E+00	9.12E-01	1.12E+01	2.21E+00
2005	6	24	4.36E+00	2.61E-01	1.84E+00	3.23E-01	6.29E-01	2.68E+01	1.22E+01	2.29E+01	9.94E-01	1.47E+01	7.56E+00	1.48E+00	3.05E+00	2.00E+01	7.36E+00
2005	6	25	4.24E+00	1.95E-01	1.76E+00	2.65E-01	5.37E-01	2.32E+01	9.45E+00	1.92E+01	7.06E-01	8.42E+00	7.69E+00	8.17E-01	1.02E+00	1.65E+01	5.82E+00
2005	6	26	9.68E+00	1.20E-02	5.53E+00	2.08E-04	7.88E-04	1.68E+01	3.20E+00	2.19E+01	4.81E+00	9.85E-01	4.08E-02	4.62E-01	3.68E-01	2.63E+01	1.24E+01
2005	6	27	1.20E+01	3.02E-01	6.02E+00	6.50E-02	4.49E-02	1.84E+01	2.74E+00	2.28E+01	6.28E+00	9.14E-01	2.19E+00	1.45E-01	1.20E-01	2.60E+01	1.65E+01
2005	6	28	5.65E+00	9.19E-02	1.52E+00	2.36E-02	2.21E-02	1.56E+01	3.61E+00	2.17E+01	1.09E+00	1.10E+01	1.89E-01	1.31E+00	1.75E+00	1.91E+01	7.10E+00
2005	6	29	4.09E+00	6.04E-03	2.38E+00	1.13E-03	6.82E-03	1.92E+01	8.63E+00	2.39E+01	6.63E-01	1.73E+01	1.73E-01	3.07E+00	5.18E+00	2.17E+01	5.85E+00
2005	6	30	2.69E+00	9.06E-05	6.53E-01	3.43E-05	4.02E-03	1.41E+01	3.56E+00	1.42E+01	4.13E-01	3.88E+00	3.69E-01	4.44E-01	9.61E-01	1.19E+01	4.18E+00
2005	7	1	2.57E+00	9.16E-04	1.23E+00	2.92E-04	2.04E-03	1.40E+01	6.60E+00	1.57E+01	1.53E-01	8.41E+00	2.63E-01	8.49E-01	1.35E+00	1.43E+01	4.10E+00
2005	7	2	1.16E+00	4.06E-04	8.58E-01	8.96E-05	9.16E-04	2.11E+01	4.63E+00	2.12E+01	2.64E-01	6.07E+00	1.55E-01	7.21E-01	1.22E+00	1.89E+01	2.63E+00
2005	7	3	1.99E+00	1.05E-03	2.40E+00	8.47E-05	5.47E-04	2.25E+01	6.03E+00	2.24E+01	1.61E-01	8.74E+00	5.51E-02	9.73E-01	1.19E+00	2.72E+01	2.68E+00
2005	7	4	1.18E+00	9.25E-04	1.22E+00	1.11E-04	6.78E-04	1.77E+01	5.86E+00	1.71E+01	4.25E-01	6.24E+00	1.53E-01	9.07E-01	1.35E+00	1.40E+01	2.24E+00
2005	7	5	5.10E+00	1.57E-03	2.01E+00	9.52E-03	4.30E-01	1.54E+01	6.93E+00	1.77E+01	3.93E-01	7.93E+00	2.84E+00	9.03E-01	1.08E+00	1.58E+01	6.13E+00
2005	7	6	2.06E+00	2.45E-04	6.03E-01	4.48E-04	1.68E-02	7.37E+00	1.76E+00	6.82E+00	8.45E-02	2.58E+00	3.68E-01	1.18E-01	6.06E-01	6.12E+00	3.64E+00
2005	7	7	1.28E+00	2.25E-03	6.22E-01	2.57E-04	1.57E-03	1.12E+01	4.70E+00	1.24E+01	1.79E-01	6.95E+00	2.28E-01	7.37E-01	1.19E+00	1.02E+01	2.29E+00
2005	7	8	6.07E-01	2.03E-03	5.53E-01	6.57E-04	3.28E-02	1.51E+01	3.82E+00	1.27E+01	3.70E-01	3.56E+00	5.47E-01	3.49E-01	1.13E+00	1.22E+01	1.37E+00
2005	7	9	6.49E-01	0.00E+00	9.04E-02	0.00E+00	4.67E-06	4.83E+00	2.18E+00	7.23E+00	9.48E-04	4.03E+00	1.83E-01	5.16E-01	6.47E-01	6.08E+00	9.08E-01
2005	7	10	3.38E-01	0.00E+00	1.02E-01	0.00E+00	9.21E-05	6.38E+00	2.68E+00	7.92E+00	1.40E-03	5.25E+00	1.46E-01	7.75E-01	6.60E-01	6.99E+00	6.41E-01
2005	7	11	1.28E+00	1.35E-03	1.01E+00	8.78E-06	9.11E-05	1.05E+01	4.18E+00	1.53E+01	1.11E-01	7.23E+00	1.08E-01	6.73E-01	1.01E+00	1.20E+01	2.59E+00
2005	7	12	1.83E+00	1.84E-03	8.09E-01	1.18E-03	7.22E-02	2.01E+01	7.47E+00	1.95E+01	5.07E-01	9.47E+00	5.40E-01	1.39E+00	1.40E+00	2.04E+01	2.99E+00
2005	7	13	6.90E-01	9.31E-05	9.55E-01	7.83E-04	1.27E-02	8.77E+00	3.20E+00	1.02E+01	3.58E-02	7.22E+00	1.20E-01	8.65E-01	6.30E-01	1.08E+01	1.14E+00
2005	7	14	1.45E+00	2.71E-03	9.77E-01	2.88E-04	1.36E-03	1.86E+01	9.30E+00	2.93E+01	3.94E-01	1.85E+01	8.61E-02	2.02E+00	2.87E+00	2.13E+01	2.77E+00
2005	7	15	7.47E-01	1.81E-03	6.83E-01	2.41E-04	1.88E-03	1.50E+01	6.36E+00	1.74E+01	3.97E-01	1.01E+01	2.14E-01	1.44E+00	1.14E+00	1.81E+01	1.27E+00
2005	7	16	4.37E+00	2.79E-01	1.15E+00	3.90E-02	8.78E-02	1.72E+01	9.31E+00	2.58E+01	1.75E+00	1.30E+01	2.75E+00	1.15E+00	1.32E+00	2.05E+01	7.72E+00
2005	7	17	3.31E+00	1.98E-01	1.34E+00	2.06E-01	5.07E-01	1.90E+01	1.00E+01	2.81E+01	1.94E+00	1.65E+01	2.43E+00	4.04E+00	5.53E+00	2.37E+01	6.38E+00
2005	7	18	7.97E-01	2.41E-03	4.79E-01	2.76E-04	1.02E-02	1.27E+01	3.41E+00	1.22E+01	2.25E-01	4.66E+00	6.83E-01	7.52E-01	8.10E-01	1.14E+01	1.41E+00
2005	7	19	1.46E+00	4.62E-01	7.42E-01	1.10E-01	2.29E-01	8.07E+00	3.12E+00	1.22E+01	3.46E-01	7.18E+00	1.69E+00	5.95E-01	1.21E+00	1.34E+01	2.00E+00
2005	7	20	2.34E+00	1.39E-01	1.12E+00	2.51E-02	4.16E-02	5.64E+00	2.21E+00	7.93E+00	3.87E-01	3.58E+00	1.64E-01	2.56E-01	3.22E-01	9.61E+00	2.98E+00
2005	7	21	6.93E+00	1.36E-02	3.49E+00	8.06E-05	3.17E-04	1.81E+01	6.13E+00	2.66E+01	3.28E+00	6.12E+00	1.01E-01	1.42E+00	1.59E+00	2.68E+01	9.27E+00
2005	7	22	3.90E+00	5.46E-01	2.20E+00	7.04E-02	1.61E-01	1.96E+01	6.76E+00	2.13E+01	1.85E+00	8.79E+00	1.89E+00	1.21E+00	2.04E+00	1.72E+01	6.52E+00
2005	7	23	2.17E-01	0.00E+00	1.68E-01	0.00E+00	0.00E+00	5.99E+00	2.69E+00	6.37E+00	6.49E-02	3.69E+00	9.00E-02	7.23E-01	4.65E-01	7.77E+00	6.76E-01
2005	7	24	4.94E+00	1.97E-01	3.31E+00	6.35E-02	6.45E-02	1.78E+01	5.53E+00	2.58E+01	2.42E+00	6.41E+00	1.78E-01	1.27E+00	7.58E-01	2.38E+01	7.06E+00
2005	7	25	1.06E+01	8.71E-01	4.20E+00	6.60E-02	9.73E-02	1.77E+01	3.31E+00	1.93E+01	3.12E+00	1.47E+00	3.02E+00	1.52E-01	3.23E-01	2.06E+01	1.46E+01
2005	7	26	2.47E+00	2.68E-03	1.57E+00	1.11E-03	5.73E-03	2.93E+01	9.15E+00	2.88E+01	3.87E-01	1.51E+01	1.29E-01	2.68E+00	2.75E+00	3.72E+01	4.09E+00
2005	7	27	2.42E+00	8.81E-02	1.34E+00	1.25E-03	2.51E-03	1.92E+01	6.04E+00	2.77E+01	6.28E-01	1.15E+01	2.58E-01	1.38E+00	9.42E-01	3.24E+01	3.61E+00
2005	7	28	2.06E+00	1.18E-01	1.30E+00	9.21E-02	2.03E-01	2.56E+01	8.89E+00	2.18E+01	3.32E-01	1.71E+01	1.22E+00	1.59E+00	1.87E+00	3.22E+01	3.00E+00
2005	7	29	3.66E+00	1.66E-02	1.10E+00	3.95E-03	7.29E-02	1.19E+01	7.38E+00	1.57E+01	3.18E-01	1.10E+01	1.08E+00	7.90E-01	1.28E+00	1.62E+01	5.46E+00
2005	7	30	1.84E+00	3.51E-03	1.43E+00	1.48E-03	5.80E-02	1.77E+01	9.46E+00	3.01E+01	5.35E-01	1.68E+01	9.27E-01	1.90E+00	1.63E+00	2.06E+01	3.58E+00
2005	7	31	3.99E+00	2.34E-02	1.04E+00	3.82E-01	4.29E-01	1.68E+01	8.58E+00	2.05E+01	7.07E-01	5.93E+00	7.93E+00	9.66E-01	1.27E+00	1.64E+01	5.49E+00
2005	8	1	1.88E+00	3.43E-03	9.67E-01	2.79E-03	9.54E-02	1.73E+01	8.61E+00	2.67E+01	4.42E-01	5.92E+00	1.15E+00	8.83E-01	1.77E+00	1.86E+01	3.15E+00
2005	8	2	6.33E+00	3.21E-03	3.21E+00	3.08E-04	1.85E-03	1.79E+01	1.07E+01	2.12E+01	3.53E+00	1.76E+01	8.54E-02	3.77E+00	4.80E+00	2.25E+01	8.20E+00
2005	8	3	1.15E+01	1.98E-01	5.80E+00	4.29E-02	5.65E-02	1.73E+01	1.51E+00	2.34E+01	4.54E+00	3.42E+00	5.24E-01	2.99E-01	8.31E-01	2.25E+01	1.48E+01
2005	8	4	1.16E+01	2.73E+00	5.11E+00	1.17E-01	1.30E-01	2.47E+01	8.13E+00	2.90E+01	2.17E+00	8.10E+00	6.77E+00	9.62E-01	9.68E-01	2.26E+01	1.70E+01

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	5	15	5.18E+00	2.09E-02	2.00E+00	6.81E-03	1.16E-02	1.79E+01	4.47E+00	1.74E+01	3.68E-01	8.91E-02	4.40E-02	1.43E-01	1.11E-01	1.56E+01	7.56E+00
2005	5	16	1.69E+00	4.36E-03	6.79E-01	7.97E-04	3.00E-03	1.45E+01	3.48E+00	1.37E+01	2.12E-01	5.12E-02	1.91E-02	9.25E-02	6.92E-02	1.27E+01	2.79E+00
2005	5	17	1.97E-01	0.00E+00	5.75E-02	0.00E+00	0.00E+00	4.17E+00	1.58E+00	4.74E+00	6.75E-07	0.00E+00	0.00E+00	1.66E-03	0.00E+00	3.35E+00	3.65E-01
2005	5	18	6.93E-01	5.40E-06	6.43E-01	2.51E-07	3.73E-06	7.15E+00	2.84E+00	7.36E+00	2.17E-02	1.72E-03	1.92E-04	1.13E-02	4.19E-03	6.50E+00	1.25E+00
2005	5	19	1.12E+00	0.00E+00	3.78E-01	0.00E+00	8.28E-07	6.77E+00	1.62E+00	7.10E+00	2.13E-02	1.40E-03	2.47E-05	5.65E-02	2.09E-02	5.11E+00	2.11E+00
2005	5	20	4.99E-01	1.30E-04	7.03E-02	1.91E-03	3.29E-03	4.66E+00	2.14E+00	5.85E+00	1.68E-03	1.73E-03	5.79E-04	1.16E-02	4.76E-03	4.56E+00	7.88E-01
2005	5	21	1.61E+00	2.04E-03	7.31E-01	2.14E-04	1.47E-03	9.85E+00	4.05E+00	1.01E+01	1.92E-01	4.53E-02	1.58E-02	7.94E-02	6.00E-02	9.71E+00	2.91E+00
2005	5	22	4.14E-01	4.14E-04	5.92E-02	3.04E-04	1.23E-03	3.63E+00	1.42E+00	3.35E+00	2.01E-02	9.90E-03	2.93E-03	3.27E-02	2.60E-02	3.07E+00	8.69E-01
2005	5	23	1.12E-01	7.09E-05	4.16E-01	1.33E-06	2.89E-05	1.05E+01	2.60E+00	1.09E+01	1.52E-01	2.21E-02	3.05E-03	5.87E-02	4.13E-02	6.78E+00	8.23E-01
2005	5	24	2.65E+00	1.21E-03	1.17E+00	9.30E-05	3.67E-04	1.98E+01	5.50E+00	1.97E+01	1.51E-01	1.78E-02	4.65E-03	9.54E-02	4.37E-02	1.91E+01	4.15E+00
2005	5	25	4.45E+00	1.66E-02	1.47E+00	4.28E-03	7.94E-03	2.49E+01	1.04E+01	3.04E+01	7.15E-01	1.41E-01	4.68E-02	3.61E-01	2.34E-01	2.39E+01	6.42E+00
2005	5	26	1.04E+01	1.03E-02	4.51E+00	1.58E-03	3.46E-03	1.86E+01	2.18E+00	2.17E+01	4.34E-01	7.62E-02	2.66E-02	1.86E-01	1.20E-01	2.15E+01	1.30E+01
2005	5	27	8.36E+00	5.37E-02	4.19E+00	1.68E-02	2.75E-02	2.27E+01	1.03E+01	2.84E+01	6.69E-01	1.85E-01	9.34E-02	3.55E-01	2.50E-01	3.70E+01	1.22E+01
2005	5	28	1.06E+01	9.56E-04	6.26E+00	2.49E-06	1.28E-05	1.43E+01	2.07E-01	1.08E+01	1.26E-01	1.10E-02	2.70E-03	1.97E-02	1.48E-02	1.67E+01	1.16E+01
2005	5	29	1.21E+01	9.78E-04	6.23E+00	1.24E-05	5.98E-05	1.65E+01	5.57E-01	1.81E+01	1.59E-01	9.89E-03	2.87E-03	1.98E-02	1.42E-02	2.38E+01	1.53E+01
2005	5	30	8.30E+00	4.32E-02	4.58E+00	1.38E-02	2.16E-02	2.70E+01	9.75E+00	3.22E+01	5.51E-01	1.52E-01	7.33E-02	3.19E-01	2.19E-01	3.93E+01	1.16E+01
2005	5	31	4.08E+00	4.40E-02	1.71E+00	2.90E-02	4.91E-02	2.03E+01	9.15E+00	1.33E+01	3.83E-01	1.78E-01	9.87E-02	3.67E-01	2.51E-01	1.47E+01	4.90E+00
2005	6	1	2.24E+00	5.58E-06	1.44E+00	0.00E+00	0.00E+00	1.57E+01	2.44E+00	1.48E+01	2.64E-02	1.29E-03	1.50E-04	2.03E-02	4.18E-03	1.65E+01	5.91E+00
2005	6	2	3.88E+00	1.04E-03	1.45E+00	1.49E-04	3.90E-04	1.63E+01	1.27E+00	2.35E+01	5.57E-02	8.27E-03	2.73E-03	2.45E-02	1.37E-02	1.36E+01	7.14E+00
2005	6	3	2.44E+00	9.15E-04	1.29E+00	6.92E-05	3.57E-04	2.06E+01	4.50E+00	2.98E+01	1.57E-01	2.01E-02	5.30E-03	6.26E-02	3.67E-02	2.36E+01	6.33E+00
2005	6	4	3.98E+00	5.39E-03	1.38E+00	3.32E-04	1.09E-03	1.35E+01	3.46E+00	1.31E+01	3.12E-01	5.12E-02	1.43E-02	1.25E-01	8.50E-02	1.53E+01	5.12E+00
2005	6	5	3.51E+00	3.72E-02	1.89E+00	1.67E-02	2.34E-02	2.01E+01	8.19E+00	1.97E+01	3.68E-01	1.20E-01	6.48E-02	2.17E-01	1.62E-01	2.41E+01	4.32E+00
2005	6	6	6.58E-01	0.00E+00	2.36E-01	0.00E+00	0.00E+00	1.07E+01	3.40E+00	1.35E+01	9.66E-03	4.69E-04	3.23E-07	4.91E-03	1.76E-03	1.30E+01	1.03E+00
2005	6	7	1.32E+00	0.00E+00	2.34E-01	0.00E+00	0.00E+00	1.13E+01	2.44E+00	1.08E+01	8.01E-03	4.76E-04	0.00E+00	1.40E-02	2.81E-03	8.20E+00	2.67E+00
2005	6	8	8.10E-01	2.12E-03	1.55E+00	1.25E-04	5.26E-04	2.02E+01	4.49E+00	2.05E+01	3.04E-01	5.78E-02	1.59E-02	8.89E-02	7.63E-02	2.06E+01	2.72E+00
2005	6	9	3.81E+00	4.20E-03	1.58E+00	4.35E-04	2.48E-03	1.55E+01	4.70E+00	1.91E+01	4.68E-01	8.91E-02	2.74E-02	1.43E-01	1.25E-01	1.23E+01	7.77E+00
2005	6	10	1.38E+00	3.39E-04	6.28E-01	3.54E-05	1.63E-04	1.47E+01	4.57E+00	1.28E+01	1.15E-01	1.39E-02	2.48E-03	1.36E-01	5.54E-02	1.44E+01	1.80E+00
2005	6	11	1.87E+00	3.55E-03	1.77E+00	5.09E-04	1.89E-03	2.23E+01	5.41E+00	1.52E+01	4.30E-01	7.49E-02	1.95E-02	1.68E-01	1.27E-01	2.14E+01	2.96E+00
2005	6	12	1.24E+00	2.22E-03	8.46E-01	2.19E-04	9.10E-04	1.83E+01	3.73E+00	1.51E+01	2.45E-01	4.11E-02	1.03E-02	1.40E-01	8.24E-02	1.24E+01	2.27E+00
2005	6	13	4.57E-01	9.54E-04	7.71E-01	1.21E-04	7.83E-04	1.12E+01	2.08E+00	1.04E+01	2.78E-01	5.31E-02	1.33E-02	6.60E-02	7.20E-02	7.70E+00	1.62E+00
2005	6	14	2.69E+00	1.59E-02	1.47E+00	1.11E-02	1.60E-02	1.90E+01	5.85E+00	1.56E+01	3.19E-01	8.56E-02	3.83E-02	1.86E-01	1.29E-01	2.49E+01	3.70E+00
2005	6	15	1.68E+00	3.94E-04	4.23E-01	1.36E-04	9.85E-04	9.10E+00	4.86E+00	9.88E+00	2.54E-01	4.97E-02	1.30E-02	9.55E-02	7.05E-02	8.33E+00	2.85E+00
2005	6	16	6.04E+00	3.32E-02	4.32E+00	1.11E-02	2.24E-02	1.68E+01	6.33E+00	1.77E+01	5.26E-01	1.55E-01	7.73E-02	2.70E-01	2.08E-01	2.12E+01	7.37E+00
2005	6	17	6.45E+00	1.48E-04	2.92E+00	6.28E-05	9.63E-04	1.09E+01	6.59E-01	1.21E+01	7.50E-02	1.62E-02	7.79E-03	1.90E-02	2.05E-02	1.19E+01	8.98E+00
2005	6	18	7.66E-01	1.19E-06	9.15E-02	4.19E-07	1.31E-04	7.47E+00	9.97E-01	5.95E+00	2.78E-01	2.09E-02	2.03E-03	4.57E-02	2.97E-02	3.57E+00	2.22E+00
2005	6	19	4.91E-01	2.00E-03	5.57E-01	1.36E-04	8.82E-04	1.10E+01	3.80E+00	1.01E+01	1.74E-01	3.60E-02	1.26E-02	7.18E-02	4.95E-02	1.02E+01	1.69E+00
2005	6	20	6.09E+00	1.73E-02	3.21E+00	1.94E-03	3.57E-03	2.41E+01	8.67E+00	2.55E+01	4.42E-01	9.16E-02	3.20E-02	2.13E-01	1.41E-01	2.96E+01	8.37E+00
2005	6	21	3.04E+00	4.81E-02	1.72E+00	1.41E-02	2.41E-02	2.28E+01	7.33E+00	2.66E+01	5.15E-01	1.63E-01	8.50E-02	3.16E-01	2.28E-01	2.73E+01	4.45E+00
2005	6	22	3.18E-01	8.08E-05	1.76E-01	1.46E-04	1.95E-04	3.98E+00	1.03E+00	3.11E+00	1.63E-03	1.38E-04	5.47E-05	2.27E-02	4.32E-03	2.70E+00	1.47E+00
2005	6	23	1.66E+00	0.00E+00	7.40E-01	0.00E+00	0.00E+00	7.96E+00	5.39E+00	1.20E+01	2.41E-02	7.46E-04	1.37E-05	1.71E-02	5.65E-03	1.11E+01	2.11E+00
2005	6	24	4.28E+00	4.54E-02	1.84E+00	1.85E-02	3.02E-02	2.68E+01	1.21E+01	2.18E+01	6.35E-01	1.89E-01	9.33E-02	3.31E-01	2.54E-01	1.99E+01	7.17E+00
2005	6	25	4.14E+00	3.69E-02	1.76E+00	2.01E-02	3.50E-02	2.32E+01	9.40E+00	1.80E+01	6.11E-01	1.76E-01	8.65E-02	3.28E-01	2.37E-01	1.64E+01	5.53E+00
2005	6	26	9.37E+00	5.45E-03	5.16E+00	2.06E-04	7.53E-04	1.66E+01	3.10E+00	2.13E+01	3.47E-01	4.85E-02	1.25E-02	1.25E-01	7.60E-02	2.62E+01	1.19E+01
2005	6	27	1.18E+01	1.66E-02	5.87E+00	3.70E-03	6.39E-03	1.83E+01	2.73E+00	2.25E+01	4.66E-01	7.68E-02	3.26E-02	1.40E-01	1.01E-01	2.59E+01	1.60E+01
2005	6	28	5.59E+00	3.05E-03	1.46E+00	1.96E-03	3.37E-03	1.55E+01	3.55E+00	2.08E+01	2.74E-01	4.47E-02	1.21E-02	1.01E-01	6.78E-02	1.90E+01	6.95E+00
2005	6	29	3.94E+00	5.99E-03	2.38E+00	1.11E-03	4.59E-03	1.91E+01	8.50E+00	2.27E+01	4.36E-01	9.43E-02	3.44E-02	1.88E-01	1.31E-01	2.16E+01	5.47E+00
2005	6	30	2.68E+00	5.33E-05	6.52E-01	3.16E-05	7.60E-04	1.41E+01	3.52E+00	1.32E+01	4.11E-01	7.20E-02	1.13E-02	1.63E-01	1.30E-01	1.19E+01	4.16E+00
2005	7	1	2.50E+00	9.16E-04	1.23E+00	2.91E-04	1.26E-03	1.40E+01	6.53E+00	1.50E+01	1.21E-01	2.51E-02	6.69E-03	1.19E-01	5.99E-02	1.43E+01	3.92E+00
2005	7	2	1.15E+00	4.02E-04	8.57E-01	8.89E-05	9.05E-04	2.11E+01	4.58E+00	2.02E+01	2.61E-01	5.23E-02	9.85E-03	1.31E-01	9.83E-02	1.88E+01	2.59E+00
2005	7	3	1.87E+00	9.74E-04	2.39E+00	7.60E-05	5.21E-04	2.25E+01	5.99E+00	2.17E+01	1.51E-01	3.10E-02	7.66E-03	1.03E-01	5.76E-02	2.71E+01	2.38E+00
2005	7	4	1.14E+00	9.25E-04	1.22E+00	1.11E-04	6.78E-04	1.77E+01	5.78E+00	1.60E+01	4.25E-01	7.01E-02	1.41E-02	1.78E-01	1.24E-01	1.39E+01	2.18E+00
2005	7	5	4.85E+00	1.46E-03	2.00E+00	9.18E-04	6.70E-03	1.53E+01	6.87E+00	1.68E+01	3.71E-01	8.87E-02	1.94E-02	1.91E-01	1.33E-01	1.58E+01	5.67E+00
2005	7	6	1.98E+00	2.41E-04	6.01E-01	1.12E-04	9.41E-04	7.36E+00	1.76E+00	6.56E+00	8.28E-02	2.00E-02	5.09E-03	6.76E-02	3.95E-02	6.10E+00	3.48E+00
2005	7	7	1.26E+00	2.22E-03	6.21E-01	2.51E-04	1.25E-03	1.12E+01	4.67E+00	1.18E+01	1.49E-01	3.50E-02	1.29E-02	9.11E-02	5.70E-02	1.01E+01	2.22E+00
2005	7	8	6.02E-01	2.03E-03	5.53E-01	6.57E-04	2.42E-03	1.51E+01	3.77E+00	1.17E+01	3.70E-01	8.22E-02	1.99E-02	1.94E-01	1.47E-01	1.21E+01	1.36E+00
2005	7	9	6.49E-01	0.00E+00	9.04E-02	0.00E+00	0.00E+00	4.83E+00	2.16E+00	6.82E+00	9.48E-04	1.96E-04	0.00E+00	1.22E-02	3.36E-03	6.02E+00	9.08E-01
2005	7	10	3.38E-01	0.00E+00	1.02E-01	0.00E+00	0.00E+00	6.38E+00	2.66E+00	7.12E+00	1.40E-03	1.49E-04	3.20E-07	3.82E-03	1.23E-03	6.96E+00	6.41E-01
2005	7	11	1.22E+00	1.35E-03	1.01E+00	8.78E-06	8.73E-05	1.05E+01	4.16E+00	1.46E+01	7.63E-02	9.77E-03	3.33E-03	7.01E-02	2.34E-02	1.20E+01	2.45E+00
2005	7	12	1.82E+00	1.70E-03	8.08E-01	6.26E-04	2.83E-03	2.01E+01	7.37E+00	1.81E+01	5.02E-01	8.36E-02	1.94E-02	2.37E-01	1.48E-01	2.03E+01	2.97E+00
2005	7	13	6.46E-01	9.31E-05	9.52E-01	7.16E-07	1.71E-05	8.77E+00	3.18E+00	9.68E+00	3.56E-02	4.99E-03	1.31E-03	9.45E-03	6.96E-03	1.08E+01	1.04E+00
2005	7	14	1.44E+00	2.70E-03	9.75E-01	2.88E-04	1.34E-03	1.86E+01	9.22E+00	2.78E+01	3.92E-01	6.80E-02	1.85E-02	1.87E-01	1.21E-01	2.12E+01	2.73E+00
2005	7	15	7.47E-01	1.81E-03	6.83E-01	2.41E-04	1.36E-03	1.50E+01	6.29E+00	1.62E+01	3.97E-01	7.73E-02	1.97E-02	2.02E-01	1.33E-01	1.80E+01	1.27E+00
2005	7	16	4.17E+00	5.04E-03	1.06E+00	1.20E-03	3.61E-03	1.71E+01	9.18E+00	2.51E+01	2.33E-01	4.68E-02	1.80E-02	1.15E-01	7.16E-02	2.03E+01	7.30E+00
2005	7	17	2.76E+00	6.85E-03	1.24E+00	2.03E-03	5.44E-03	1.89E+01	8.88E+00	2.64E+01	7.44E-01	1.17E-01	3.23E-02	2.85E-01	1.97E-01	2.28E+01	5.69E+00
2005	7	18	7.97E-01	2.40E-03	4.79E-01	2.70E-04	3.01E-03	1.27E+01	3.35E+00	1.13E+01	2.25E-01	4.34E-02	1.42E-02	1.28E-01	7.90E-02	1.13E+01	1.41E+00
2005	7	19	1.45E+00	2.04E-02	7.39E-01	8.48E-03	1.36E-02	8.07E+00	3.09E+00	1.18E+01	1.80E-01	5.28E-02	3.00E-02	8.37E-02	6.86E-02	1.34E+01	1.99E+00
2005	7	20	2.33E+00	6.79E-03	1.12E+00	1.89E-03	1.40E-03	5.63E+00	2.20E+00	7.86E+00	1.58E-02	3.06E-03	2.61E-03	3.05E-03	2.23E-03	9.60E+00	2.93E+00
2005	7	21	6.45E+00	1.12E-03	3.32E+00	8.00E-05	3.14E-04	1.78E+01	5.81E+00	2.54E+01	2.73E-01	3.47E-02	7.96E-03	1.06E-01	6.28E-02	2.64E+01	8.56E+00
2005	7	22	3.83E+00	3.21E-02	2.18E+00	1.01E-02	1.94E-02	1.95E+01	6.73E+00	2.07E+01	4.81E-01	1.49E-01	6.80E-02	2.88E-01	2.17E-01	1.71E+01	6.34E+00
2005	7	23	2.17E-01	0.00E+00	1.68E-01	0.00E+00	0.00E+00	5.99E+00	2.67E+00	5.89E+00	6.49E-02	5.53E-03	4.85E-04	1.60E-02	1.06E-02	7.76E+00	6.76E-01
2005	7	24	4.08E+00	2.38E-02	2.99E+00	8.29E-03	9.28E-03	1.74E+01	4.89E+00	2.41E+01	2.91E-01	6.94E-02	2.76E-02	1.64E-01	1.15E-01	2.29E+01	6.02E+00
2005	7	25	1.03E+01	1.77E-02	4.08E+00	5.65E-03	6.11E-03	1.76E+01	3.31E+00	1.89E+01	3.54E-01	6.88E-02	2.95E-02	1.27E-01	9.51E-02	2.06E+01	1.41E+01
2005	7	26	2.41E+00	2.64E-03	1.57E+00	8.68E-04	2.80E-03	2.93E+01	8.87E+00	2.72E+01	2.64E-01	4.58E-02	1.25E-02	1.52E-01	9.02E-02	3.69E+01	4.00E+00
2005	7	27	2.40E+00	3.69E-03	1.34E+00	7.18E-04	1.60E-03	1.92E+01	5.97E+00	2.66E+01	2.07E-01	3.45E-02	9.62E-03	1.43E-01	7.69E-02	3.22E+01	3.54E+00
2005	7	28	2.06E+00	5.15E-03	1.30E+00	1.82E-03	4.70E-03	2.56E+01	8.82E+00	2.07E+01	3.14E-01	6.84E-02	1.81E-02	2.25E-01	1.41E-01	3.20E+01	2.99E+00
2005	7	29	3.64E+00	1.15E-02	1.10E+00	3.12E-03	1.27E-02	1.19E+01	7.33E+00	1.52E+01	2.69E-01	1.04E-01	5.44E-02	1.36E-01	1.20E-01	1.61E+01	5.40E+00
2005	7	30	1.83E+00	3.43E-03	1.43E+00	9.28E-04	4.45E-03	1.77E+01	9.38E+00	2.88E+01	5.09E-01	1.16E-01	3.45E-02	2.72E-01	1.86E-01	2.05E+01	3.54E+00
2005	7	31	3.95E+00	2.29E-02	1.04E+00	1.58E-02	2.86E-02	1.68E+01	8.52E+00	1.95E+01	6.66E-01	1.93E-01	9.20E-02	3.18E-01	2.40E-01	1.63E+01	5.39E+00
2005	8	1	1.88E+00	3.39E-03	9.67E-01	2.45E-03	9.56E-03	1.73E+01	8.51E+00	2.52E+01	4.23E-01	1.06E-01	3.10E-02	2.40E-01	1.65E-01	1.86E+01	3.15E+00
2005	8	2	6.03E+00	2.74E-03	3.17E+00	2.68E-04	1.10E-03	1.78E+01	1.01E+01	2.03E+01	3.64E-01	7.09E-02	2.08E-02	1.74E-01	1.13E-01	2.22E+01	7.79E+00
2005	8	3	1.10E+01	6.91E-03	5.36E+00	1.63E-03	1.66E-03	1.70E+01	1.48E+00	2.31E+01	4.23E-01	2.69E-02	1.03E-02	5.54E-02	3.65E-02	2.25E+01	1.41E+01
2005	8	4	1.14E+01	8.35E-02	5.09E+00	2.39E-02	3.53E-02	2.47E+01	8.11E+00	2.85E+01	9.72E-01	2.58E-01	1.33E-01	4.23E-01	3.31E-01	2.26E+01	1.65E+01

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	5	15	8.99E-02	9.44E-01	1.23E-02	1.01E-01	1.51E-01	3.85E-02	1.75E-02	4.40E-01	1.81E-02	6.55E+00	3.19E+00	5.64E-01	7.91E-01	4.05E-02	2.52E-01
2005	5	16	3.94E-02	1.16E-05	3.06E-03	1.19E-05	5.20E-03	1.05E-02	4.27E-02	1.15E+00	1.59E-02	7.95E+00	4.11E-01	6.97E-01	1.13E+00	6.66E-02	1.24E-01
2005	5	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-11	0.00E+00	8.22E-03	6.70E-01	3.68E-19	2.58E+00	1.62E-01	3.94E-01	5.12E-01	1.32E-03	0.00E+00
2005	5	18	3.15E-02	0.00E+00	1.42E-07	9.29E-03	9.76E-02	3.77E-04	2.31E-02	6.40E-01	1.32E-02	5.06E+00	4.54E-01	4.96E-01	7.71E-01	1.19E-02	6.01E-02
2005	5	19	5.02E-02	0.00E+00	2.57E-04	0.00E+00	2.67E-04	1.11E-03	2.70E-03	5.81E-01	7.29E-03	2.16E+00	3.24E-01	9.90E-02	5.78E-01	6.47E-03	1.53E-01
2005	5	20	3.17E-03	8.71E-02	1.16E-04	5.53E-02	8.54E-02	7.52E-04	2.20E-02	6.83E-01	1.58E-03	4.65E+00	1.01E+00	6.10E-01	5.49E-01	2.63E-02	4.23E-03
2005	5	21	1.87E-02	0.00E+00	6.57E-05	0.00E+00	6.42E-06	3.79E-04	2.47E-02	5.98E-01	5.14E-04	3.93E+00	2.10E-01	4.68E-01	1.10E+00	3.79E-02	6.57E-02
2005	5	22	1.20E-04	0.00E+00	0.00E+00	0.00E+00	1.66E-04	0.00E+00	1.07E-02	4.00E-01	1.20E-15	2.71E+00	2.59E-01	3.87E-01	5.02E-01	2.21E-03	4.13E-04
2005	5	23	2.58E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.02E-02	7.66E-01	2.54E-16	5.43E+00	6.59E-02	5.80E-01	7.31E-01	2.94E-02	2.74E-03
2005	5	24	4.60E-02	6.71E-03	5.09E-04	5.71E-05	5.23E-03	2.58E-03	1.17E-01	1.26E+00	5.72E-01	1.70E+01	4.12E-01	1.94E+00	2.98E+00	1.36E-01	1.08E-01
2005	5	25	2.12E-01	2.04E-01	1.71E-01	1.10E-02	2.16E-02	1.92E-01	3.15E-01	1.41E+00	2.10E+00	1.86E+01	8.87E-01	3.24E+00	6.03E+00	3.27E-01	2.66E-01
2005	5	26	6.71E-01	5.24E-02	2.29E-01	5.51E-03	1.01E-02	2.31E-01	4.85E-01	9.83E-01	4.59E+00	5.94E-01	1.57E-01	5.99E-01	5.32E-01	7.38E-01	9.05E-01
2005	5	27	1.99E-01	3.33E-01	9.59E-02	6.34E-02	1.96E-01	7.95E-02	7.35E-02	6.08E-01	3.13E+00	1.50E+01	2.10E+00	1.19E+00	2.26E+00	1.31E-01	4.26E-01
2005	5	28	5.55E-01	4.51E-06	2.55E-01	9.54E-10	6.69E-09	1.43E-01	6.90E-05	2.17E-02	2.20E+00	8.98E-05	9.59E-06	4.82E-05	2.66E-05	1.24E-02	9.09E-01
2005	5	29	5.00E-01	5.05E-03	3.31E-01	0.00E+00	0.00E+00	2.19E-01	4.37E-04	1.15E-01	2.02E+00	9.25E-02	7.14E-02	6.69E-05	1.05E-04	3.43E-02	8.20E-01
2005	5	30	1.81E-01	1.40E+00	2.05E-02	3.85E-01	5.21E-01	3.45E-02	3.22E-02	8.39E-01	2.16E+00	9.28E+00	4.71E+00	6.78E-01	1.37E+00	1.43E-01	4.03E-01
2005	5	31	6.78E-02	2.44E-01	9.31E-04	6.87E-01	1.31E+00	2.49E-03	2.89E-02	7.61E-01	2.17E-01	9.47E+00	1.08E+01	3.23E-01	9.41E-01	1.43E-01	2.03E-01
2005	6	1	2.61E-01	3.69E-06	2.71E-02	2.84E-08	2.94E-07	7.24E-02	9.60E-02	1.05E+00	1.30E+00	5.70E+00	1.23E-02	9.57E-01	1.28E+00	1.63E-01	3.13E-01
2005	6	2	3.27E-01	7.36E-05	3.01E-03	1.50E-06	7.64E-06	6.25E-03	8.77E-01	1.14E+00	4.19E-02	1.66E+00	4.27E-04	2.64E+00	1.79E+00	5.92E-01	4.98E-01
2005	6	3	1.47E-01	2.88E-03	3.41E-03	9.10E-04	1.79E-02	1.05E-02	6.76E-01	1.06E+00	2.15E-01	8.12E+00	1.22E+00	1.23E+00	9.84E-01	3.40E-01	2.45E-01
2005	6	4	1.20E-01	3.53E-01	2.43E-02	5.35E-03	9.19E-03	4.01E-02	4.64E-02	6.73E-01	1.08E+00	9.53E+00	4.56E-01	8.09E-01	1.52E+00	7.40E-02	2.23E-01
2005	6	5	1.05E-01	7.17E-01	5.91E-02	2.28E-01	3.13E-01	7.71E-02	2.10E-01	1.12E+00	1.79E+00	1.64E+01	1.92E+00	1.96E+00	3.24E+00	2.30E-01	1.58E-01
2005	6	6	4.71E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.74E-02	1.34E+00	1.37E-03	1.29E+01	6.98E-03	1.92E+00	2.16E+00	6.14E-02	2.40E-02
2005	6	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-02	1.13E+00	0.00E+00	3.96E+00	7.21E-02	6.02E-01	7.31E-01	2.56E-02	0.00E+00
2005	6	8	5.49E-02	1.59E-05	3.45E-03	9.84E-08	8.54E-07	6.34E-03	3.03E-02	1.08E+00	2.69E-03	8.44E+00	8.50E-02	7.47E-01	1.19E+00	1.17E-01	1.52E-01
2005	6	9	7.48E-02	2.00E-02	9.10E-03	1.92E-02	9.34E-02	2.62E-02	2.41E-02	7.83E-01	4.34E-02	6.96E+00	2.41E+00	3.33E-01	1.40E+00	4.60E-02	2.37E-01
2005	6	10	5.00E-03	8.38E-07	7.15E-06	1.84E-07	1.08E-06	1.67E-05	7.35E-02	1.21E+00	2.07E-05	9.79E+00	7.67E-02	1.29E+00	7.18E-01	7.96E-02	2.52E-02
2005	6	11	5.13E-02	4.42E-05	2.51E-03	1.07E-05	5.70E-04	5.94E-03	3.06E-02	1.08E+00	2.24E-02	1.08E+01	1.97E-01	7.79E-01	9.70E-01	1.16E-01	1.39E-01
2005	6	12	2.54E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.47E-02	1.21E+00	0.00E+00	4.39E+00	1.33E-01	3.27E-01	9.93E-01	5.97E-02	1.11E-02
2005	6	13	5.95E-03	0.00E+00	0.00E+00	0.00E+00	1.23E-07	0.00E+00	2.56E-02	7.22E-01	3.52E-25	2.90E+00	2.10E-01	3.08E-01	6.80E-01	3.37E-02	1.93E-02
2005	6	14	4.22E-02	7.34E-01	8.57E-04	1.19E-01	1.76E-01	3.52E-03	3.77E-02	6.80E-01	5.94E-02	1.02E+01	2.94E+00	8.70E-01	7.57E-01	1.20E-01	1.40E-01
2005	6	15	8.13E-03	6.42E-05	3.47E-04	1.24E-05	5.53E-05	1.21E-03	1.28E-02	4.99E-01	1.90E-03	7.66E+00	1.74E-01	5.94E-01	1.22E+00	1.88E-02	1.87E-02
2005	6	16	3.29E-01	9.69E-02	3.23E-01	1.84E-02	9.37E-02	3.84E-01	9.61E-02	6.28E-01	3.24E+00	7.34E+00	1.17E+00	7.38E-01	1.44E+00	1.88E-01	5.53E-01
2005	6	17	3.13E-02	2.60E-03	5.95E-01	9.39E-04	2.01E-03	5.56E-01	1.17E-03	1.26E-01	4.55E+00	1.31E+00	2.32E-01	2.75E-02	1.58E-01	1.46E-02	9.19E-02
2005	6	18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-04	0.00E+00	3.77E-04	3.87E-01	8.39E-25	1.82E+00	3.21E-01	3.68E-02	5.07E-01	8.40E-03	0.00E+00
2005	6	19	1.56E-02	0.00E+00	0.00E+00	0.00E+00	9.21E-07	0.00E+00	2.08E-02	6.25E-01	8.39E-03	2.93E+00	1.90E-01	3.46E-01	9.49E-01	3.44E-02	5.81E-02
2005	6	20	1.57E-01	1.55E+00	7.38E-03	3.83E-02	1.12E-01	1.38E-02	5.65E-02	1.00E+00	1.04E-01	1.45E+01	1.77E+00	1.14E+00	1.51E+00	1.32E-01	3.19E-01
2005	6	21	1.88E-01	6.13E-01	1.23E-01	9.07E-02	1.83E-01	1.60E-01	2.67E-01	1.15E+00	9.68E-01	8.57E+00	2.41E+00	2.39E+00	3.66E+00	3.86E-01	2.38E-01
2005	6	22	0.00E+00	5.13E-04	0.00E+00	8.57E-03	1.55E-02	0.00E+00	8.08E-04	1.24E-01	2.30E-07	1.98E+00	4.14E-01	2.88E-02	6.00E-01	6.38E-03	0.00E+00
2005	6	23	3.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.36E-04	6.56E-02	8.26E-01	1.60E-02	1.13E+01	1.58E-02	1.15E+00	9.07E-01	4.51E-02	1.07E-01
2005	6	24	8.10E-02	2.15E-01	1.67E-03	3.05E-01	5.98E-01	4.61E-03	5.56E-02	1.15E+00	3.59E-01	1.45E+01	7.47E+00	1.15E+00	2.80E+00	1.45E-01	1.88E-01
2005	6	25	9.31E-02	1.58E-01	1.67E-03	2.45E-01	5.02E-01	4.11E-03	4.94E-02	1.15E+00	9.56E-02	8.25E+00	7.61E+00	4.90E-01	7.79E-01	1.13E-01	2.85E-01
2005	6	26	3.18E-01	6.51E-03	3.69E-01	2.53E-06	3.54E-05	2.52E-01	1.00E-01	5.29E-01	4.47E+00	9.36E-01	2.83E-02	3.37E-01	2.92E-01	1.56E-01	5.35E-01
2005	6	27	2.15E-01	2.86E-01	1.50E-01	6.13E-02	3.85E-02	1.15E-01	4.61E-03	2.97E-01	5.81E+00	8.37E-01	2.16E+00	4.95E-03	1.85E-02	8.21E-02	5.38E-01
2005	6	28	6.34E-02	8.89E-02	5.63E-02	2.16E-02	1.88E-02	7.66E-02	5.24E-02	9.14E-01	8.12E-01	1.09E+01	1.77E-01	1.21E+00	1.68E+00	1.27E-01	1.57E-01
2005	6	29	1.48E-01	4.85E-05	4.40E-03	2.18E-05	2.24E-03	1.47E-02	1.25E-01	1.22E+00	2.27E-01	1.72E+01	1.38E-01	2.88E+00	5.05E+00	1.38E-01	3.82E-01
2005	6	30	8.76E-03	3.73E-05	9.08E-04	2.73E-06	3.26E-03	3.44E-03	3.61E-02	9.89E-01	2.45E-03	3.81E+00	3.58E-01	2.81E-01	8.30E-01	5.17E-02	2.36E-02
2005	7	1	7.17E-02	3.40E-07	0.00E+00	1.60E-06	7.85E-04	3.86E-04	6.47E-02	7.46E-01	3.22E-02	8.39E+00	2.56E-01	7.30E-01	1.29E+00	8.25E-02	1.83E-01
2005	7	2	1.43E-02	4.60E-06	1.67E-04	7.16E-07	1.10E-05	1.21E-03	5.24E-02	1.06E+00	2.18E-03	6.02E+00	1.46E-01	5.89E-01	1.12E+00	1.05E-01	4.08E-02
2005	7	3	1.20E-01	7.24E-05	4.90E-03	8.73E-06	2.66E-05	1.23E-02	4.68E-02	7.12E-01	9.46E-03	8.71E+00	4.74E-02	8.70E-01	1.13E+00	1.03E-01	2.97E-01
2005	7	4	3.63E-02	2.65E-08	3.47E-05	4.90E-08	1.78E-07	5.57E-04	7.35E-02	1.14E+00	5.79E-04	6.17E+00	1.39E-01	7.29E-01	1.23E+00	6.17E-02	5.88E-02
2005	7	5	2.45E-01	1.16E-04	3.60E-03	8.60E-03	4.23E-01	7.72E-03	6.13E-02	8.64E-01	2.18E-02	7.84E+00	2.82E+00	7.12E-01	9.45E-01	4.15E-02	4.67E-01
2005	7	6	7.29E-02	3.46E-06	2.07E-03	3.36E-04	1.59E-02	4.12E-03	4.89E-03	2.68E-01	1.63E-03	2.56E+00	3.63E-01	5.02E-02	5.67E-01	2.45E-02	1.63E-01
2005	7	7	2.36E-02	3.22E-05	6.92E-04	5.80E-06	3.14E-04	2.23E-03	2.65E-02	5.66E-01	3.05E-02	6.92E+00	2.15E-01	6.46E-01	1.13E+00	3.84E-02	7.32E-02
2005	7	8	4.50E-03	1.35E-06	4.60E-06	6.20E-07	3.04E-02	9.08E-06	4.97E-02	9.94E-01	2.19E-04	3.48E+00	5.27E-01	1.55E-01	9.80E-01	6.91E-02	8.72E-03
2005	7	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.67E-06	0.00E+00	2.77E-02	4.08E-01	1.97E-14	4.03E+00	1.83E-01	5.03E-01	6.44E-01	6.28E-02	0.00E+00
2005	7	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.21E-05	0.00E+00	1.80E-02	7.97E-01	0.00E+00	5.25E+00	1.46E-01	7.71E-01	6.59E-01	2.89E-02	0.00E+00
2005	7	11	5.89E-02	0.00E+00	1.42E-03	0.00E+00	3.82E-06	3.44E-03	2.05E-02	6.84E-01	3.51E-02	7.22E+00	1.05E-01	6.03E-01	9.91E-01	3.30E-02	1.44E-01
2005	7	12	9.20E-03	1.40E-04	2.63E-04	5.56E-04	6.93E-02	3.29E-03	9.88E-02	1.38E+00	5.22E-03	9.39E+00	5.21E-01	1.15E+00	1.25E+00	1.20E-01	2.41E-02
2005	7	13	4.39E-02	0.00E+00	3.59E-03	7.82E-04	1.27E-02	8.60E-03	2.13E-02	4.83E-01	2.46E-04	7.22E+00	1.19E-01	8.56E-01	6.23E-01	8.36E-03	9.77E-02
2005	7	14	1.48E-02	4.92E-06	2.13E-03	3.94E-07	2.11E-05	6.89E-03	8.56E-02	1.52E+00	2.48E-03	1.84E+01	6.75E-02	1.83E+00	2.75E+00	6.69E-02	3.69E-02
2005	7	15	1.54E-04	0.00E+00	0.00E+00	0.00E+00	5.20E-04	0.00E+00	6.59E-02	1.21E+00	0.00E+00	1.00E+01	1.94E-01	1.24E+00	1.01E+00	7.80E-02	4.60E-04
2005	7	16	2.01E-01	2.74E-01	8.23E-02	3.78E-02	8.42E-02	1.12E-01	1.27E-01	7.27E-01	1.52E+00	1.29E+01	2.73E+00	1.03E+00	1.24E+00	2.34E-01	4.12E-01
2005	7	17	5.54E-01	1.91E-01	9.44E-02	2.04E-01	5.02E-01	1.80E-01	1.17E+00	1.66E+00	1.20E+00	1.64E+01	2.40E+00	3.75E+00	5.34E+00	8.62E-01	6.85E-01
2005	7	18	0.00E+00	5.77E-06	0.00E+00	6.33E-06	7.23E-03	0.00E+00	6.25E-02	9.30E-01	7.76E-05	4.62E+00	6.69E-01	6.24E-01	7.32E-01	5.71E-02	1.52E-06
2005	7	19	5.30E-03	4.42E-01	3.67E-03	1.02E-01	2.16E-01	7.15E-03	3.24E-02	4.44E-01	1.66E-01	7.12E+00	1.66E+00	5.12E-01	1.14E+00	5.83E-02	1.06E-02
2005	7	20	1.20E-02	1.32E-01	3.24E-03	2.32E-02	4.02E-02	9.54E-03	1.12E-02	6.61E-02	3.71E-01	3.58E+00	1.62E-01	2.53E-01	3.20E-01	5.12E-03	4.94E-02
2005	7	21	4.78E-01	1.25E-02	1.71E-01	6.23E-07	3.12E-06	2.64E-01	3.13E-01	1.14E+00	3.01E+00	6.08E+00	9.31E-02	1.31E+00	1.53E+00	3.94E-01	7.08E-01
2005	7	22	7.12E-02	5.14E-01	1.62E-02	6.04E-02	1.42E-01	2.40E-02	3.59E-02	6.43E-01	1.37E+00	8.64E+00	1.82E+00	9.24E-01	1.82E+00	1.06E-01	1.75E-01
2005	7	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E-02	4.78E-01	1.75E-17	3.69E+00	8.95E-02	7.07E-01	4.54E-01	1.65E-02	0.00E+00
2005	7	24	8.60E-01	1.73E-01	3.20E-01	5.52E-02	5.53E-02	4.19E-01	6.42E-01	1.66E+00	2.13E+00	6.34E+00	1.51E-01	1.11E+00	6.43E-01	9.03E-01	1.04E+00
2005	7	25	2.56E-01	8.53E-01	1.11E-01	6.03E-02	9.12E-02	5.86E-02	5.75E-03	3.62E-01	2.77E+00	1.40E+00	2.99E+00	2.51E-02	2.28E-01	2.51E-02	5.33E-01
2005	7	26	6.45E-02	4.48E-05	1.16E-04	2.42E-04	2.92E-03	1.16E-03	2.81E-01	1.58E+00	1.22E-01	1.50E+01	1.16E-01	2.53E+00	2.66E+00	3.48E-01	8.94E-02
2005	7	27	2.55E-02	8.44E-02	4.99E-03	5.34E-04	9.14E-04	1.02E-02	6.71E-02	1.16E+00	4.21E-01	1.15E+01	2.48E-01	1.24E+00	8.65E-01	1.98E-01	6.46E-02
2005	7	28	6.21E-03	1.13E-01	7.05E-05	9.03E-02	1.98E-01	1.17E-04	6.65E-02	1.13E+00	1.85E-02	1.70E+01	1.20E+00	1.36E+00	1.73E+00	2.13E-01	1.14E-02
2005	7	29	2.02E-02	5.02E-03	2.67E-04	8.24E-04	6.02E-02	4.42E-03	4.96E-02	5.19E-01	4.96E-02	1.09E+01	1.03E+00	6.54E-01	1.16E+00	5.89E-02	6.49E-02
2005	7	30	9.59E-03	7.21E-05	3.16E-05	5.54E-04	5.35E-02	1.16E-04	7.79E-02	1.26E+00	2.61E-02	1.66E+01	8.92E-01	1.63E+00	1.44E+00	9.68E-02	3.91E-02
2005	7	31	3.67E-02	4.41E-04	3.83E-04	3.66E-01	4.00E-01	1.96E-03	6.76E-02	9.51E-01	4.06E-02	5.74E+00	7.84E+00	6.48E-01	1.03E+00	1.02E-01	1.06E-01
2005	8	1	1.20E-03	4.01E-05	3.73E-05	3.38E-04	8.58E-02	8.96E-05	9.84E-02	1.52E+00	1.99E-02	5.81E+00	1.12E+00	6.43E-01	1.61E+00	7.01E-02	4.55E-03
2005	8	2	2.96E-01	4.62E-04	4.74E-02	3.93E-05	7.46E-04	1.14E-01	6.35E-01	9.20E-01	3.16E+00	1.75E+01	6.46E-02	3.60E+00	4.69E+00	3.13E-01	4.10E-01
2005	8	3	4.40E-01	1.91E-01	4.41E-01	4.13E-02	5.48E-02	3.06E-01	2.69E-02	3.35E-01	4.12E+00	3.40E+00	5.14E-01	2.44E-01	7.95E-01	9.67E-02	7.27E-01
2005	8	4	2.30E-01	2.65E+00	1.76E-02	9.27E-02	9.49E-02	3.23E-02	2.47E-02	5.00E-01	1.19E+00	7.84E+00	6.63E+00	5.39E-01	6.37E-01	5.82E-02	5.48E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	8	5	1.34E+00	2.91E-03	1.15E+00	6.11E-04	1.82E-03	2.08E+01	9.87E+00	3.04E+01	4.33E-01	1.97E+01	5.30E-02	2.13E+00	1.75E+00	2.77E+01	3.03E+00	1.33E+00	2.89E-03	1.15E+00	4.97E-04	1.72E-03	2.08E+01	9.78E+00	2.88E+01	4.33E-01	7.50E-02	1.63E-02	2.51E-01	1.50E-01	2.75E+01	2.97E+00	1.47E-02	2.65E-05	1.26E-05	1.14E-04	9.35E-05	1.65E-05	8.93E-02	1.59E+00	3.80E-05	1.96E+01	3.67E-02	1.88E+00	1.60E+00	1.15E-01	6.15E-02
2005	8	6	2.93E+00	4.52E-01	1.47E+00	6.71E-02	7.38E-02	2.21E+01	1.08E+01	3.02E+01	9.97E-01	1.39E+01	4.08E-01	4.50E+00	4.62E+00	2.40E+01	3.52E+00	2.70E+00	1.85E-02	1.43E+00	7.29E-03	9.03E-03	2.21E+01	1.04E+01	2.85E+01	4.81E-01	9.61E-02	3.55E-02	2.40E-01	1.52E-01	2.37E+01	3.21E+00	2.25E-01	4.33E-01	4.23E-02	5.98E-02	6.47E-02	7.53E-02	4.25E-01	1.71E+00	5.17E-01	1.38E+01	3.72E-01	4.26E+00	4.47E+00	3.30E-01	3.12E-01
2005	8	7	4.92E+00	3.27E-03	2.22E+00	4.36E-04	5.80E-04	1.78E+01	6.13E+00	2.30E+01	2.44E+00	1.15E+01	1.40E-02	2.11E+00	1.69E+00	2.41E+01	6.23E+00	4.85E+00	4.33E-04	2.16E+00	2.02E-05	2.61E-04	1.77E+01	5.99E+00	2.20E+01	3.15E-01	5.12E-02	1.04E-02	1.70E-01	9.92E-02	2.40E+01	6.13E+00	6.50E-02	2.84E-03	5.17E-02	4.15E-04	3.19E-04	5.44E-02	1.35E-01	1.02E+00	2.12E+00	1.15E+01	3.61E-03	1.94E+00	1.59E+00	1.34E-01	1.03E-01
2005	8	8	8.19E+00	1.75E-04	4.48E+00	1.14E-06	1.32E-05	1.01E+01	7.55E-01	1.24E+01	5.13E+00	8.19E-03	1.53E-03	1.67E-02	1.03E-02	1.76E+01	1.16E+01	7.99E+00	1.04E-04	3.37E+00	1.14E-06	1.32E-05	9.16E+00	7.54E-01	1.24E+01	7.82E-02	4.16E-03	5.40E-04	1.38E-02	7.74E-03	1.76E+01	1.13E+01	2.02E-01	7.16E-05	1.11E+00	0.00E+00	0.00E+00	9.12E-01	8.51E-04	7.20E-02	5.05E+00	4.02E-03	9.88E-04	2.84E-03	2.54E-03	2.29E-02	3.21E-01
2005	8	9	8.39E+00	1.69E-02	3.94E+00	6.18E-03	4.32E-03	7.90E+00	2.71E-01	1.14E+01	6.61E+00	3.06E-03	4.55E-03	2.63E-03	2.41E-03	1.54E+01	1.09E+01	8.37E+00	9.72E-03	3.89E+00	5.50E-03	4.26E-03	7.83E+00	2.71E-01	1.14E+01	4.73E-02	2.69E-03	4.33E-03	2.49E-03	2.17E-03	1.54E+01	1.08E+01	2.22E-02	7.16E-03	4.60E-02	6.75E-04	5.77E-05	6.98E-02	5.09E-05	1.61E-03	6.56E+00	3.76E-04	2.24E-04	1.42E-04	2.38E-04	1.55E-03	5.80E-02
2005	8	10	7.46E+00	8.01E-04	4.47E+00	0.00E+00	0.00E+00	9.31E+00	2.89E-01	7.89E+00	4.81E+00	5.33E-05	2.00E-03	4.26E-06	1.49E-06	1.67E+01	9.42E+00	7.35E+00	0.00E+00	3.92E+00	0.00E+00	0.00E+00	9.08E+00	2.89E-01	7.88E+00	1.80E-03	5.45E-07	0.00E+00	4.20E-06	1.47E-06	1.67E+01	9.21E+00	1.03E-01	8.01E-04	5.49E-01	0.00E+00	0.00E+00	2.34E-01	5.49E-06	8.23E-03	4.81E+00	5.28E-05	2.00E-03	5.25E-08	2.06E-08	3.47E-03	2.07E-01
2005	8	11	1.20E+01	4.97E-01	6.16E+00	7.94E-02	1.25E-01	1.80E+01	3.61E+00	1.98E+01	8.07E+00	7.06E+00	8.46E-01	1.36E+00	2.56E+00	2.35E+01	1.57E+01	1.17E+01	7.23E-03	5.87E+00	2.02E-03	3.04E-03	1.77E+01	3.37E+00	1.95E+01	2.31E-01	2.12E-02	9.80E-03	9.44E-02	4.05E-02	2.32E+01	1.52E+01	3.05E-01	4.90E-01	2.90E-01	7.73E-02	1.22E-01	2.94E-01	2.36E-01	2.56E-01	7.84E+00	7.04E+00	8.36E-01	1.27E+00	2.52E+00	2.43E-01	5.42E-01
2005	8	12	1.61E+01	2.78E-03	8.53E+00	3.39E-05	9.16E-05	2.10E+01	2.52E-01	1.93E+01	5.93E+00	1.97E-02	5.75E-03	4.86E-02	3.12E-02	2.42E+01	1.87E+01	1.55E+01	2.74E-03	7.74E+00	3.34E-05	9.11E-05	2.04E+01	2.49E-01	1.91E+01	1.68E-01	1.94E-02	5.70E-03	4.78E-02	3.08E-02	2.41E+01	1.77E+01	5.60E-01	4.44E-05	7.89E-01	4.84E-07	4.48E-07	6.01E-01	2.85E-03	1.23E-01	5.76E+00	3.52E-04	4.62E-05	7.82E-04	4.02E-04	6.42E-02	9.84E-01
2005	8	13	3.26E+00	5.25E-02	2.02E+00	1.59E-02	5.48E-02	2.60E+01	1.05E+01	2.88E+01	1.48E+00	2.92E+01	2.83E-01	3.07E+00	6.07E+00	2.85E+01	6.57E+00	3.18E+00	2.31E-02	1.90E+00	7.17E-03	1.34E-02	2.59E+01	1.04E+01	2.75E+01	6.04E-01	1.40E-01	5.37E-02	3.19E-01	2.19E-01	2.83E+01	6.45E+00	7.84E-02	2.93E-02	1.17E-01	8.70E-03	4.14E-02	8.27E-02	1.57E-01	1.25E+00	8.75E-01	2.91E+01	2.30E-01	2.75E+00	5.85E+00	2.04E-01	1.22E-01
2005	8	14	1.29E+00	1.53E-03	1.10E+00	1.06E-04	4.75E-04	1.76E+01	5.07E+00	1.68E+01	1.21E+00	9.67E+00	1.31E-01	1.32E+00	7.41E-01	1.89E+01	1.76E+00	1.28E+00	1.53E-03	1.08E+00	1.06E-04	4.72E-04	1.76E+01	5.01E+00	1.58E+01	3.87E-01	4.33E-02	8.88E-03	1.54E-01	9.34E-02	1.89E+01	1.74E+00	1.46E-02	2.04E-06	2.45E-02	0.00E+00	2.82E-06	1.84E-02	6.48E-02	1.00E+00	8.21E-01	9.63E+00	1.22E-01	1.17E+00	6.47E-01	7.46E-02	2.42E-02
2005	8	15	4.05E+00	1.85E+00	1.76E+00	5.41E-01	1.01E+00	1.26E+01	6.19E+00	2.01E+01	2.06E+00	8.76E+00	6.75E+00	7.34E-01	1.29E+00	1.63E+01	5.58E+00	3.94E+00	7.74E-02	1.67E+00	3.83E-02	4.72E-02	1.24E+01	6.12E+00	1.97E+01	2.89E-01	1.20E-01	9.34E-02	1.86E-01	1.37E-01	1.62E+01	5.35E+00	1.15E-01	1.77E+00	8.47E-02	5.03E-01	9.59E-01	1.02E-01	7.18E-02	3.67E-01	1.77E+00	8.64E+00	6.66E+00	5.48E-01	1.15E+00	1.03E-01	2.25E-01
2005	8	16	1.84E+00	2.92E+00	6.53E-01	3.78E-01	6.00E-01	3.85E+00	3.42E+00	8.96E+00	2.28E-01	5.36E+00	8.59E+00	2.04E-01	6.04E-01	7.95E+00	2.67E+00	1.84E+00	8.68E-02	6.53E-01	4.07E-02	4.87E-02	3.85E+00	3.41E+00	8.94E+00	2.12E-01	1.07E-01	1.05E-01	1.17E-01	9.91E-02	7.94E+00	2.66E+00	2.40E-04	2.83E+00	1.38E-06	3.37E-01	5.52E-01	7.69E-05	2.10E-03	2.09E-02	1.54E-02	5.26E+00	8.49E+00	8.68E-02	5.05E-01	1.05E-02	1.06E-02
2005	8	17	8.21E+00	1.15E+00	3.58E+00	2.72E-01	4.57E-01	8.49E+00	2.61E+00	1.52E+01	4.06E+00	1.75E+00	2.40E+00	1.35E-01	2.18E-01	1.54E+01	1.07E+01	7.99E+00	3.57E-02	3.32E+00	1.87E-02	2.98E-02	8.23E+00	2.60E+00	1.52E+01	1.19E-01	6.00E-02	5.51E-02	6.86E-02	6.09E-02	1.53E+01	1.03E+01	2.16E-01	1.11E+00	2.52E-01	2.53E-01	4.27E-01	2.58E-01	1.04E-02	5.74E-02	3.94E+00	1.69E+00	2.34E+00	6.69E-02	1.57E-01	6.32E-02	3.43E-01
2005	8	18	1.41E+01	8.07E-01	6.67E+00	1.22E-01	1.78E-01	2.40E+01	7.16E+00	2.39E+01	9.16E+00	5.18E+00	2.01E+00	9.86E-01	1.31E+00	2.70E+01	1.75E+01	1.38E+01	1.79E-02	6.18E+00	5.20E-03	9.31E-03	2.36E+01	6.89E+00	2.34E+01	5.77E-01	9.25E-02	3.81E-02	1.76E-01	1.27E-01	2.67E+01	1.69E+01	3.65E-01	7.90E-01	4.89E-01	1.17E-01	1.69E-01	3.55E-01	2.72E-01	5.50E-01	8.58E+00	5.09E+00	1.97E+00	8.10E-01	1.19E+00	2.33E-01	6.06E-01
2005	8	19	2.32E+00	4.18E-01	2.08E+00	9.08E-02	1.39E-01	3.02E+01	1.27E+01	3.57E+01	1.38E+00	2.11E+01	2.28E+00	2.47E+00	3.46E+00	3.23E+01	3.26E+00	2.21E+00	4.07E-02	2.02E+00	1.31E-02	2.44E-02	3.02E+01	1.25E+01	3.41E+01	7.69E-01	2.19E-01	9.87E-02	4.09E-01	3.05E-01	3.21E+01	3.09E+00	1.10E-01	3.77E-01	6.17E-02	7.78E-02	1.15E-01	6.44E-02	1.47E-01	1.57E+00	6.10E-01	2.09E+01	2.18E+00	2.06E+00	3.16E+00	2.23E-01	1.71E-01
2005	8	20	3.65E+00	1.15E-02	2.28E+00	2.14E-03	6.27E-03	2.28E+01	9.60E+00	2.60E+01	6.73E-01	1.19E+01	1.84E-01	1.73E+00	1.70E+00	2.18E+01	4.74E+00	3.57E+00	1.12E-02	2.28E+00	2.06E-03	5.45E-03	2.28E+01	9.51E+00	2.46E+01	5.33E-01	1.14E-01	3.93E-02	2.70E-01	1.77E-01	2.16E+01	4.56E+00	8.42E-02	2.68E-04	4.13E-03	7.08E-05	8.24E-04	7.93E-03	8.99E-02	1.44E+00	1.40E-01	1.18E+01	1.45E-01	1.46E+00	1.52E+00	1.27E-01	1.79E-01
2005	8	21	2.84E+00	5.30E-03	1.80E+00	1.54E-03	7.93E-02	2.12E+01	9.27E+00	2.15E+01	3.18E-01	1.04E+01	1.42E+00	9.09E-01	1.66E+00	3.20E+01	4.47E+00	2.79E+00	5.18E-03	1.79E+00	1.47E-03	4.54E-03	2.12E+01	9.20E+00	2.02E+01	3.08E-01	7.26E-02	2.22E-02	1.92E-01	1.26E-01	3.18E+01	4.35E+00	4.88E-02	1.23E-04	1.68E-03	7.07E-05	7.47E-02	1.29E-02	6.65E-02	1.29E+00	1.09E-02	1.03E+01	1.40E+00	7.17E-01	1.54E+00	1.68E-01	1.14E-01
2005	8	22	9.57E+00	5.88E-02	4.36E+00	8.61E-04	8.25E-03	1.95E+01	5.10E+00	2.56E+01	4.62E+00	5.81E+00	3.58E-01	6.80E-01	7.17E-01	2.96E+01	1.25E+01	9.41E+00	1.39E-02	4.32E+00	7.28E-04	3.44E-03	1.95E+01	5.05E+00	2.51E+01	5.68E-01	1.18E-01	3.95E-02	2.68E-01	1.86E-01	2.95E+01	1.22E+01	1.59E-01	4.49E-02	3.89E-02	1.33E-04	4.81E-03	6.11E-02	4.62E-02	5.48E-01	4.05E+00	5.69E+00	3.19E-01	4.13E-01	5.31E-01	6.28E-02	3.64E-01
2005	8	23	3.37E+00	1.32E-01	8.23E-01	2.54E-01	5.28E-01	1.77E+01	6.74E+00	2.49E+01	9.22E-01	3.61E+00	4.83E+00	1.68E+00	1.69E+00	2.03E+01	5.12E+00	3.28E+00	2.74E-02	7.80E-01	1.79E-02	2.65E-02	1.76E+01	6.62E+00	2.35E+01	5.28E-01	1.61E-01	7.33E-02	2.60E-01	2.11E-01	2.01E+01	4.97E+00	9.13E-02	1.04E-01	4.29E-02	2.36E-01	5.02E-01	8.33E-02	1.24E-01	1.32E+00	3.94E-01	3.45E+00	4.76E+00	1.42E+00	1.48E+00	2.17E-01	1.50E-01
2005	8	24	2.26E+00	2.75E-04	1.32E+00	1.27E-05	5.33E-05	1.94E+01	6.25E+00	3.91E+01	2.09E-01	8.46E+00	2.20E-03	5.26E+00	5.25E+00	2.77E+01	5.35E+00	2.22E+00	2.74E-04	1.32E+00	1.27E-05	5.33E-05	1.94E+01	6.09E+00	3.80E+01	1.90E-01	1.37E-02	1.97E-03	6.73E-02	3.12E-02	2.75E+01	5.25E+00	3.44E-02	3.65E-07	1.55E-03	0.00E+00	0.00E+00	5.28E-03	1.64E-01	1.12E+00	1.81E-02	8.45E+00	2.30E-04	5.20E+00	5.22E+00	1.64E-01	1.01E-01
2005	8	25	1.74E+00	1.10E-03	1.11E+00	7.66E-05	5.63E-04	2.30E+01	1.08E+01	2.50E+01	6.50E-01	1.88E+01	3.29E-02	2.03E+00	1.85E+00	2.76E+01	2.94E+00	1.73E+00	1.10E-03	1.11E+00	7.66E-05	5.61E-04	2.30E+01	1.07E+01	2.38E+01	6.48E-01	9.86E-02	1.80E-02	2.85E-01	1.85E-01	2.74E+01	2.92E+00	5.36E-03	0.00E+00	8.66E-08	0.00E+00	2.48E-06	2.64E-05	8.10E-02	1.19E+00	1.27E-03	1.87E+01	1.49E-02	1.74E+00	1.67E+00	1.41E-01	1.97E-02
2005	8	26	1.74E+00	1.75E-03	1.18E+00	2.00E-04	6.70E-04	2.28E+01	6.27E+00	2.28E+01	4.42E-01	1.05E+01	8.23E-02	1.60E+00	9.55E-01	2.25E+01	2.30E+00	1.73E+00	1.75E-03	1.18E+00	2.00E-04	6.70E-04	2.28E+01	6.18E+00	2.14E+01	4.41E-01	7.09E-02	1.61E-02	2.01E-01	1.27E-01	2.24E+01	2.27E+00	8.45E-03	0.00E+00	4.04E-04	0.00E+00	0.00E+00	1.70E-03	9.02E-02	1.43E+00	9.19E-04	1.04E+01	6.62E-02	1.39E+00	8.28E-01	1.18E-01	2.58E-02
2005	8	27	2.25E+00	3.31E-03	1.57E+00	1.61E-03	1.88E-02	2.86E+01	1.13E+01	3.26E+01	5.43E-01	1.95E+01	3.06E-01	2.13E+00	2.65E+00	2.78E+01	3.37E+00	2.22E+00	3.23E-03	1.57E+00	6.25E-04	2.57E-03	2.86E+01	1.12E+01	3.09E+01	4.98E-01	8.64E-02	2.32E-02	2.52E-01	1.53E-01	2.76E+01	3.29E+00	3.13E-02	8.01E-05	7.49E-04	9.86E-04	1.62E-02	1.68E-03	1.06E-01	1.75E+00	4.52E-02	1.94E+01	2.83E-01	1.88E+00	2.50E+00	1.55E-01	7.53E-02
2005	8	28	8.49E+00	6.99E-01	2.71E+00	4.53E-02	7.84E-02	2.07E+01	7.93E+00	2.56E+01	6.63E-01	7.74E+00	1.44E+00	1.07E+00	1.15E+00	2.84E+01	1.14E+01	8.37E+00	3.14E-02	2.71E+00	4.21E-03	8.29E-03	2.07E+01	7.84E+00	2.45E+01	5.13E-01	1.37E-01	5.52E-02	3.47E-01	2.11E-01	2.83E+01	1.11E+01	1.20E-01	6.67E-01	4.07E-03	4.11E-02	7.01E-02	8.21E-03	8.40E-02	1.14E+00	1.50E-01	7.60E+00	1.38E+00	7.22E-01	9.43E-01	1.28E-01	2.84E-01
2005	8	29	4.35E+00	2.45E-01	8.96E-01	3.46E-01	1.24E-01	1.52E+01	4.55E+00	9.51E+00	6.31E-01	3.19E+00	6.63E+00	5.70E-01	5.07E-01	7.22E+00	5.45E+00	4.24E+00	5.80E-02	8.94E-01	4.01E-02	4.46E-02	1.52E+01	4.54E+00	9.14E+00	6.10E-01	2.51E-01	1.32E-01	2.96E-01	2.70E-01	7.15E+00	5.20E+00	1.11E-01	1.87E-01	1.47E-03	3.06E-01	7.92E-02	5.84E-03	1.10E-02	3.64E-01	2.08E-02	2.94E+00	6.50E+00	2.74E-01	2.37E-01	6.66E-02	2.49E-01
2005	8	30	9.78E-01	0.00E+00	4.73E-01	0.00E+00	0.00E+00	9.88E+00	2.96E+00	1.43E+01	1.33E-01	6.89E+00	2.17E-02	1.01E+00	7.02E-01	1.05E+01	1.51E+00	9.24E-01	0.00E+00	4.73E-01	0.00E+00	0.00E+00	9.88E+00	2.91E+00	1.34E+01	1.26E-01	7.59E-03	4.07E-04	6.07E-02	2.81E-02	1.05E+01	1.37E+00	5.36E-02	0.00E+00	1.59E-04	0.00E+00	0.00E+00	2.19E-03	5.15E-02	9.34E-01	6.80E-03	6.88E+00	2.13E-02	9.51E-01	6.74E-01	4.58E-02	1.38E-01
2005	8	31	2.66E+00	3.20E-03	1.26E+00	1.26E-04	8.48E-04	1.82E+01	7.97E+00	2.28E+01	3.78E-01	1.42E+01	4.34E-02	1.50E+00	1.47E+00	2.32E+01	4.52E+00	2.62E+00	3.20E-03	1.26E+00	1.26E-04	8.48E-04	1.82E+01	7.90E+00	2.16E+01	3.65E-01	5.07E-02	1.44E-02	1.43E-01	8.99E-02	2.31E+01	4.41E+00	4.37E-02	0.00E+00	9.64E-04	0.00E+00	0.00E+00	8.74E-03	6.91E-02	1.15E+00	1.33E-02	1.42E+01	2.90E-02	1.36E+00	1.38E+00	9.81E-02	1.07E-01
2005	9	1	2.98E+00	2.98E-03	1.16E+00	8.33E-04	8.42E-03	2.64E+01	1.24E+01	2.68E+01	5.83E-01	1.46E+01	4.99E-01	1.79E+00	1.86E+00	2.82E+01	3.88E+00	2.98E+00	2.97E-03	1.16E+00	8.25E-04	4.52E-03	2.64E+01	1.23E+01	2.50E+01	5.81E-01	1.19E-01	3.16E-02	3.04E-01	2.20E-01	2.80E+01	3.87E+00	1.35E-03	1.40E-05	8.42E-05	7.32E-06	3.90E-03	3.27E-04	1.08E-01	1.80E+00	2.12E-03	1.45E+01	4.67E-01	1.49E+00	1.64E+00	1.33E-01	3.64E-03
2005	9	2	6.79E+00	7.24E-02	2.83E+00	3.66E-01	6.70E-01	2.79E+01	1.31E+01	2.82E+01	7.63E-01	9.84E+00	1.16E+01	1.14E+00	1.90E+00	3.05E+01	8.52E+00	6.76E+00	3.75E-02	2.83E+00	2.73E-02	4.89E-02	2.79E+01	1.30E+01	2.69E+01	7.36E-01	2.50E-01	1.19E-01	4.73E-01	3.46E-01	3.03E+01	8.43E+00	3.11E-02	3.49E-02	8.49E-04	3.39E-01	6.21E-01	2.44E-03	5.98E-02	1.32E+00	2.66E-02	9.59E+00	1.15E+01	6.70E-01	1.55E+00	2.08E-01	8.33E-02
2005	9	3	2.00E+00	7.46E-03	7.63E-01	3.82E-03	5.82E-02	1.33E+01	8.12E+00	2.01E+01	4.07E-01	6.31E+00	1.14E+00	1.13E+00	1.51E+00	1.28E+01	3.13E+00	2.00E+00	7.43E-03	7.63E-01	3.65E-03	1.22E-02	1.33E+01	8.03E+00	1.92E+01	4.04E-01	1.22E-01	4.54E-02	2.59E-01	1.88E-01	1.27E+01	3.13E+00	2.98E-03	2.31E-05	4.93E-05	1.62E-04	4.59E-02	1.83E-04	9.48E-02	8.41E-01	2.61E-03	6.19E+00	1.09E+00	8.68E-01	1.33E+00	7.96E-02	6.28E-03
2005	9	4	6.57E+00	2.05E-01	2.33E+00	9.94E-02	3.52E-01	2.05E+01	1.11E+01	2.31E+01	1.18E+00	9.67E+00	4.82E+00	1.01E+00	1.88E+00	2.00E+01	1.01E+01	6.55E+00	5.55E-02	2.32E+00	1.72E-02	3.22E-02	2.04E+01	1.11E+01	2.21E+01	6.15E-01	1.70E-01	1.07E-01	2.26E-01	1.86E-01	2.00E+01	1.00E+01	1.72E-02	1.49E-01	7.39E-03	8.22E-02	3.20E-01	3.80E-02	5.93E-02	9.96E-01	5.64E-01	9.50E+00	4.71E+00	7.82E-01	1.70E+00	4.72E-02	5.51E-02
2005	9	5	6.96E+00	6.42E-01	3.10E+00	1.02E-01	1.73E-01	2.40E+01	1.49E+01	2.84E+01	1.77E+00	2.20E+01	4.25E+00	2.65E+00	3.46E+00	2.85E+01	9.21E+00	6.83E+00	3.28E-02	3.06E+00	8.34E-03	1.58E-02	2.39E+01	1.47E+01	2.70E+01	5.49E-01	1.33E-01	6.72E-02	3.11E-01	1.94E-01	2.84E+01	8.99E+00	1.29E-01	6.09E-01	3.96E-02	9.40E-02	1.57E-01	6.41E-02	1.61E-01	1.38E+00	1.22E+00	2.18E+01	4.18E+00	2.34E+00	3.27E+00	9.94E-02	2.27E-01
2005	9	6	8.59E+00	7.14E-01	3.85E+00	1.21E-01	1.61E-01	3.23E+01	1.27E+01	4.51E+01	3.34E+00	1.24E+01	1.50E+00	4.76E+00	5.33E+00	3.36E+01	1.14E+01	8.24E+00	3.62E-02	3.71E+00	1.31E-02	2.06E-02	3.21E+01	1.20E+01	4.34E+01	9.34E-01	1.89E-01	7.78E-02	3.79E-01	2.67E-01	3.32E+01	1.09E+01	3.48E-01	6.78E-01	1.44E-01	1.08E-01	1.40E-01	2.07E-01	6.66E-01	1.72E+00	2.41E+00	1.22E+01	1.43E+00	4.38E+00	5.06E+00	4.34E-01	4.89E-01
2005	9	7	7.77E+00	1.19E+00	3.53E+00	1.90E-01	3.04E-01	2.48E+01	1.47E+01	3.18E+01	2.58E+00	1.65E+01	4.61E+00	1.94E+00	2.90E+00	2.69E+01	9.87E+00	7.68E+00	8.17E-02	3.50E+00	2.68E-02	4.30E-02	2.48E+01	1.46E+01	3.10E+01	1.05E+00	3.14E-01	1.58E-01	5.50E-01	4.12E-01	2.68E+01	9.65E+00	8.93E-02	1.11E+00	3.18E-02	1.64E-01	2.61E-01	5.00E-02	5.45E-02	8.62E-01	1.53E+00	1.62E+01	4.45E+00	1.39E+00	2.49E+00	9.96E-02	2.22E-01
2005	9	8	3.51E+00	3.70E-03	1.61E+00	1.53E-03	1.65E-01	1.75E+01	1.01E+01	2.41E+01	6.58E-01	1.25E+01	2.09E+00	1.36E+00	1.43E+00	1.65E+01	5.45E+00	3.38E+00	3.69E-03	1.61E+00	1.23E-03	5.67E-03	1.75E+01	1.00E+01	2.30E+01	6.43E-01	1.25E-01	2.80E-02	2.64E-01	2.21E-01	1.64E+01	5.17E+00	1.33E-01	8.90E-06	3.98E-04	3.04E-04	1.60E-01	1.27E-03	8.00E-02	1.15E+00	1.46E-02	1.24E+01	2.06E+00	1.10E+00	1.21E+00	6.06E-02	2.79E-01
2005	9	9	1.25E+01	3.23E-01	7.61E+00	1.93E-01	2.66E-01	1.37E+01	4.64E+00	1.57E+01	1.16E+01	2.63E+00	1.87E+00	3.85E-01	5.68E-01	2.17E+01	1.47E+01	1.22E+01	3.18E-02	7.03E+00	1.36E-02	1.53E-02	1.31E+01	4.59E+00	1.54E+01	2.08E-01	5.61E-02	3.48E-02	6.63E-02	6.11E-02	2.17E+01	1.44E+01	3.21E-01	2.91E-01	5.78E-01	1.79E-01	2.51E-01	5.22E-01	5.21E-02	2.35E-01	1.14E+01	2.57E+00	1.84E+00	3.19E-01	5.07E-01	7.59E-02	3.33E-01
2005	9	10	4.99E+00	1.02E-04	2.14E+00	3.32E-06	1.90E-05	1.90E+01	4.19E+00	2.63E+01	8.65E-01	1.10E+01	8.58E-04	2.28E+00	2.13E+00	2.36E+01	5.84E+00	4.47E+00	1.02E-04	2.03E+00	3.32E-06	1.90E-05	1.87E+01	3.77E+00	2.48E+01	3.74E-02	2.41E-03	4.40E-04	1.41E-02	6.46E-03	2.32E+01	5.24E+00	5.25E-01	3.42E-13	1.17E-01	0.00E+00	0.00E+00	2.53E-01	4.20E-01	1.49E+00	8.28E-01	1.10E+01	4.18E-04	2.26E+00	2.12E+00	4.15E-01	5.99E-01
2005	9	11	1.75E+00	5.69E-04	6.77E-01	6.77E-05	1.94E-04	1.79E+01	8.15E+00	2.20E+01	1.54E-01	1.59E+01	3.09E-01	1.85E+00	2.86E+00	3.02E+01	2.98E+00	1.75E+00	5.69E-04	6.77E-01	6.77E-05	1.89E-04	1.79E+01	8.10E+00	2.07E+01	1.48E-01	1.82E-02	2.18E-03	5.64E-02	3.53E-02	3.00E+01	2.98E+00	1.64E-06	0.00E+00	0.00E+00	0.00E+00	5.27E-06	1.89E-05	4.64E-02	1.29E+00	5.99E-03	1.58E+01	3.06E-01	1.80E+00	2.83E+00	1.90E-01	4.11E-04
2005	9	12	1.01E+01	9.08E-03	4.74E+00	7.12E-04	2.93E-03	2.65E+01	4.89E+00	3.10E+01	3.07E+00	6.50E+00	2.57E-01	5.97E-01	1.46E+00	2.77E+01	1.25E+01	9.63E+00	8.26E-03	4.54E+00	6.89E-04	2.03E-03	2.63E+01	4.76E+00	3.01E+01	4.67E-01	1.02E-01	3.09E-02	1.46E-01	1.21E-01	2.74E+01	1.17E+01	4.29E-01	8.24E-04	2.05E-01	2.22E-05	9.07E-04	1.62E-01	1.26E-01	9.12E-01	2.60E+00	6.40E+00	2.26E-01	4.51E-01	1.34E+00	3.56E-01	7.66E-01
2005	9	13	3.99E+00	1.71E-01	2.82E+00	4.78E-02	7.95E-02	1.96E+01	1.09E+01	2.22E+01	2.19E+00	2.11E+01	5.49E-01	3.35E+00	3.92E+00	2.19E+01	4.97E+00	3.67E+00	6.03E-02	2.62E+00	2.36E-02	3.74E-02	1.94E+01	1.06E+01	2.10E+01	5.58E-01	1.90E-01	1.09E-01	3.42E-01	2.47E-01	2.15E+01	4.49E+00	3.13E-01	1.10E-01	2.02E-01	2.41E-02	4.21E-02	1.70E-01	3.13E-01	1.25E+00	1.63E+00	2.09E+01	4.40E-01	3.00E+00	3.67E+00	3.76E-01	4.83E-01
2005	9	14	3.02E+00	8.81E-03	2.21E+00	1.42E-03	4.31E-03	1.82E+01	8.77E+00	2.47E+01	4.67E-01	1.41E+01	3.84E-01	1.37E+00	1.31E+00	2.34E+01	5.04E+00	2.93E+00	7.99E-03	2.21E+00	1.38E-03	3.90E-03	1.82E+01	8.72E+00	2.34E+01	4.12E-01	7.33E-02	2.44E-02	1.73E-01	1.26E-01	2.33E+01	4.77E+00	8.72E-02	8.14E-04	2.55E-03	4.35E-05	4.15E-04	1.26E-02	5.53E-02	1.25E+00	5.54E-02	1.40E+01	3.59E-01	1.19E+00	1.18E+00	8.79E-02	2.68E-01
2005	9	15	1.46E+01	1.13E+00	6.14E+00	2.06E-01	2.17E-01	1.86E+01	5.92E+00	2.49E+01	7.82E+00	4.26E+00	1.72E+00	6.70E-01	1.15E+00	3.31E+01	1.98E+01	1.43E+01	4.88E-02	5.92E+00	1.92E-02	2.45E-02	1.84E+01	5.83E+00	2.45E+01	6.62E-01	1.75E-01	7.44E-02	2.72E-01	2.18E-01	3.30E+01	1.94E+01	2.50E-01	1.08E+00	2.24E-01	1.87E-01	1.93E-01	2.42E-01	9.79E-02	3.88E-01	7.16E+00	4.08E+00	1.64E+00	3.98E-01	9.34E-01	1.23E-01	3.95E-01
2005	9	16	1.60E+01	3.14E-01	9.56E+00	4.36E-02	7.66E-02	1.91E+01	4.02E+00	2.28E+01	1.11E+01	1.03E+00	5.93E-01	6.53E-01	6.67E-01	2.38E+01	2.05E+01	1.55E+01	4.40E-02	8.73E+00	1.14E-02	1.74E-02	1.83E+01	3.79E+00	2.24E+01	5.58E-01	1.24E-01	6.60E-02	1.98E-01	1.54E-01	2.34E+01	1.99E+01	4.86E-01	2.70E-01	8.37E-01	3.22E-02	5.92E-02	7.99E-01	2.23E-01	4.31E-01	1.05E+01	9.06E-01	5.27E-01	4.55E-01	5.14E-01	3.16E-01	6.46E-01
2005	9	17	6.72E+00	8.66E-01	3.10E+00	3.82E-01	4.99E-01	2.49E+01	1.40E+01	3.21E+01	3.64E+00	2.44E+01	8.61E+00	2.97E+00	5.06E+00	2.14E+01	1.00E+01	6.30E+00	4.86E-02	2.69E+00	2.12E-02	3.84E-02	2.46E+01	1.37E+01	3.04E+01	1.18E+00	3.14E-01	1.21E-01	6.73E-01	4.76E-01	2.10E+01	9.52E+00	4.16E-01	8.17E-01	4.03E-01	3.61E-01	4.60E-01	3.33E-01	3.50E-01	1.62E+00	2.46E+00	2.41E+01	8.49E+00	2.29E+00	4.58E+00	3.67E-01	5.12E-01
2005	9	18	2.28E+00	6.57E-03	1.92E+00	1.00E-03	2.14E-03	1.61E+01	7.20E+00	1.68E+01	3.19E-01	1.17E+01	1.88E-01	1.66E+00	9.18E-01	1.95E+01	3.24E+00	2.18E+00	6.56E-03	1.91E+00	1.00E-03	2.14E-03	1.61E+01	7.13E+00	1.58E+01	3.17E-01	7.32E-02	2.29E-02	1.77E-01	1.17E-01	1.94E+01	3.02E+00	9.50E-02	4.65E-06	6.98E-03	3.80E-08	4.37E-06	1.58E-02	7.31E-02	9.63E-01	2.30E-03	1.16E+01	1.65E-01	1.48E+00	8.01E-01	5.20E-02	2.25E-01
2005	9	19	3.03E-01	0.00E+00	7.41E-02	0.00E+00	0.00E+00	4.37E+00	2.23E+00	4.67E+00	7.62E-04	3.51E+00	1.45E-01	5.16E-01	5.50E-01	3.80E+00	7.70E-01	3.03E-01	0.00E+00	7.41E-02	0.00E+00	0.00E+00	4.37E+00	2.21E+00	4.47E+00	7.62E-04	2.25E-05	0.00E+00	4.21E-03	5.44E-04	3.80E+00	7.70E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-02	1.97E-01	2.01E-19	3.51E+00	1.45E-01	5.12E-01	5.50E-01	2.17E-05	0.00E+00
2005	9	20	7.94E+00	4.91E-03	3.60E+00	2.95E-04	1.86E-03	1.51E+01	1.22E+01	2.29E+01	5.38E-01	1.44E+01	3.21E-01	1.72E+00	2.38E+00	2.22E+01	1.03E+01	7.91E+00	4.76E-03	3.57E+00	2.86E-04	1.39E-03	1.50E+01	1.22E+01	2.23E+01	2.55E-01	4.73E-02	1.59E-02	1.05E-01	7.05E-02	2.22E+01	1.02E+01	2.64E-02	1.55E-04	2.85E-02	9.19E-06	4.68E-04	1.07E-01	5.58E-02	5.98E-01	2.84E-01	1.43E+01	3.05E-01	1.61E+00	2.31E+00	1.51E-02	8.81E-02
2005	9	21	8.93E+00	9.80E-01	3.24E+00	1.41E-01	2.23E-01	2.75E+01	1.06E+01	4.00E+01	2.62E+00	1.40E+01	2.65E+00	6.19E+00	7.39E+00	4.08E+01	1.36E+01	8.75E+00	3.09E-02	3.22E+00	4.59E-03	7.86E-03	2.75E+01	9.75E+00	3.86E+01	7.75E-01	1.40E-01	5.45E-02	2.82E-01	1.93E-01	4.06E+01	1.33E+01	1.77E-01	9.49E-01	2.44E-02	1.37E-01	2.15E-01	3.91E-02	8.11E-01	1.34E+00	1.84E+00	1.38E+01	2.60E+00	5.91E+00	7.20E+00	2.62E-01	3.25E-01
2005	9	22	9.12E+00	6.50E-01	4.14E+00	3.46E-01	6.89E-01	2.33E+01	9.97E+00	1.92E+01	9.17E+00	1.98E+01	4.88E+00	1.95E+00	4.02E+00	2.27E+01	1.21E+01	9.02E+00	9.34E-02	3.32E+00	4.87E-02	7.55E-02	2.26E+01	9.90E+00	1.85E+01	8.83E-01	3.11E-01	1.83E-01	4.89E-01	3.87E-01	2.26E+01	1.20E+01	1.03E-01	5.57E-01	8.16E-01	2.98E-01	6.14E-01	7.15E-01	6.70E-02	6.98E-01	8.29E+00	1.95E+01	4.70E+00	1.46E+00	3.63E+00	1.34E-01	1.85E-01
2005	9	23	1.59E+01	1.11E+00	9.62E+00	2.03E-01	2.83E-01	2.59E+01	5.83E+00	2.43E+01	1.15E+01	2.63E+00	6.62E+00	4.46E-01	4.65E-01	2.61E+01	1.91E+01	1.54E+01	4.67E-02	7.84E+00	1.55E-02	2.71E-02	2.42E+01	5.81E+00	2.39E+01	7.09E-01	1.86E-01	9.61E-02	3.19E-01	2.44E-01	2.60E+01	1.83E+01	5.27E-01	1.06E+00	1.78E+00	1.87E-01	2.56E-01	1.75E+00	1.30E-02	4.57E-01	1.08E+01	2.45E+00	6.52E+00	1.27E-01	2.20E-01	1.19E-01	7.66E-01
2005	9	24	4.25E+00	9.37E-01	2.39E+00	1.21E-01	1.53E-01	2.80E+01	1.23E+01	3.72E+01	1.46E+00	9.19E+00	4.61E+00	2.84E+00	2.34E+00	3.60E+01	6.58E+00	3.49E+00	4.20E-02	2.25E+00	1.45E-02	1.81E-02	2.77E+01	1.14E+01	3.46E+01	6.67E-01	1.58E-01	6.99E-02	3.35E-01	2.27E-01	3.49E+01	5.63E+00	7.56E-01	8.95E-01	1.37E-01	1.07E-01	1.35E-01	2.32E-01	9.54E-01	2.54E+00	7.94E-01	9.04E+00	4.54E+00	2.51E+00	2.12E+00	1.14E+00	9.45E-01
2005	9	25	4.11E+00	5.26E-03	2.54E+00	6.37E-04	1.56E-03	1.55E+01	7.74E+00	1.83E+01	2.22E-01	1.48E+01	4.32E-02	1.49E+00	7.07E-01	1.97E+01	6.03E+00	4.06E+00	5.23E-03	2.51E+00	6.37E-04	1.55E-03	1.55E+01	7.67E+00	1.76E+01	2.10E-01	4.16E-02	1.35E-02	1.18E-01	7.24E-02	1.96E+01	5.88E+00	5.14E-02	3.32E-05	2.19E-02	0.00E+00	7.00E-06	5.64E-02	6.91E-02	6.77E-01	1.12E-02	1.47E+01	2.97E-02	1.37E+00	6.35E-01	2.98E-02	1.52E-01
2005	9	26	4.13E+00	1.24E-03	1.28E+00	7.80E-05	7.02E-04	9.49E+00	4.73E+00	1.24E+01	4.02E-01	7.34E+00	1.48E-01	7.37E-01	1.09E+00	1.10E+01	6.68E+00	4.10E+00	1.19E-03	1.27E+00	7.46E-05	6.69E-04	9.44E+00	4.70E+00	1.22E+01	3.70E-01	6.10E-02	1.25E-02	9.97E-02	9.61E-02	1.10E+01	6.58E+00	2.91E-02	5.10E-05	1.65E-02	3.46E-06	3.28E-05	5.12E-02	3.34E-02	1.99E-01	3.19E-02	7.28E+00	1.36E-01	6.37E-01	9.90E-01	9.61E-03	9.47E-02
2005	9	27	7.40E+00	1.28E+00	4.26E+00	2.80E-01	3.97E-01	1.52E+01	6.36E+00	1.77E+01	2.74E+00	3.08E+00	7.37E+00	3.46E-01	4.37E-01	2.09E+01	9.57E+00	7.33E+00	4.02E-02	4.10E+00	1.30E-02	2.18E-02	1.51E+01	6.34E+00	1.75E+01	4.97E-01	1.53E-01	7.77E-02	2.71E-01	2.00E-01	2.08E+01	9.44E+00	6.53E-02	1.24E+00	1.53E-01	2.67E-01	3.75E-01	7.24E-02	2.50E-02	2.31E-01	2.25E+00	2.92E+00	7.29E+00	7.47E-02	2.37E-01	5.06E-02	1.34E-01
2005	9	28	1.59E+00	1.96E-02	8.25E-01	8.25E-03	1.82E-02	9.20E+00	4.80E+00	1.53E+01	3.70E-01	8.42E+00	1.94E-01	1.31E+00	1.05E+00	1.09E+01	2.26E+00	1.58E+00	1.94E-02	8.25E-01	7.15E-03	1.20E-02	9.20E+00	4.72E+00	1.42E+01	3.27E-01	8.43E-02	4.12E-02	1.95E-01	1.28E-01	1.08E+01	2.20E+00	1.14E-02	1.88E-04	2.98E-04	1.10E-03	6.19E-03	5.07E-04	7.85E-02	1.08E+00	4.29E-02	8.34E+00	1.53E-01	1.11E+00	9.21E-01	6.42E-02	5.78E-02
2005	9	29	8.02E-01	2.63E-05	2.64E-01	1.11E-05	2.20E-03	5.45E+00	9.59E-01	4.35E+00	7.03E-02	1.86E+00	3.67E-01	1.87E-01	3.89E-01	3.45E+00	1.69E+00	8.01E-01	2.63E-05	2.64E-01	1.11E-05	3.87E-04	5.45E+00	9.58E-01	4.26E+00	7.03E-02	2.15E-02	5.70E-03	2.09E-02	9.83E-03	3.45E+00	1.69E+00	2.48E-04	0.00E+00	0.00E+00	0.00E+00	1.81E-03	0.00E+00	1.17E-03	9.51E-02	2.88E-05	1.84E+00	3.61E-01	1.66E-01	3.79E-01	2.45E-04	1.89E-03
2005	9	30	5.48E+00	1.21E+00	1.99E+00	3.23E-01	3.34E-01	1.72E+01	8.17E+00	1.82E+01	6.84E-01	7.63E+00	1.02E+01	7.19E-01	1.16E+00	1.56E+01	7.67E+00	5.41E+00	9.67E-02	1.98E+00	2.94E-02	4.34E-02	1.72E+01	8.16E+00	1.78E+01	5.53E-01	2.10E-01	1.39E-01	2.81E-01	2.33E-01	1.56E+01	7.48E+00	6.79E-02	1.11E+00	1.11E-03	2.94E-01	2.91E-01	9.23E-03	7.59E-03	3.23E-01	1.31E-01	7.42E+00	1.00E+01	4.38E-01	9.23E-01	1.70E-02	1.88E-01
2005	10	1	1.33E+00	1.13E-02	2.81E-01	1.74E-01	2.31E-01	2.60E+00	6.71E-01	3.13E+00	1.22E-01	2.10E+00	1.76E+00	1.58E-01	4.36E-01	2.45E+00	2.11E+00	1.19E+00	7.50E-03	2.75E-01	1.17E-02	1.65E-02	2.58E+00	6.65E-01	2.77E+00	1.09E-01	3.52E-02	2.22E-02	4.34E-02	3.95E-02	2.43E+00	1.82E+00	1.38E-01	3.77E-03	6.08E-03	1.62E-01	2.15E-01	2.42E-02	5.64E-03	3.61E-01	1.38E-02	2.07E+00	1.74E+00	1.15E-01	3.96E-01	1.53E-02	2.93E-01
2005	10	2	3.38E+00	7.17E-03	2.04E+00	5.29E-04	1.81E-03	4.24E+00	2.56E+00	6.34E+00	1.99E+00	7.67E+00	1.17E-01	9.71E-01	1.35E+00	5.33E+00	4.21E+00	3.18E+00	4.10E-03	1.95E+00	4.73E-04	1.56E-03	4.07E+00	2.53E+00	5.87E+00	1.61E-01	3.73E-02	1.54E-02	5.62E-02	4.43E-02	5.29E+00	3.75E+00	1.99E-01	3.08E-03	8.99E-02	5.64E-05	2.47E-04	1.71E-01	2.80E-02	4.74E-01	1.83E+00	7.63E+00	1.02E-01	9.15E-01	1.30E+00	4.58E-02	4.66E-01
2005	10	3	3.57E+00	1.32E-03	2.00E+00	7.01E-05	1.68E-04	2.98E+00	2.71E-02	2.03E+00	4.54E+00	8.02E-03	2.93E-03	9.01E-03	7.59E-03	3.70E+00	4.42E+00	3.29E+00	8.02E-04	1.74E+00	6.75E-05	1.58E-04	2.80E+00	2.52E-02	2.02E+00	3.41E-02	3.70E-03	1.49E-03	5.69E-03	4.69E-03	3.70E+00	3.81E+00	2.83E-01	5.15E-04	2.64E-01	2.66E-06	9.46E-06	1.80E-01	1.87E-03	5.94E-03	4.51E+00	4.32E-03	1.44E-03	3.32E-03	2.89E-03	4.37E-03	6.06E-01
2005	10	4	3.50E+00	5.04E-01	1.56E+00	2.10E-02	2.43E-02	3.44E+00	8.03E-01	3.87E+00	7.29E+00	4.59E-01	2.64E+00	5.94E-02	9.80E-02	5.04E+00	4.57E+00	3.19E+00	7.67E-03	1.48E+00	1.48E-03	2.54E-03	3.35E+00	8.01E-01	3.71E+00	1.11E-01	2.80E-02	1.31E-02	5.05E-02	3.70E-02	5.01E+00	4.01E+00	3.09E-01	4.96E-01	7.52E-02	1.95E-02	2.18E-02	9.04E-02	2.93E-03	1.57E-01	7.18E+00	4.31E-01	2.62E+00	8.92E-03	6.10E-02	3.16E-02	5.59E-01
2005	10	5	3.14E+00	6.72E-01	1.54E+00	1.89E-01	2.93E-01	4.18E+00	2.90E+00	6.71E+00	2.79E+00	1.86E+01	2.75E+00	1.95E+00	2.28E+00	6.07E+00	4.07E+00	3.00E+00	2.72E-02	1.51E+00	1.22E-02	1.88E-02	4.12E+00	2.81E+00	5.73E+00	2.05E-01	7.99E-02	4.54E-02	1.40E-01	1.06E-01	5.93E+00	3.80E+00	1.44E-01	6.45E-01	3.05E-02	1.77E-01	2.75E-01	5.46E-02	8.87E-02	9.74E-01	2.59E+00	1.85E+01	2.71E+00	1.81E+00	2.18E+00	1.45E-01	2.78E-01
2005	10	6	4.02E-01	2.37E-06	7.94E-02	2.96E-06	1.61E-05	9.06E-01	8.57E-01	1.86E+00	1.78E-02	5.18E+00	7.55E-02	1.02E+00	4.35E-01	1.53E+00	5.73E-01	4.02E-01	2.21E-06	7.94E-02	2.69E-06	4.45E-06	9.06E-01	7.73E-01	1.50E+00	1.04E-02	6.12E-04	3.80E-05	4.55E-03	2.73E-03	1.50E+00	5.73E-01	4.61E-04	1.63E-07	2.65E-05	2.64E-07	1.16E-05	7.68E-06	8.40E-02	3.59E-01	7.40E-03	5.18E+00	7.55E-02	1.01E+00	4.33E-01	3.11E-02	7.69E-04
2005	10	7	5.97E-02	0.00E+00	2.35E-02	0.00E+00	3.06E-06	6.87E-01	3.79E-01	1.65E+00	1.26E-03	1.83E+00	7.21E-02	3.72E-01	3.12E-01	7.40E-01	1.27E-01	5.97E-02	0.00E+00	2.35E-02	0.00E+00	0.00E+00	6.87E-01	3.61E-01	1.09E+00	1.26E-03	1.24E-04	0.00E+00	4.80E-03	1.55E-03	7.40E-01	1.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-06	0.00E+00	1.73E-02	5.63E-01	4.28E-22	1.83E+00	7.21E-02	3.68E-01	3.10E-01	0.00E+00	0.00E+00
2005	10	8	1.46E+00	5.74E-03	8.62E-01	2.66E-02	1.24E-01	4.58E+00	3.42E+00	8.58E+00	3.69E-01	1.76E+01	5.33E-01	1.58E+00	2.26E+00	6.24E+00	2.19E+00	1.39E+00	5.04E-03	8.51E-01	5.53E-04	1.95E-03	4.55E+00	3.35E+00	7.50E+00	1.90E-01	4.25E-02	1.62E-02	9.69E-02	6.49E-02	6.14E+00	1.95E+00	7.78E-02	7.04E-04	1.01E-02	2.60E-02	1.22E-01	3.42E-02	6.47E-02	1.08E+00	1.78E-01	1.76E+01	5.16E-01	1.48E+00	2.19E+00	9.78E-02	2.46E-01
2005	10	9	1.08E+00	4.04E-02	5.98E-01	1.91E-01	2.14E-01	4.97E+00	3.62E+00	9.97E+00	1.99E-01	1.09E+01	5.85E+00	3.67E+00	4.33E+00	5.77E+00	1.72E+00	1.07E+00	5.51E-03	5.87E-01	1.73E-03	4.50E-03	4.92E+00	3.19E+00	8.23E+00	1.70E-01	4.28E-02	1.78E-02	8.88E-02	6.28E-02	5.62E+00	1.68E+00	1.77E-02	3.49E-02	1.09E-02	1.89E-01	2.09E-01	4.57E-02	4.26E-01	1.74E+00	2.89E-02	1.09E+01	5.83E+00	3.58E+00	4.26E+00	1.54E-01	4.03E-02
2005	10	10	5.95E-02	0.00E+00	7.70E-04	0.00E+00	0.00E+00	3.71E-01	3.28E-01	1.03E+00	1.56E-16	3.53E+00	1.29E-02	4.31E-01	2.81E-01	6.37E-01	1.02E-01	5.95E-02	0.00E+00	7.70E-04	0.00E+00	0.00E+00	3.71E-01	2.81E-01	7.79E-01	0.00E+00	0.00E+00	0.00E+00	4.01E-06	8.90E-09	6.33E-01	1.02E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E-02	2.47E-01	1.56E-16	3.53E+00	1.29E-02	4.31E-01	2.81E-01	3.96E-03	0.00E+00
2005	10	11	1.31E+00	1.02E+00	5.64E-01	1.15E-01	1.26E-01	3.28E+00	2.57E+00	5.09E+00	5.94E-01	9.15E+00	3.54E+00	1.19E+00	1.40E+00	4.56E+00	1.68E+00	1.27E+00	1.13E-02	5.54E-01	4.28E-03	6.57E-03	3.25E+00	2.50E+00	4.23E+00	1.60E-01	4.55E-02	2.16E-02	9.70E-02	6.40E-02	4.47E+00	1.60E+00	3.86E-02	1.01E+00	1.05E-02	1.11E-01	1.19E-01	3.16E-02	6.93E-02	8.56E-01	4.34E-01	9.10E+00	3.52E+00	1.09E+00	1.34E+00	9.27E-02	8.78E-02
2005	10	12	1.28E-01	9.72E-03	1.24E-01	1.28E-02	2.16E-02	1.40E+00	1.15E+00	3.60E+00	4.52E-02	3.08E+00	1.52E-01	1.16E+00	4.20E-01	1.92E+00	1.91E-01	1.28E-01	6.75E-04	1.24E-01	3.36E-04	8.38E-04	1.40E+00	1.09E+00	2.44E+00	4.37E-02	1.11E-02	3.72E-03	3.32E-02	1.96E-02	1.91E+00	1.91E-01	9.18E-05	9.05E-03	2.98E-05	1.25E-02	2.08E-02	4.58E-05	5.58E-02	1.16E+00	1.50E-03	3.07E+00	1.48E-01	1.13E+00	4.00E-01	1.42E-02	1.14E-04
2005	10	13	4.04E-01	3.20E-05	1.67E-01	0.00E+00	6.30E-07	1.65E+00	1.02E+00	3.13E+00	8.32E-02	3.59E+00	5.71E-02	6.59E-01	3.87E-01	2.33E+00	8.04E-01	3.71E-01	3.20E-05	1.64E-01	0.00E+00	6.30E-07	1.64E+00	9.61E-01	2.02E+00	4.17E-02	3.63E-03	3.28E-04	5.35E-03	8.62E-03	2.31E+00	6.96E-01	3.25E-02	0.00E+00	3.18E-03	0.00E+00	0.00E+00	1.07E-02	5.68E-02	1.10E+00	4.15E-02	3.59E+00	5.68E-02	6.54E-01	3.79E-01	1.69E-02	1.08E-01
2005	10	14	2.79E+00	5.90E-01	2.01E+00	3.12E-02	5.38E-02	5.68E+00	2.56E+00	7.05E+00	2.46E+00	1.19E+01	7.44E-01	1.26E+00	1.01E+00	7.03E+00	4.05E+00	2.49E+00	1.03E-02	1.88E+00	5.23E-03	8.12E-03	5.59E+00	2.49E+00	5.84E+00	2.22E-01	5.97E-02	2.83E-02	1.07E-01	8.14E-02	6.88E+00	3.39E+00	3.08E-01	5.79E-01	1.28E-01	2.60E-02	4.56E-02	9.20E-02	7.12E-02	1.21E+00	2.24E+00	1.19E+01	7.15E-01	1.15E+00	9.31E-01	1.54E-01	6.54E-01
2005	10	15	1.62E+00	4.16E-01	7.42E-01	6.41E-02	1.12E-01	2.76E+00	9.15E-01	2.56E+00	1.19E+00	1.58E+00	2.49E+00	2.96E-01	3.56E-01	1.97E+00	2.09E+00	1.45E+00	1.92E-02	6.74E-01	8.39E-03	1.14E-02	2.70E+00	8.84E-01	2.30E+00	1.55E-01	6.06E-02	3.36E-02	9.32E-02	7.51E-02	1.90E+00	1.82E+00	1.69E-01	3.97E-01	6.82E-02	5.57E-02	1.00E-01	6.03E-02	3.12E-02	2.62E-01	1.04E+00	1.52E+00	2.45E+00	2.03E-01	2.81E-01	7.68E-02	2.75E-01
2005	10	16	1.08E-02	0.00E+00	9.58E-03	0.00E+00	6.57E-05	3.79E-01	2.27E-01	6.87E-01	2.34E-17	1.05E+00	9.54E-02	2.18E-01	3.01E-01	3.84E-01	1.88E-02	1.08E-02	0.00E+00	9.58E-03	0.00E+00	0.00E+00	3.79E-01	2.24E-01	5.73E-01	0.00E+00	0.00E+00	0.00E+00	2.53E-04	1.21E-06	3.84E-01	1.88E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.57E-05	0.00E+00	2.47E-03	1.14E-01	2.34E-17	1.05E+00	9.54E-02	2.18E-01	3.01E-01	0.00E+00	0.00E+00
2005	10	17	2.56E-01	1.59E-06	1.03E-01	0.00E+00	2.89E-05	1.40E+00	2.46E-01	1.52E+00	6.69E-02	9.64E-01	1.05E-01	5.37E-02	4.85E-01	1.02E+00	5.28E-01	2.55E-01	1.59E-06	1.03E-01	0.00E+00	1.22E-05	1.40E+00	2.46E-01	1.45E+00	5.91E-02	1.09E-02	1.09E-03	1.30E-02	1.37E-02	1.02E+00	5.26E-01	3.33E-04	0.00E+00	0.00E+00	0.00E+00	1.67E-05	6.63E-04	1.39E-04	7.35E-02	7.89E-03	9.53E-01	1.04E-01	4.07E-02	4.71E-01	3.40E-05	1.91E-03
2005	10	18	2.77E+00	1.48E+00	1.26E+00	1.20E-01	1.67E-01	4.84E+00	2.69E+00	7.41E+00	1.03E+00	1.03E+01	2.74E+00	1.55E+00	2.11E+00	5.42E+00	3.70E+00	2.70E+00	2.57E-02	1.24E+00	1.05E-02	1.49E-02	4.78E+00	2.60E+00	6.69E+00	2.67E-01	8.42E-02	4.29E-02	1.53E-01	1.12E-01	5.37E+00	3.58E+00	6.39E-02	1.46E+00	2.50E-02	1.09E-01	1.52E-01	6.09E-02	8.57E-02	7.17E-01	7.61E-01	1.02E+01	2.70E+00	1.40E+00	2.00E+00	5.45E-02	1.17E-01
2005	10	19	2.73E-01	4.39E-03	2.76E-01	2.56E-03	4.42E-03	1.59E+00	1.10E+00	3.71E+00	6.48E-02	5.79E+00	4.78E-02	1.20E+00	5.38E-01	2.09E+00	4.14E-01	2.58E-01	4.11E-03	2.76E-01	1.37E-03	2.53E-03	1.59E+00	1.04E+00	2.85E+00	6.25E-02	1.73E-02	8.84E-03	3.50E-02	2.41E-02	1.98E+00	3.43E-01	1.43E-02	2.75E-04	3.61E-04	1.19E-03	1.89E-03	1.12E-03	6.67E-02	8.65E-01	2.30E-03	5.77E+00	3.90E-02	1.16E+00	5.14E-01	1.12E-01	7.08E-02
2005	10	20	1.54E+00	2.95E-01	9.01E-01	5.87E-02	1.31E-01	3.43E+00	7.42E-01	5.00E+00	1.39E+00	1.74E+00	1.43E+00	3.56E-01	6.65E-01	4.40E+00	2.34E+00	1.35E+00	2.10E-02	8.34E-01	7.31E-03	1.24E-02	3.35E+00	6.97E-01	4.40E+00	1.01E-01	3.87E-02	2.72E-02	4.70E-02	4.37E-02	4.32E+00	1.95E+00	1.96E-01	2.74E-01	6.70E-02	5.14E-02	1.19E-01	7.59E-02	4.55E-02	6.01E-01	1.29E+00	1.70E+00	1.40E+00	3.09E-01	6.21E-01	8.59E-02	3.96E-01
2005	10	21	1.95E+00	2.50E-01	1.21E+00	3.88E-02	5.71E-02	5.77E+00	3.67E+00	8.98E+00	9.86E-01	1.66E+01	7.99E-01	2.16E+00	1.69E+00	6.61E+00	2.57E+00	1.81E+00	1.16E-02	1.17E+00	2.89E-03	5.78E-03	5.67E+00	3.56E+00	7.72E+00	2.49E-01	6.68E-02	3.01E-02	1.12E-01	8.64E-02	6.48E+00	2.31E+00	1.40E-01	2.38E-01	3.56E-02	3.59E-02	5.13E-02	1.01E-01	1.09E-01	1.26E+00	7.37E-01	1.65E+01	7.69E-01	2.04E+00	1.60E+00	1.24E-01	2.57E-01
2005	10	22	2.44E+00	6.20E-01	1.45E+00	2.52E-01	3.02E-01	4.55E+00	3.74E+00	7.73E+00	2.03E+00	1.38E+01	6.16E+00	2.05E+00	3.04E+00	5.99E+00	3.09E+00	2.31E+00	1.24E-02	1.41E+00	4.53E-03	7.25E-03	4.47E+00	3.62E+00	6.05E+00	1.50E-01	4.78E-02	2.29E-02	9.74E-02	6.76E-02	5.90E+00	2.87E+00	1.27E-01	6.07E-01	3.93E-02	2.48E-01	2.95E-01	8.09E-02	1.24E-01	1.68E+00	1.88E+00	1.38E+01	6.14E+00	1.96E+00	2.97E+00	9.01E-02	2.18E-01
2005	10	23	8.93E-01	3.19E-03	5.26E-01	9.10E-04	1.30E-03	3.78E+00	2.66E+00	6.82E+00	1.04E-01	9.76E+00	4.10E-02	1.88E+00	6.91E-01	5.44E+00	1.59E+00	8.37E-01	3.12E-03	5.20E-01	8.93E-04	1.26E-03	3.77E+00	2.53E+00	5.50E+00	6.48E-02	1.48E-02	4.61E-03	6.73E-02	3.33E-02	5.36E+00	1.44E+00	5.67E-02	7.27E-05	5.55E-03	1.69E-05	4.74E-05	1.09E-02	1.29E-01	1.32E+00	3.89E-02	9.75E+00	3.63E-02	1.81E+00	6.58E-01	7.43E-02	1.49E-01
2005	10	24	1.89E+00	3.87E-01	1.06E+00	4.03E-02	6.83E-02	3.62E+00	2.32E+00	5.30E+00	9.06E-01	9.20E+00	2.18E+00	8.38E-01	1.20E+00	4.15E+00	2.66E+00	1.83E+00	9.46E-03	1.04E+00	2.23E-03	4.11E-03	3.58E+00	2.26E+00	4.60E+00	1.98E-01	4.39E-02	1.91E-02	8.59E-02	6.11E-02	4.11E+00	2.55E+00	5.51E-02	3.77E-01	1.96E-02	3.81E-02	6.42E-02	4.67E-02	5.83E-02	6.97E-01	7.08E-01	9.16E+00	2.16E+00	7.53E-01	1.14E+00	3.77E-02	1.08E-01
2005	10	25	2.04E+00	1.22E+00	8.98E-01	2.77E-01	4.23E-01	5.86E+00	3.56E+00	8.64E+00	1.29E+00	1.05E+01	4.78E+00	1.08E+00	1.52E+00	6.95E+00	3.17E+00	1.94E+00	2.98E-02	8.86E-01	1.40E-02	2.02E-02	5.84E+00	3.50E+00	7.31E+00	2.99E-01	1.06E-01	5.50E-02	2.01E-01	1.46E-01	6.85E+00	2.94E+00	9.77E-02	1.19E+00	1.17E-02	2.63E-01	4.02E-01	1.73E-02	5.72E-02	1.32E+00	9.93E-01	1.04E+01	4.72E+00	8.82E-01	1.37E+00	9.75E-02	2.25E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	10	26	6.47E-01	2.97E-04	3.83E-01	1.60E-05	2.03E-04	3.03E+00	1.64E+00	4.49E+00	8.22E-02	5.87E+00	6.12E-02	1.12E+00	8.24E-01	3.37E+00	1.09E+00
2005	10	27	4.22E+00	6.32E-01	3.12E+00	3.03E-02	3.18E-02	6.31E+00	2.35E+00	7.39E+00	5.04E+00	4.47E+00	3.44E+00	1.21E+00	8.60E-01	8.05E+00	5.24E+00
2005	10	28	1.23E+00	6.10E-02	5.93E-01	3.31E-02	5.35E-02	2.38E+00	1.72E+00	4.87E+00	1.93E-01	5.39E+00	4.94E-01	1.01E+00	1.15E+00	2.87E+00	1.73E+00
2005	10	29	9.09E-02	0.00E+00	1.62E-03	0.00E+00	0.00E+00	5.10E-01	5.10E-01	1.46E+00	2.58E-17	2.35E+00	1.14E-02	8.54E-01	2.29E-01	8.10E-01	1.25E-01
2005	10	30	2.70E-01	0.00E+00	6.53E-02	0.00E+00	0.00E+00	7.67E-01	5.98E-01	2.15E+00	6.23E-03	4.85E+00	2.00E-02	8.64E-01	4.72E-01	1.16E+00	3.58E-01
2005	10	31	1.54E-01	0.00E+00	2.14E-02	0.00E+00	4.33E-04	8.48E-01	3.71E-01	1.77E+00	3.02E-03	1.41E+00	1.21E-01	4.67E-01	3.53E-01	9.02E-01	2.86E-01
2005	11	1	1.07E+00	2.27E-01	4.32E-01	1.19E-01	1.45E-01	3.42E+00	9.88E-01	4.63E+00	1.15E+00	2.16E+00	5.94E-01	3.70E-01	5.29E-01	3.70E+00	1.59E+00
2005	11	2	7.65E-01	1.75E-04	5.25E-01	3.32E-06	1.02E-04	2.66E+00	1.43E+00	4.35E+00	9.24E-02	6.19E+00	2.37E-02	9.18E-01	5.43E-01	3.31E+00	1.38E+00
2005	11	3	2.98E+00	4.34E-01	1.53E+00	6.18E-02	8.78E-02	4.22E+00	2.04E+00	5.61E+00	1.35E+00	5.12E+00	3.32E+00	6.06E-01	6.85E-01	4.56E+00	3.98E+00
2005	11	4	2.62E-01	2.10E-03	3.67E-02	7.25E-02	1.48E-01	1.05E+00	6.83E-01	2.46E+00	3.96E-02	1.96E+00	1.28E+00	7.12E-01	6.40E-01	1.29E+00	3.92E-01
2005	11	5	1.04E+00	6.64E-04	5.39E-01	2.72E-02	5.56E-02	2.25E+00	1.69E+00	4.59E+00	3.63E-01	5.11E+00	2.51E-01	8.50E-01	7.35E-01	3.10E+00	1.52E+00
2005	11	6	2.44E+00	5.53E-02	1.28E+00	4.96E-03	1.36E-02	2.90E+00	7.84E-01	3.23E+00	3.70E+00	1.72E+00	3.67E-01	4.66E-01	4.29E-01	3.17E+00	3.18E+00
2005	11	7	6.66E-01	2.81E-01	2.87E-01	1.92E-01	2.82E-01	2.80E+00	2.87E+00	6.14E+00	3.41E-01	1.24E+01	4.01E+00	2.44E+00	1.55E+00	4.21E+00	1.09E+00
2005	11	8	1.08E-01	3.59E-04	3.29E-02	4.73E-05	1.76E-04	1.27E+00	4.66E-01	2.07E+00	3.54E-02	3.66E+00	9.18E-03	5.53E-01	3.30E-01	9.86E-01	1.84E-01
2005	11	9	4.53E-02	0.00E+00	7.25E-03	0.00E+00	6.58E-11	2.89E-01	2.05E-01	7.87E-01	7.99E-16	2.10E+00	2.98E-02	3.23E-01	2.05E-01	4.92E-01	5.64E-02
2005	11	10	5.93E-02	0.00E+00	1.37E-02	0.00E+00	1.23E-04	4.80E-01	2.82E-01	1.12E+00	1.67E-04	1.27E+00	1.23E-01	2.01E-01	3.54E-01	6.32E-01	9.66E-02
2005	11	11	3.84E-01	8.36E-05	1.11E-01	1.06E-05	1.19E-04	1.54E+00	3.77E-01	2.63E+00	5.94E-02	1.32E+00	1.26E-01	1.67E-01	4.39E-01	1.38E+00	7.20E-01
2005	11	12	2.25E-01	7.21E-06	5.66E-02	8.19E-07	3.21E-05	1.51E+00	4.80E-01	2.76E+00	5.91E-02	2.08E+00	6.54E-02	4.70E-01	6.00E-01	1.13E+00	4.03E-01
2005	11	13	1.83E-01	2.79E-07	3.56E-02	5.21E-04	1.71E-01	8.49E-01	5.60E-01	1.94E+00	2.78E-03	2.33E+00	8.46E-01	6.08E-01	4.65E-01	1.16E+00	3.30E-01
2005	11	14	2.45E+00	1.15E+00	1.03E+00	5.93E-02	6.42E-02	5.25E+00	1.62E+00	6.95E+00	1.71E+00	2.44E+00	1.81E+00	6.18E-01	7.15E-01	6.08E+00	3.55E+00
2005	11	15	1.77E-01	3.37E-02	2.26E-01	2.08E-02	2.85E-02	2.07E+00	1.47E+00	4.45E+00	9.55E-02	9.06E+00	1.12E-01	1.52E+00	4.55E-01	3.34E+00	2.72E-01
2005	11	16	2.59E-01	0.00E+00	1.30E-02	0.00E+00	0.00E+00	1.27E+00	6.93E-01	2.66E+00	1.06E-02	5.57E+00	1.06E-03	7.34E-01	5.72E-01	1.93E+00	3.28E-01
2005	11	17	1.06E+00	3.32E-03	6.21E-01	4.40E-04	1.07E-03	1.64E+00	1.42E+00	2.56E+00	4.14E-01	9.36E+00	2.47E-02	7.19E-01	9.90E-01	2.55E+00	1.59E+00
2005	11	18	1.64E+00	9.15E-04	9.09E-01	7.65E-05	2.99E-04	2.54E+00	2.03E+00	3.50E+00	1.68E-01	1.00E+01	7.78E-03	7.10E-01	5.68E-01	2.90E+00	2.34E+00
2005	11	19	2.55E+00	1.42E-03	1.17E+00	3.67E-04	6.50E-04	2.96E+00	2.18E+00	4.32E+00	9.73E-01	1.12E+01	1.28E-02	1.09E+00	8.86E-01	4.06E+00	3.54E+00
2005	11	20	1.48E+00	3.22E-04	9.57E-01	4.86E-05	1.08E-04	3.61E+00	1.93E+00	4.90E+00	6.46E-02	1.14E+01	3.05E-03	1.37E+00	4.31E-01	4.25E+00	2.23E+00
2005	11	21	1.08E+00	1.11E-04	5.60E-01	2.62E-05	8.26E-05	2.25E+00	1.40E+00	3.31E+00	1.41E-02	8.55E+00	1.32E-03	1.08E+00	1.90E-01	2.59E+00	1.54E+00
2005	11	22	8.82E-01	4.68E-04	6.08E-01	5.76E-05	1.28E-04	2.22E+00	1.30E+00	4.12E+00	4.74E-02	7.79E+00	2.86E-03	1.04E+00	1.65E-01	3.12E+00	1.21E+00
2005	11	23	4.61E-01	1.36E-04	2.37E-01	3.06E-05	1.05E-04	1.87E+00	1.41E+00	4.34E+00	2.81E-02	9.95E+00	2.44E-03	1.17E+00	7.05E-01	3.06E+00	6.89E-01
2005	11	24	6.06E-01	1.40E-05	2.30E-01	1.28E-06	1.21E-05	2.15E+00	1.35E+00	4.01E+00	2.39E-02	7.71E+00	5.69E-03	1.01E+00	2.49E-01	3.17E+00	8.41E-01
2005	11	25	1.65E+00	7.51E-01	8.68E-01	7.44E-02	1.07E-01	3.86E+00	2.26E+00	7.43E+00	2.62E+00	4.85E+00	2.16E+00	1.08E+00	1.23E+00	6.00E+00	2.32E+00
2005	11	26	1.82E-01	4.81E-05	8.07E-02	1.08E-06	1.33E-05	1.60E+00	7.43E-01	2.97E+00	6.44E-03	4.84E+00	6.29E-03	7.05E-01	3.02E-01	2.41E+00	3.33E-01
2005	11	27	4.27E+00	2.10E-04	2.38E+00	4.58E-07	3.45E-06	4.46E+00	2.38E-01	4.09E+00	9.01E+00	1.48E-02	7.93E-04	1.96E-02	1.88E-02	4.54E+00	5.11E+00
2005	11	28	6.45E+00	2.79E-01	3.29E+00	8.62E-04	1.66E-03	5.90E+00	7.29E-01	5.79E+00	8.38E+00	2.21E-01	4.50E-01	9.01E-02	8.64E-02	7.22E+00	7.79E+00
2005	11	29	1.79E+00	0.00E+00	1.11E+00	0.00E+00	0.00E+00	1.86E+00	1.04E-01	1.60E+00	5.87E+00	9.19E-08	7.58E-07	3.24E-11	1.10E-09	2.59E+00	2.25E+00
2005	11	30	3.89E+00	1.35E+00	2.01E+00	7.83E-01	7.77E-01	3.55E+00	1.57E+00	3.85E+00	6.34E+00	2.52E+00	6.41E+00	4.34E-01	7.14E-01	4.64E+00	4.96E+00
2005	12	1	3.63E+00	1.03E-02	2.52E+00	1.15E-04	4.91E-04	3.31E+00	2.43E-01	2.41E+00	7.20E+00	2.05E-01	3.36E-02	2.03E-01	1.50E-01	3.77E+00	4.04E+00
2005	12	2	1.86E+00	2.95E+00	1.01E+00	4.58E-01	4.55E-01	3.48E+00	1.48E+00	4.54E+00	5.34E+00	5.26E+00	2.35E+00	4.64E-01	1.70E-01	5.39E+00	2.63E+00
2005	12	3	1.17E+00	2.19E-03	7.83E-01	4.62E-04	1.30E-03	6.21E+00	4.34E+00	1.20E+01	1.62E-01	2.37E+01	9.87E-02	2.21E+00	1.22E+00	9.25E+00	1.71E+00
2005	12	4	3.72E-01	2.62E-04	1.24E-01	5.50E-05	2.04E-04	2.34E+00	1.52E+00	5.99E+00	4.81E-02	9.52E+00	1.60E-03	1.18E+00	3.45E-01	3.74E+00	5.23E-01
2005	12	5	3.26E-01	0.00E+00	1.51E-01	0.00E+00	0.00E+00	6.02E-01	3.02E-01	1.47E+00	5.07E-01	1.92E+00	1.44E-03	3.45E-01	2.09E-01	1.08E+00	4.45E-01
2005	12	6	4.16E+00	2.72E-01	1.45E+00	7.02E-02	1.48E-01	7.18E+00	5.17E+00	1.20E+01	2.58E+00	1.52E+01	2.05E+00	4.48E+00	4.61E+00	9.87E+00	5.24E+00
2005	12	7	9.60E-01	8.47E-05	4.53E-01	5.16E-06	3.92E-05	1.88E+00	1.49E+00	3.42E+00	8.62E-02	7.34E+00	2.53E-03	1.22E+00	3.22E-01	2.70E+00	1.28E+00
2005	12	8	2.28E-02	0.00E+00	4.12E-03	0.00E+00	0.00E+00	4.02E-01	4.02E-01	1.05E+00	5.49E-17	3.37E+00	2.54E-03	7.20E-01	2.29E-01	6.13E-01	3.72E-02
2005	12	9	9.30E-02	0.00E+00	1.14E-02	0.00E+00	0.00E+00	4.98E-01	3.70E-01	1.51E+00	6.61E-03	4.72E+00	2.06E-04	5.28E-01	2.52E-01	8.50E-01	2.02E-01
2005	12	10	3.55E-01	0.00E+00	1.64E-01	0.00E+00	0.00E+00	1.32E+00	6.60E-01	2.50E+00	5.08E-03	5.31E+00	1.83E-03	1.02E+00	2.32E-01	2.07E+00	4.89E-01
2005	12	11	6.00E-01	0.00E+00	3.26E-01	0.00E+00	0.00E+00	2.35E+00	1.13E+00	3.38E+00	6.58E-03	7.29E+00	1.69E-03	1.21E+00	2.43E-01	2.54E+00	8.27E-01
2005	12	12	5.81E-01	1.44E-03	4.76E-01	1.79E-04	6.72E-04	2.91E+00	1.65E+00	4.35E+00	6.73E-02	9.98E+00	1.01E-02	1.34E+00	3.63E-01	3.99E+00	8.25E-01
2005	12	13	6.36E-01	0.00E+00	1.88E-01	0.00E+00	0.00E+00	1.91E+00	1.61E+00	5.15E+00	8.50E-03	1.14E+01	7.09E-06	1.26E+00	6.39E-01	3.23E+00	8.31E-01
2005	12	14	2.11E+00	4.42E-03	1.24E+00	7.99E-04	1.74E-03	4.67E+00	2.75E+00	6.88E+00	6.37E-01	1.84E+01	1.56E-02	1.66E+00	1.08E+00	6.31E+00	2.80E+00
2005	12	15	4.75E+00	1.35E-01	2.58E+00	8.66E-03	1.98E-02	7.32E+00	5.10E+00	1.02E+01	6.58E+00	1.58E+01	4.89E-01	4.36E+00	3.62E+00	1.01E+01	6.30E+00
2005	12	16	4.75E+00	1.09E-02	4.04E+00	2.74E-03	5.16E-03	7.06E+00	1.88E+00	9.17E+00	7.51E+00	9.66E-01	2.79E-02	4.32E-01	2.83E-01	9.61E+00	5.73E+00
2005	12	17	3.00E+00	2.44E-01	2.06E+00	5.41E-02	9.81E-02	7.39E+00	6.62E+00	1.32E+01	6.67E+00	2.00E+01	1.02E+00	6.15E+00	6.60E+00	1.14E+01	4.45E+00
2005	12	18	5.00E-01	4.26E-03	4.76E-01	1.95E-03	3.70E-03	5.20E+00	4.25E+00	1.12E+01	1.17E-01	1.70E+01	1.19E-02	2.09E+00	1.87E+00	9.64E+00	8.00E-01
2005	12	19	7.26E-01	1.59E-04	5.30E-01	2.12E-05	1.05E-04	3.59E+00	2.39E+00	6.03E+00	8.72E-02	1.10E+01	3.66E-03	1.62E+00	4.60E-01	4.63E+00	1.03E+00
2005	12	20	5.65E-01	4.65E-07	1.20E-01	1.21E-08	9.36E-07	7.75E-01	8.42E-01	1.84E+00	1.73E-02	5.24E+00	8.59E-03	1.01E+00	2.43E-01	1.42E+00	7.68E-01
2005	12	21	1.87E-01	0.00E+00	3.35E-02	5.95E-03	1.07E-01	7.86E-01	8.11E-01	2.37E+00	3.27E-03	9.05E+00	4.20E-01	1.02E+00	7.02E-01	1.47E+00	2.46E-01
2005	12	22	9.37E-02	0.00E+00	8.03E-03	0.00E+00	2.47E-08	4.96E-01	4.31E-01	1.26E+00	9.19E-06	1.04E+00	4.36E-02	6.91E-01	2.48E-01	7.85E-01	1.74E-01
2005	12	23	9.66E-02	0.00E+00	1.69E-03	0.00E+00	0.00E+00	4.96E-01	5.40E-01	1.51E+00	4.96E-18	2.07E+00	1.65E-02	7.37E-01	2.41E-01	8.73E-01	1.61E-01
2005	12	24	4.93E-02	0.00E+00	5.10E-03	0.00E+00	0.00E+00	2.96E-01	3.10E-01	8.89E-01	1.66E-17	2.84E+00	1.41E-02	4.44E-01	1.98E-01	5.88E-01	6.65E-02
2005	12	25	2.90E-02	0.00E+00	7.92E-03	0.00E+00	5.83E-10	3.64E-01	3.11E-01	8.00E-01	3.41E-06	1.96E+00	4.95E-02	3.75E-01	2.37E-01	5.18E-01	7.82E-02
2005	12	26	1.38E-01	0.00E+00	6.57E-03	0.00E+00	0.00E+00	5.66E-01	6.47E-01	1.76E+00	2.22E-18	7.91E+00	2.29E-03	7.81E-01	4.99E-01	1.16E+00	1.72E-01
2005	12	27	1.10E-01	0.00E+00	3.97E-03	0.00E+00	0.00E+00	5.28E-01	5.07E-01	1.68E+00	4.84E-18	1.40E+00	5.02E-02	8.01E-01	2.47E-01	8.75E-01	1.58E-01
2005	12	28	2.79E+00	2.19E-01	1.42E+00	1.11E-02	3.15E-02	3.27E+00	1.42E+00	5.67E+00	2.60E+00	1.09E+01	5.11E-01	2.72E+00	3.01E+00	4.49E+00	3.34E+00
2005	12	29	2.78E-01	3.33E-02	5.36E-02	2.09E-02	3.09E-02	7.96E-01	7.39E-01	2.14E+00	1.36E-02	3.63E+00	6.54E-02	9.81E-01	3.39E-01	1.23E+00	4.00E-01
2005	12	30	8.02E-01	5.56E-01	4.30E-01	7.21E-01	1.27E+00	2.02E+00	2.55E+00	4.97E+00	9.83E-01	9.30E+00	8.90E+00	2.08E+00	2.51E+00	2.95E+00	1.17E+00
2005	12	31	1.72E+00	5.62E-02	9.60E-01	2.45E-02	5.12E-02	3.15E+00	4.18E+00	7.19E+00	1.76E+00	2.08E+01	5.99E-01	4.71E+00	2.96E+00	5.31E+00	2.47E+00
2006	1	1	6.70E-01	1.59E-02	4.92E-01	2.79E-02	1.74E-01	2.60E+00	2.45E+00	4.86E+00	2.63E-01	9.69E+00	2.05E+00	2.15E+00	1.30E+00	3.63E+00	9.51E-01
2006	1	2	7.99E-01	1.76E-03	2.49E-01	3.09E-03	2.91E-02	1.73E+00	2.07E+00	4.42E+00	6.90E-02	1.23E+01	5.85E-01	1.47E+00	1.05E+00	2.91E+00	1.17E+00
2006	1	3	4.13E-01	1.47E-03	1.96E-01	1.51E-03	1.14E-02	1.62E+00	1.12E+00	2.97E+00	8.29E-02	4.81E+00	7.77E-02	1.05E+00	7.22E-01	1.79E+00	6.38E-01
2006	1	4	1.12E-01	0.00E+00	5.23E-03	0.00E+00	0.00E+00	5.19E-01	6.18E-01	1.82E+00	2.33E-17	2.90E+00	8.39E-03	8.55E-01	2.61E-01	9.21E-01	1.84E-01
2006	1	5	5.81E-02	0.00E+00	8.81E-04	0.00E+00	0.00E+00	3.03E-01	3.80E-01	9.07E-01	3.68E-18	1.99E+00	1.68E-02	6.21E-01	1.68E-01	6.18E-01	9.21E-02
2006	1	6	5.24E-01	2.99E-03	3.40E-01	6.19E-04	3.12E-03	2.85E+00	1.16E+00	4.89E+00	1.14E-01	1.93E+00	2.69E-01	3.58E-01	1.06E+00	2.87E+00	9.17E-01
2006	1	7	2.99E+00	5.47E-01	1.36E+00	2.50E-02	2.67E-02	2.54E+00	1.25E+00	3.98E+00	4.37E+00	1.23E+00	5.07E-01	2.30E-01	3.87E-01	3.81E+00	3.73E+00
2006	1	8	3.57E+00	3.58E-01	1.92E+00	7.21E-02	1.39E-01	3.39E+00	1.25E+00	4.10E+00	3.60E+00	2.00E+00	1.43E+00	5.31E-01	6.76E-01	4.04E+00	4.60E+00
2006	1	9	3.05E-02	0.00E+00	2.57E-02	0.00E+00	5.65E-05	4.74E-01	2.79E-01	1.36E+00	3.59E-04	9.34E-01	1.07E-01	1.57E-01	2.98E-01	5.11E-01	4.97E-02
2006	1	10	4.65E-01	2.69E-04	1.86E-01	6.85E-04	1.14E-01	2.12E+00	7.21E-01	3.37E+00	2.63E-02	1.57E+00	8.20E-01	1.85E-01	6.68E-01	1.95E+00	7.18E-01
2006	1	11	7.43E-01	2.17E-01	1.68E-01	2.18E-01	2.36E-01	2.02E+00	9.32E-01	2.76E+00	1.30E-01	2.42E+00	3.32E+00	3.66E-01	6.19E-01	1.74E+00	9.73E-01
2006	1	12	1.09E-01	0.00E+00	3.05E-02	0.00E+00	1.30E-04	6.70E-01	7.35E-01	2.03E+00	8.60E-03	2.09E+00	5.31E-02	9.91E-01	4.47E-01	1.01E+00	2.04E-01
2006	1	13	3.82E-01	2.48E-03	3.51E-01	1.05E-03	8.14E-02	3.82E+00	1.76E+00	5.80E+00	1.50E-01	2.59E+00	9.61E-01	5.15E-01	9.62E-01	3.53E+00	8.78E-01
2006	1	14	3.68E+00	1.07E-02	1.86E+00	1.41E-03	4.23E-03	7.03E+00	2.73E+00	8.99E+00	5.14E+00	8.16E+00	1.44E-01	1.96E+00	3.28E+00	7.55E+00	4.69E+00
2006	1	15	1.08E+00	7.33E-03	2.78E-01	2.36E-03	6.52E-03	2.85E+00	2.31E+00	6.03E+00	6.88E-01	9.47E+00	8.13E-02	1.86E+00	1.14E+00	5.15E+00	1.35E+00

Year	Month	Day	Baseline														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	10	26	5.99E-01	2.95E-04	3.73E-01	1.60E-05	2.02E-04	3.00E+00	1.55E+00	3.60E+00	6.36E-02	1.05E-02	2.94E-03	2.64E-02	1.76E-02	3.33E+00	9.70E-01
2005	10	27	3.52E+00	1.82E-02	2.24E+00	3.63E-03	6.58E-03	5.81E+00	2.20E+00	6.52E+00	3.02E-01	6.95E-02	3.25E-02	1.35E-01	9.65E-02	7.74E+00	4.10E+00
2005	10	28	1.15E+00	1.22E-02	5.78E-01	4.57E-03	8.77E-03	2.32E+00	1.68E+00	3.69E+00	1.18E-01	4.45E-02	2.58E-02	6.86E-02	5.42E-02	2.82E+00	1.55E+00
2005	10	29	9.09E-02	0.00E+00	1.62E-03	0.00E+00	0.00E+00	5.10E-01	4.70E-01	8.61E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.10E-01	1.25E-01
2005	10	30	2.59E-01	0.00E+00	6.53E-02	0.00E+00	0.00E+00	7.66E-01	5.65E-01	1.40E+00	6.19E-04	0.00E+00	0.00E+00	1.29E-04	8.43E-06	1.13E+00	3.38E-01
2005	10	31	1.54E-01	0.00E+00	2.14E-02	0.00E+00	1.02E-07	8.48E-01	3.65E-01	1.08E+00	3.01E-03	7.50E-04	5.78E-05	4.25E-03	1.84E-03	9.02E-01	2.86E-01
2005	11	1	1.03E+00	7.03E-03	4.25E-01	4.65E-03	6.27E-03	3.41E+00	9.60E-01	3.69E+00	7.44E-02	1.91E-02	1.00E-02	3.95E-02	3.00E-02	3.67E+00	1.48E+00
2005	11	2	6.40E-01	1.65E-04	5.10E-01	2.83E-06	8.77E-05	2.63E+00	1.40E+00	3.46E+00	6.89E-02	1.17E-02	2.45E-03	2.64E-02	2.00E-02	3.26E+00	1.12E+00
2005	11	3	2.74E+00	7.01E-03	1.51E+00	1.37E-03	2.80E-03	4.15E+00	2.01E+00	4.97E+00	1.25E-01	3.08E-02	1.45E-02	5.41E-02	4.02E-02	4.51E+00	3.53E+00
2005	11	4	2.62E-01	1.51E-03	3.62E-02	1.25E-03	2.33E-03	1.05E+00	6.35E-01	1.88E+00	3.67E-02	1.05E-02	4.43E-03	1.64E-02	1.42E-02	1.22E+00	3.90E-01
2005	11	5	9.95E-01	3.10E-04	5.34E-01	2.56E-05	5.18E-04	2.23E+00	1.64E+00	3.30E+00	5.29E-02	9.74E-03	3.68E-03	2.52E-02	1.54E-02	3.08E+00	1.38E+00
2005	11	6	2.14E+00	4.51E-03	1.19E+00	6.35E-04	1.50E-03	2.79E+00	7.59E-01	2.77E+00	7.17E-02	1.86E-02	8.86E-03	3.18E-02	2.42E-02	3.12E+00	2.60E+00
2005	11	7	6.39E-01	3.51E-03	2.86E-01	4.10E-03	6.17E-03	2.79E+00	2.75E+00	4.73E+00	5.11E-02	2.04E-02	9.96E-03	5.99E-02	3.53E-02	4.17E+00	1.01E+00
2005	11	8	1.08E-01	3.59E-04	3.29E-02	4.73E-05	1.76E-04	1.27E+00	4.10E-01	1.20E+00	3.54E-02	6.16E-03	1.62E-03	1.61E-02	1.08E-02	9.72E-01	1.84E-01
2005	11	9	4.53E-02	0.00E+00	7.25E-03	0.00E+00	0.00E+00	2.89E-01	1.80E-01	6.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-01	5.64E-02
2005	11	10	5.93E-02	0.00E+00	1.37E-02	0.00E+00	0.00E+00	4.80E-01	2.73E-01	8.20E-01	1.67E-04	3.04E-05	0.00E+00	2.68E-03	8.03E-04	6.26E-01	9.66E-02
2005	11	11	3.81E-01	8.36E-05	1.11E-01	1.06E-05	9.96E-05	1.54E+00	3.67E-01	2.20E+00	5.67E-02	1.00E-02	2.47E-03	1.95E-02	1.68E-02	1.36E+00	6.99E-01
2005	11	12	2.25E-01	7.21E-06	5.64E-02	8.19E-07	3.02E-05	1.51E+00	4.61E-01	1.81E+00	5.58E-02	6.73E-03	7.95E-04	1.39E-02	1.14E-02	1.12E+00	4.01E-01
2005	11	13	1.83E-01	2.79E-07	3.56E-02	3.63E-05	4.32E-04	8.49E-01	5.43E-01	1.13E+00	2.78E-03	1.48E-03	4.02E-04	1.10E-02	5.09E-03	1.16E+00	3.30E-01
2005	11	14	1.92E+00	2.67E-02	8.31E-01	7.72E-03	1.10E-02	5.03E+00	1.55E+00	6.01E+00	1.89E-01	6.40E-02	3.73E-02	1.01E-01	7.83E-02	5.88E+00	2.74E+00
2005	11	15	1.65E-01	4.15E-03	2.23E-01	1.92E-03	3.05E-03	2.07E+00	1.35E+00	3.05E+00	5.76E-02	1.86E-02	8.96E-03	3.33E-02	2.56E-02	3.28E+00	2.40E-01
2005	11	16	2.59E-01	0.00E+00	1.30E-02	0.00E+00	0.00E+00	1.27E+00	5.98E-01	1.87E+00	1.06E-02	2.63E-04	0.00E+00	5.71E-03	1.25E-03	1.91E+00	3.28E-01
2005	11	17	1.01E+00	3.20E-03	6.01E-01	4.33E-04	1.04E-03	1.59E+00	1.38E+00	2.29E+00	6.41E-02	1.44E-02	6.87E-03	2.31E-02	1.81E-02	2.54E+00	1.48E+00
2005	11	18	1.62E+00	8.16E-04	8.73E-01	6.95E-05	2.78E-04	2.41E+00	1.97E+00	3.16E+00	7.23E-02	1.33E-02	4.20E-03	2.24E-02	1.80E-02	2.86E+00	2.29E+00
2005	11	19	2.37E+00	1.40E-03	1.14E+00	3.66E-04	6.43E-04	2.83E+00	2.12E+00	3.96E+00	8.14E-02	1.71E-02	5.40E-03	3.97E-02	2.64E-02	4.01E+00	3.18E+00
2005	11	20	1.27E+00	2.95E-04	9.34E-01	4.84E-05	1.01E-04	3.54E+00	1.84E+00	4.29E+00	5.72E-02	8.26E-03	1.20E-03	2.74E-02	1.61E-02	4.20E+00	1.77E+00
2005	11	21	9.50E-01	1.09E-04	5.53E-01	2.61E-05	8.06E-05	2.23E+00	1.31E+00	2.91E+00	1.31E-02	2.22E-03	4.42E-04	1.45E-02	5.86E-03	2.53E+00	1.31E+00
2005	11	22	7.65E-01	4.43E-04	5.88E-01	5.64E-05	1.17E-04	2.17E+00	1.23E+00	3.62E+00	4.27E-02	5.28E-03	1.23E-03	1.68E-02	1.00E-02	3.11E+00	9.77E-01
2005	11	23	4.38E-01	1.36E-04	2.32E-01	3.06E-05	6.52E-05	1.86E+00	1.28E+00	3.21E+00	2.40E-02	3.32E-03	7.05E-04	1.32E-02	5.93E-03	2.98E+00	6.29E-01
2005	11	24	5.71E-01	1.40E-05	2.30E-01	1.28E-06	1.21E-05	2.15E+00	1.23E+00	3.22E+00	2.35E-02	2.22E-03	2.30E-04	1.32E-02	6.86E-03	3.08E+00	7.91E-01
2005	11	25	1.43E+00	1.31E-02	5.02E-01	4.73E-03	7.78E-03	3.51E+00	2.13E+00	5.75E+00	1.59E-01	5.44E-02	2.57E-02	1.18E-01	7.93E-02	5.61E+00	2.03E+00
2005	11	26	1.60E-01	4.81E-05	8.07E-02	1.08E-06	1.33E-05	1.60E+00	6.59E-01	1.83E+00	6.44E-03	1.33E-03	3.11E-04	2.44E-03	1.97E-03	2.39E+00	2.41E-01
2005	11	27	3.81E+00	1.87E-04	2.08E+00	4.42E-07	3.28E-06	3.99E+00	2.33E-01	4.05E+00	3.17E-02	2.39E-03	5.52E-04	5.63E-03	3.59E-03	4.52E+00	4.43E+00
2005	11	28	5.94E+00	5.82E-03	3.10E+00	5.63E-04	1.04E-03	5.64E+00	7.21E-01	5.51E+00	1.03E-01	2.10E-02	9.37E-03	3.98E-02	2.89E-02	7.13E+00	6.95E+00
2005	11	29	1.79E+00	0.00E+00	1.05E+00	0.00E+00	0.00E+00	1.77E+00	1.04E-01	1.60E+00	1.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.59E+00	2.24E+00
2005	11	30	3.81E+00	2.17E-02	1.90E+00	1.82E-02	2.87E-02	3.35E+00	1.53E+00	3.83E+00	1.44E-01	7.79E-02	5.33E-02	8.19E-02	7.93E-02	4.62E+00	4.85E+00
2005	12	1	3.11E+00	2.41E-04	2.03E+00	1.18E-05	3.72E-05	2.76E+00	4.11E-02	2.19E+00	9.98E-03	1.54E-03	5.13E-04	3.10E-03	2.12E-03	3.57E+00	3.37E+00
2005	12	2	1.83E+00	2.11E-02	9.45E-01	1.27E-02	1.54E-02	3.39E+00	1.45E+00	4.14E+00	9.96E-02	4.31E-02	2.73E-02	5.25E-02	4.91E-02	5.31E+00	2.57E+00
2005	12	3	1.09E+00	2.19E-03	7.77E-01	4.61E-04	1.30E-03	6.19E+00	4.17E+00	9.61E+00	1.37E-01	3.26E-02	9.23E-03	8.69E-02	5.73E-02	8.92E+00	1.50E+00
2005	12	4	3.52E-01	2.62E-04	1.24E-01	5.50E-05	2.04E-04	2.34E+00	1.37E+00	4.42E+00	4.81E-02	6.95E-03	1.37E-03	3.57E-02	1.78E-02	3.65E+00	4.59E-01
2005	12	5	2.59E-01	0.00E+00	1.18E-01	0.00E+00	0.00E+00	5.59E-01	2.55E-01	1.15E+00	1.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.94E-01	3.63E-01
2005	12	6	3.06E+00	1.49E-02	1.24E+00	5.47E-03	1.10E-02	6.94E+00	3.72E+00	8.72E+00	2.54E-01	8.01E-02	3.70E-02	1.67E-01	1.18E-01	8.45E+00	3.71E+00
2005	12	7	8.89E-01	8.47E-05	4.41E-01	5.16E-06	3.92E-05	1.82E+00	1.44E+00	2.87E+00	4.14E-02	5.39E-03	8.60E-04	2.68E-02	1.39E-02	2.68E+00	1.14E+00
2005	12	8	2.28E-02	0.00E+00	4.12E-03	0.00E+00	0.00E+00	4.02E-01	3.72E-01	7.43E-01	0.00E+00	0.00E+00	0.00E+00	4.46E-07	0.00E+00	6.12E-01	3.72E-02
2005	12	9	9.30E-02	0.00E+00	1.14E-02	0.00E+00	0.00E+00	4.98E-01	3.20E-01	1.02E+00	6.61E-03	1.64E-06	0.00E+00	1.55E-03	3.08E-04	8.48E-01	2.02E-01
2005	12	10	3.39E-01	0.00E+00	1.63E-01	0.00E+00	0.00E+00	1.31E+00	6.11E-01	2.05E+00	4.29E-03	8.92E-05	0.00E+00	3.78E-03	7.77E-04	2.03E+00	4.21E-01
2005	12	11	4.60E-01	0.00E+00	3.24E-01	0.00E+00	0.00E+00	2.35E+00	1.05E+00	2.79E+00	6.36E-03	2.51E-04	6.28E-08	6.60E-03	1.57E-03	2.45E+00	5.99E-01
2005	12	12	5.39E-01	1.35E-03	4.64E-01	1.72E-04	6.36E-04	2.88E+00	1.52E+00	3.24E+00	6.05E-02	1.37E-02	5.11E-03	2.94E-02	2.01E-02	3.93E+00	7.32E-01
2005	12	13	5.99E-01	0.00E+00	1.84E-01	0.00E+00	0.00E+00	1.90E+00	1.47E+00	3.77E+00	8.37E-03	3.05E-04	5.09E-06	5.35E-03	1.52E-03	3.19E+00	7.65E-01
2005	12	14	1.96E+00	4.13E-03	1.21E+00	7.57E-04	1.61E-03	4.54E+00	2.64E+00	5.68E+00	1.26E-01	2.77E-02	1.12E-02	4.84E-02	3.71E-02	6.17E+00	2.46E+00
2005	12	15	3.14E+00	1.57E-02	1.71E+00	2.99E-03	7.15E-03	6.13E+00	3.42E+00	7.67E+00	2.71E-01	8.40E-02	3.86E-02	1.58E-01	1.14E-01	8.49E+00	4.22E+00
2005	12	16	3.38E+00	4.53E-03	1.89E+00	9.44E-04	1.84E-03	4.97E+00	1.55E+00	7.57E+00	1.46E-01	2.67E-02	1.05E-02	6.56E-02	4.14E-02	8.95E+00	3.89E+00
2005	12	17	2.27E+00	2.34E-02	1.70E+00	7.15E-03	1.24E-02	6.95E+00	5.05E+00	1.02E+01	2.77E-01	8.23E-02	4.41E-02	1.44E-01	1.07E-01	1.04E+01	3.35E+00
2005	12	18	4.36E-01	3.64E-03	4.75E-01	1.28E-03	2.45E-03	5.20E+00	4.04E+00	8.55E+00	1.13E-01	2.43E-02	9.61E-03	7.52E-02	4.36E-02	9.43E+00	5.65E-01
2005	12	19	5.96E-01	1.59E-04	5.27E-01	2.12E-05	1.05E-04	3.58E+00	2.24E+00	4.94E+00	4.77E-02	6.81E-03	1.27E-03	3.42E-02	1.76E-02	4.55E+00	7.62E-01
2005	12	20	4.67E-01	0.00E+00	1.19E-01	0.00E+00	0.00E+00	7.73E-01	8.12E-01	1.23E+00	1.65E-02	1.05E-03	5.26E-05	6.01E-03	3.39E-03	1.40E+00	6.25E-01
2005	12	21	1.87E-01	0.00E+00	3.35E-02	1.32E-06	2.34E-05	7.86E-01	7.14E-01	1.61E+00	3.27E-03	1.38E-04	6.71E-07	4.38E-03	1.37E-03	1.31E+00	2.46E-01
2005	12	22	9.37E-02	0.00E+00	8.03E-03	0.00E+00	0.00E+00	4.96E-01	4.12E-01	7.42E-01	9.19E-06	0.00E+00	0.00E+00	2.05E-03	1.96E-04	7.85E-01	1.74E-01
2005	12	23	9.66E-02	0.00E+00	1.69E-03	0.00E+00	0.00E+00	4.96E-01	4.87E-01	9.87E-01	0.00E+00	0.00E+00	0.00E+00	6.07E-05	0.00E+00	8.72E-01	1.61E-01
2005	12	24	4.93E-02	0.00E+00	5.10E-03	0.00E+00	0.00E+00	2.96E-01	2.77E-01	5.86E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.99E-01	6.65E-02
2005	12	25	2.90E-02	0.00E+00	7.92E-03	0.00E+00	0.00E+00	3.64E-01	2.88E-01	6.23E-01	3.41E-06	0.00E+00	0.00E+00	4.72E-04	6.68E-05	5.18E-01	7.82E-02
2005	12	26	1.38E-01	0.00E+00	6.57E-03	0.00E+00	0.00E+00	5.66E-01	5.58E-01	1.14E+00	0.00E+00	0.00E+00	0.00E+00	3.16E-06	0.00E+00	1.12E+00	1.72E-01
2005	12	27	1.10E-01	0.00E+00	3.97E-03	0.00E+00	0.00E+00	5.28E-01	4.88E-01	9.59E-01	0.00E+00	0.00E+00	0.00E+00	1.52E-04	6.84E-06	8.75E-01	1.58E-01
2005	12	28	2.61E+00	3.47E-03	1.08E+00	2.63E-04	5.98E-04	2.86E+00	1.36E+00	4.40E+00	8.92E-02	1.90E-02	8.36E-03	2.50E-02	2.16E-02	4.28E+00	3.11E+00
2005	12	29	2.76E-01	9.81E-04	5.27E-02	1.37E-04	3.69E-04	7.92E-01	6.54E-01	1.53E+00	7.51E-03	2.53E-03	1.44E-03	5.12E-03	3.48E-03	1.21E+00	3.91E-01
2005	12	30	7.56E-01	6.78E-03	3.87E-01	1.05E-02	1.80E-02	1.98E+00	2.37E+00	3.69E+00	8.42E-02	4.96E-02	2.31E-02	1.06E-01	8.35E-02	2.88E+00	1.11E+00
2005	12	31	1.35E+00	3.00E-03	8.82E-01	7.33E-04	1.48E-03	3.02E+00	3.53E+00	5.64E+00	9.37E-02	2.14E-02	8.30E-03	6.01E-02	3.50E-02	4.86E+00	2.02E+00
2006	1	1	5.60E-01	6.34E-03	4.74E-01	3.39E-03	6.59E-03	2.57E+00	2.28E+00	3.71E+00	1.16E-01	3.83E-02	1.70E-02	7.89E-02	5.65E-02	3.55E+00	7.89E-01
2006	1	2	7.82E-01	2.31E-04	2.47E-01	8.78E-05	4.05E-04	1.72E+00	1.87E+00	3.52E+00	2.66E-02	4.18E-03	1.87E-03	1.07E-02	6.01E-03	2.87E+00	1.09E+00
2006	1	3	3.39E-01	1.31E-03	1.95E-01	2.32E-04	1.14E-03	1.62E+00	1.09E+00	2.47E+00	6.42E-02	1.52E-02	5.83E-03	3.54E-02	2.24E-02	1.77E+00	5.06E-01
2006	1	4	1.12E-01	0.00E+00	5.23E-03	0.00E+00	0.00E+00	5.19E-01	5.59E-01	1.02E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-07	0.00E+00	9.21E-01	1.84E-01
2006	1	5	5.81E-02	0.00E+00	8.81E-04	0.00E+00	0.00E+00	3.03E-01	3.42E-01	5.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.16E-01	9.21E-02
2006	1	6	4.83E-01	2.70E-03	3.33E-01	5.49E-04	2.20E-03	2.84E+00	1.15E+00	3.69E+00	1.09E-01	2.42E-02	1.15E-02	4.29E-02	3.10E-02	2.82E+00	8.33E-01
2006	1	7	2.95E+00	4.39E-03	1.29E+00	4.58E-04	1.43E-03	2.43E+00	1.23E+00	3.61E+00	1.21E-01	1.98E-02	9.10E-03	3.48E-02	2.41E-02	3.78E+00	3.65E+00
2006	1	8	3.12E+00	8.91E-03	1.80E+00	2.15E-03	3.97E-03	3.29E+00	1.22E+00	3.60E+00	1.23E-01	2.87E-02	1.49E-02	5.45E-02	3.87E-02	4.00E+00	3.78E+00
2006	1	9	3.05E-02	0.00E+00	2.57E-02	0.00E+00	0.00E+00	4.74E-01	2.78E-01	6.83E-01	3.59E-04	7.74E-05	0.00E+00	5.10E-03	1.21E-03	5.11E-01	4.97E-02
2006	1	10	4.60E-01	2.69E-04	1.86E-01	6.55E-04	1.14E-03	2.12E+00	7.06E-01	2.36E+00	2.31E-02	4.42E-03	2.05E-03	2.71E-02	1.13E-02	1.91E+00	7.06E-01
2006	1	11	6.99E-01	2.71E-03	1.67E-01	9.79E-03	1.26E-02	2.02E+00	9.18E-01	2.02E+00	3.45E-02	1.37E-02	7.61E-03	3.08E-02	2.37E-02	1.67E+00	9.01E-01
2006	1	12	1.09E-01	0.00E+00	3.05E-02	0.00E+00	0.00E+00	6.70E-01	7.15E-01	1.28E+00	8.60E-03	2.23E-04	7.35E-07	6.85E-03	3.18E-03	1.01E+00	2.04E-01
2006	1	13	3.81E-01	2.48E-03	3.51E-01	8.51E-04	2.93E-03	3.82E+00	1.70E+00	4.27E+00	1.50E-01	3.78E-02	1.25E-02	5.81E-02	5.11E-02	3.45E+00	8.71E-01
2006	1	14	2.07E+00	4.98E-03	1.21E+00	7.86E-04	2.63E-03	5.94E+00	2.11E+00	6.19E+00	2.08E-01	5.11E-02	1.93E-02	8.89E-02	7.01E-02	6.34E+00	2.77E+00
2006	1	15	9.86E-01	2.27E-03	2.39E-01	7.76E-04	1.77E-03	2.78E+00	2.07E+00	3.84E+00	5.55E-02	1.51E-02	6.44E-03	3.98E-02	2.36E-02	5.04E+00	1.23E+00

Year	Month	Day	Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2005	10	26	4.82E-02	2.21E-06	1.02E-02	0.00E+00	9.17E-07	2.83E-02	8.88E-02	8.89E-01	1.86E-02	5.86E+00	5.83E-02	1.09E+00	8.06E-01	3.83E-02	1.16E-01
2005	10	27	7.03E-01	6.14E-01	8.77E-01	2.67E-02	2.52E-02	5.03E-01	1.55E-01	8.69E-01	4.74E+00	4.40E+00	3.41E+00	1.07E+00	7.63E-01	3.12E-01	1.14E+00
2005	10	28	8.78E-02	4.88E-02	1.53E-02	2.85E-02	4.47E-02	5.47E-02	4.51E-02	1.18E+00	7.53E-02	5.35E+00	4.68E-01	9.40E-01	1.10E+00	4.29E-02	1.78E-01
2005	10	29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.05E-02	5.98E-01	2.58E-17	2.35E+00	1.14E-02	8.54E-01	2.29E-01	0.00E+00	0.00E+00
2005	10	30	1.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-04	3.29E-02	7.49E-01	5.61E-03	4.85E+00	2.00E-02	8.64E-01	4.72E-01	2.71E-02	2.01E-02
2005	10	31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.33E-04	0.00E+00	5.50E-03	6.87E-01	1.60E-05	1.41E+00	1.21E-01	4.62E-01	3.51E-01	2.04E-05	0.00E+00
2005	11	1	3.78E-02	2.20E-01	6.38E-03	1.15E-01	1.39E-01	7.89E-03	2.78E-02	9.43E-01	1.08E+00	2.14E+00	5.84E-01	3.30E-01	4.99E-01	3.17E-02	1.13E-01
2005	11	2	1.25E-01	9.93E-06	1.50E-02	4.89E-07	1.47E-05	3.44E-02	3.37E-02	8.94E-01	2.34E-02	6.18E+00	2.13E-02	8.92E-01	5.23E-01	5.10E-02	2.62E-01
2005	11	3	2.35E-01	4.27E-01	2.80E-02	6.04E-02	8.50E-02	6.74E-02	2.64E-02	6.38E-01	1.22E+00	5.09E+00	3.31E+00	5.52E-01	6.45E-01	5.41E-02	4.49E-01
2005	11	4	1.31E-04	5.91E-04	5.00E-04	7.13E-02	1.45E-01	1.08E-03	4.84E-02	5.77E-01	2.96E-03	1.95E+00	1.28E+00	6.96E-01	6.25E-01	6.72E-02	1.85E-03
2005	11	5	4.84E-02	3.54E-04	5.06E-03	2.72E-02	5.51E-02	2.08E-02	4.22E-02	1.29E+00	3.10E-01	5.10E+00	2.48E-01	8.25E-01	7.19E-01	2.28E-02	1.45E-01
2005	11	6	2.96E-01	5.08E-02	8.66E-02	4.33E-03	1.21E-02	1.06E-01	2.48E-02	4.63E-01	3.63E+00	1.70E+00	3.58E-01	4.34E-01	4.05E-01	5.14E-02	5.84E-01
2005	11	7	2.60E-02	2.78E-01	1.00E-03	1.88E-01	2.76E-01	2.15E-03	1.22E-01	1.41E+00	2.90E-01	1.24E+01	4.00E+00	2.38E+00	1.52E+00	3.69E-02	7.38E-02
2005	11	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.64E-02	8.75E-01	2.56E-16	3.65E+00	7.57E-03	5.37E-01	3.19E-01	1.40E-02	0.00E+00
2005	11	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-11	0.00E+00	2.48E-02	1.62E-01	7.99E-16	2.10E+00	2.98E-02	3.23E-01	2.05E-01	7.95E-02	0.00E+00
2005	11	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-04	0.00E+00	8.83E-03	3.03E-01	5.68E-18	1.27E+00	1.23E-01	1.98E-01	3.53E-01	5.96E-03	0.00E+00
2005	11	11	3.23E-03	0.00E+00	8.17E-05	0.00E+00	1.94E-05	1.26E-03	9.41E-03	4.37E-01	2.80E-03	1.31E+00	1.24E-01	1.48E-01	4.22E-01	1.15E-02	2.16E-02
2005	11	12	6.68E-04	0.00E+00	2.15E-04	0.00E+00	1.91E-06	5.54E-03	1.88E-02	9.47E-01	3.27E-03	2.07E+00	6.46E-02	4.56E-01	5.88E-01	1.82E-03	2.49E-03
2005	11	13	0.00E+00	0.00E+00	0.00E+00	4.84E-04	1.71E-01	0.00E+00	1.75E-02	8.16E-01	2.19E-20	2.33E+00	8.46E-01	5.97E-01	4.60E-01	4.98E-04	0.00E+00
2005	11	14	5.22E-01	1.12E+00	1.95E-01	5.16E-02	5.31E-02	2.16E-01	7.20E-02	9.35E-01	1.52E+00	2.38E+00	1.77E+00	5.17E-01	6.37E-01	2.02E-01	8.12E-01
2005	11	15	1.20E-02	2.96E-02	2.59E-03	1.89E-02	2.55E-02	3.63E-03	1.19E-01	1.40E+00	3.78E-02	9.04E+00	1.03E-01	1.49E+00	4.29E-01	5.50E-02	3.15E-02
2005	11	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.52E-02	7.87E-01	3.79E-17	5.57E+00	1.06E-03	7.28E-01	5.71E-01	2.01E-02	0.00E+00
2005	11	17	4.96E-02	1.23E-04	2.06E-02	7.32E-06	3.58E-05	5.06E-02	4.63E-02	2.73E-01	3.50E-01	9.35E+00	1.78E-02	6.96E-01	9.72E-01	1.11E-02	1.16E-01
2005	11	18	1.55E-02	9.94E-05	3.56E-02	7.00E-06	2.13E-05	1.27E-01	5.80E-02	3.39E-01	9.58E-02	1.00E+01	3.58E-03	6.88E-01	5.50E-01	4.26E-02	4.40E-02
2005	11	19	1.83E-01	1.93E-05	2.96E-02	8.73E-07	6.99E-06	1.29E-01	5.94E-02	3.58E-01	8.91E-01	1.12E+01	7.36E-03	1.05E+00	8.59E-01	4.80E-02	3.62E-01
2005	11	20	2.09E-01	2.78E-05	2.34E-02	1.72E-07	6.61E-06	7.04E-02	8.74E-02	6.06E-01	7.38E-03	1.14E+01	1.85E-03	1.34E+00	4.15E-01	5.07E-02	4.62E-01
2005	11	21	1.32E-01	1.84E-06	7.17E-03	5.11E-08	2.05E-06	2.10E-02	8.70E-02	3.96E-01	1.06E-03	8.55E+00	8.73E-04	1.06E+00	1.84E-01	6.00E-02	2.26E-01
2005	11	22	1.17E-01	2.50E-05	2.03E-02	1.22E-06	1.06E-05	4.41E-02	6.37E-02	5.02E-01	4.64E-03	7.78E+00	1.63E-03	1.02E+00	1.55E-01	1.77E-02	2.31E-01
2005	11	23	2.34E-02	9.30E-08	4.50E-03	0.00E+00	3.97E-05	1.25E-02	1.28E-01	1.13E+00	4.08E-03	9.95E+00	1.74E-03	1.16E+00	6.99E-01	8.40E-02	6.02E-02
2005	11	24	3.53E-02	0.00E+00	1.30E-04	0.00E+00	0.00E+00	7.64E-04	1.26E-01	7.93E-01	3.43E-04	7.71E+00	5.46E-03	1.00E+00	2.42E-01	8.80E-02	5.05E-02
2005	11	25	2.12E-01	7.38E-01	3.66E-01	6.97E-02	9.92E-02	3.46E-01	1.30E-01	1.69E+00	2.46E+00	4.80E+00	2.14E+00	9.59E-01	1.15E+00	3.84E-01	2.94E-01
2005	11	26	2.17E-02	0.00E+00	4.19E-05	0.00E+00	0.00E+00	8.73E-04	8.44E-02	1.14E+00	1.32E-17	4.84E+00	5.97E-03	7.02E-01	3.00E-01	2.29E-02	9.17E-02
2005	11	27	4.57E-01	2.31E-05	3.00E-01	1.55E-08	1.69E-07	4.63E-01	5.02E-03	3.44E-02	8.98E+00	1.24E-02	2.42E-04	1.40E-02	1.52E-02	1.82E-02	6.73E-01
2005	11	28	5.10E-01	2.73E-01	1.84E-01	2.98E-04	6.19E-04	2.52E-01	8.29E-03	2.84E-01	8.28E+00	2.00E-01	4.40E-01	5.03E-02	5.76E-02	9.72E-02	8.44E-01
2005	11	29	3.66E-03	0.00E+00	6.43E-02	0.00E+00	0.00E+00	9.89E-02	0.00E+00	0.00E+00	5.87E+00	9.19E-08	7.58E-07	3.24E-11	1.10E-09	0.00E+00	1.32E-02
2005	11	30	7.64E-02	1.33E+00	1.06E-01	7.65E-01	7.48E-01	1.94E-01	3.96E-02	2.39E-02	6.20E+00	2.44E+00	6.36E+00	3.52E-01	6.35E-01	1.67E-02	1.14E-01
2005	12	1	5.22E-01	1.00E-02	4.90E-01	1.03E-04	4.54E-04	5.51E-01	2.02E-01	2.17E-01	7.19E+00	2.03E-01	3.31E-02	2.00E-01	1.48E-01	2.06E-01	6.62E-01
2005	12	2	2.75E-02	2.93E+00	6.16E-02	4.45E-01	4.39E-01	8.68E-02	2.57E-02	4.00E-01	5.24E+00	5.21E+00	2.32E+00	4.11E-01	1.21E-01	7.92E-02	6.36E-02
2005	12	3	8.16E-02	8.19E-06	5.80E-03	1.19E-06	5.62E-06	2.13E-02	1.70E-01	2.34E+00	2.54E-02	2.37E+01	8.95E-02	2.12E+00	1.16E+00	3.27E-01	2.08E-01
2005	12	4	1.95E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-01	1.57E+00	6.26E-17	9.51E+00	2.33E-04	1.15E+00	3.27E-01	9.05E-02	6.37E-02
2005	12	5	6.70E-02	0.00E+00	3.31E-02	0.00E+00	0.00E+00	4.24E-02	4.64E-02	3.18E-01	5.07E-01	1.92E+00	1.44E-03	3.45E-01	2.09E-01	8.98E-02	8.15E-02
2005	12	6	1.11E+00	2.58E-01	2.12E-01	6.48E-02	1.37E-01	2.44E-01	1.45E+00	3.32E+00	2.32E+00	1.51E+01	2.02E+00	4.31E+00	4.50E+00	1.42E+00	1.54E+00
2005	12	7	7.11E-02	0.00E+00	1.14E-02	0.00E+00	0.00E+00	5.94E-02	5.13E-02	5.53E-01	4.48E-02	7.34E+00	1.67E-03	1.19E+00	3.08E-01	1.68E-02	1.38E-01
2005	12	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E-02	3.03E-01	5.49E-17	3.37E+00	2.54E-03	7.20E-01	2.29E-01	3.42E-04	0.00E+00
2005	12	9	5.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.02E-02	4.82E-01	1.98E-16	4.72E+00	2.06E-04	5.26E-01	2.51E-01	2.12E-03	5.36E-06
2005	12	10	1.59E-02	0.00E+00	1.35E-03	0.00E+00	0.00E+00	1.45E-02	4.89E-02	4.52E-01	7.92E-04	5.31E+00	1.83E-03	1.02E+00	2.32E-01	4.32E-02	6.80E-02
2005	12	11	1.39E-01	0.00E+00	1.69E-03	0.00E+00	0.00E+00	3.08E-03	8.52E-02	5.91E-01	2.19E-04	7.29E+00	1.69E-03	1.20E+00	2.42E-01	9.41E-02	2.28E-01
2005	12	12	4.19E-02	9.01E-05	1.17E-02	6.95E-06	3.59E-05	2.80E-02	1.29E-01	1.12E+00	6.79E-03	9.97E+00	4.98E-03	1.31E+00	3.43E-01	6.58E-02	9.29E-02
2005	12	13	3.76E-02	0.00E+00	3.83E-03	0.00E+00	0.00E+00	1.05E-02	1.48E-01	1.37E+00	1.31E-04	1.14E+01	2.00E-06	1.26E+00	6.37E-01	3.23E-02	6.64E-02
2005	12	14	1.48E-01	2.89E-04	3.27E-02	4.15E-05	1.25E-04	1.25E-01	1.12E-01	1.21E+00	5.11E-01	1.84E+01	4.34E-03	1.61E+00	1.05E+00	1.34E-01	3.37E-01
2005	12	15	1.61E+00	1.19E-01	8.72E-01	5.67E-03	1.27E-02	1.19E+00	1.68E+00	2.52E+00	6.31E+00	1.57E+01	4.50E-01	4.20E+00	3.50E+00	1.58E+00	2.08E+00
2005	12	16	1.37E+00	6.32E-03	2.15E+00	1.80E-03	3.32E-03	2.09E+00	3.28E-01	1.61E+00	7.36E+00	9.39E-01	1.74E-02	3.66E-01	2.42E-01	6.61E-01	1.84E+00
2005	12	17	7.31E-01	2.20E-01	3.56E-01	4.70E-02	8.57E-02	4.40E-01	1.57E+00	2.96E+00	6.39E+00	1.99E+01	9.79E-01	6.01E+00	6.50E+00	9.56E-01	1.10E+00
2005	12	18	6.36E-02	6.16E-04	5.05E-04	6.70E-04	1.25E-03	9.57E-04	2.13E-01	2.66E+00	4.08E-03	1.70E+01	2.30E-03	2.01E+00	1.82E+00	2.10E-01	2.35E-01
2005	12	19	1.30E-01	0.00E+00	3.68E-03	0.00E+00	0.00E+00	5.44E-03	1.49E-01	1.09E+00	3.96E-02	1.10E+01	2.39E-03	1.59E+00	4.43E-01	8.37E-02	2.67E-01
2005	12	20	9.75E-02	4.65E-07	8.51E-04	1.21E-08	9.36E-07	2.11E-03	3.01E-02	6.05E-01	7.61E-04	5.24E+00	8.54E-03	1.00E+00	2.40E-01	2.30E-02	1.42E-01
2005	12	21	0.00E+00	0.00E+00	0.00E+00	5.95E-03	1.07E-01	0.00E+00	9.69E-02	7.63E-01	2.62E-18	9.05E+00	4.20E-01	1.02E+00	7.01E-01	1.56E-01	0.00E+00
2005	12	22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-08	0.00E+00	1.90E-02	5.15E-01	1.23E-17	1.04E+00	4.36E-02	6.89E-01	2.48E-01	0.00E+00	0.00E+00
2005	12	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.30E-02	5.26E-01	4.96E-18	2.07E+00	1.65E-02	7.37E-01	2.41E-01	6.47E-04	0.00E+00
2005	12	24	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.34E-02	3.03E-01	1.66E-17	2.84E+00	1.41E-02	4.44E-01	1.98E-01	8.95E-02	0.00E+00
2005	12	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.83E-10	0.00E+00	2.30E-02	1.76E-01	9.95E-17	1.96E+00	4.95E-02	3.75E-01	2.37E-01	0.00E+00	0.00E+00
2005	12	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.83E-02	6.19E-01	2.22E-18	7.91E+00	2.29E-03	7.81E-01	4.99E-01	3.58E-02	0.00E+00
2005	12	27	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-02	7.22E-01	4.84E-18	1.40E+00	5.02E-02	8.01E-01	2.47E-01	0.00E+00	0.00E+00
2005	12	28	1.86E-01	2.15E-01	3.35E-01	1.09E-02	3.09E-02	4.10E-01	6.11E-02	1.28E+00	2.51E+00	1.09E+01	5.03E-01	2.69E+00	2.99E+00	2.18E-01	2.31E-01
2005	12	29	2.61E-03	3.23E-02	9.14E-04	2.07E-02	3.06E-02	3.90E-03	8.55E-02	6.10E-01	6.05E-03	3.63E+00	6.40E-02	9.76E-01	3.35E-01	1.55E-02	8.59E-03
2005	12	30	4.67E-02	5.49E-01	4.26E-02	7.11E-01	1.25E+00	3.53E-02	1.78E-01	1.28E+00	8.98E-01	9.25E+00	8.87E+00	1.98E+00	2.42E+00	7.64E-02	5.23E-02
2005	12	31	3.67E-01	5.32E-02	7.80E-02	2.38E-02	4.97E-02	1.23E-01	6.49E-01	1.55E+00	1.67E+00	2.08E+01	5.91E-01	4.65E+00	2.92E+00	4.56E-01	4.51E-01
2006	1	1	1.10E-01	9.57E-03	1.86E-02	2.45E-02	1.68E-01	2.96E-02	1.68E-01	1.15E+00	1.46E-01	9.65E+00	2.03E+00	2.07E+00	1.24E+00	7.84E-02	1.62E-01
2006	1	2	1.68E-02	1.52E-03	2.34E-03	3.01E-03	2.87E-02	8.24E-03	1.92E-01	9.06E-01	4.24E-02	1.23E+01	5.83E-01	1.46E+00	1.05E+00	3.84E-02	7.59E-02
2006	1	3	7.43E-02	1.58E-04	1.63E-03	1.28E-03	1.02E-02	5.74E-03	2.92E-02	5.07E-01	1.86E-02	4.79E+00	7.18E-02	1.01E+00	6.99E-01	2.22E-02	1.32E-01
2006	1	4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.95E-02	7.93E-01	2.33E-17	2.90E+00	8.39E-03	8.55E-01	2.61E-01	0.00E+00	0.00E+00
2006	1	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E-02	3.72E-01	3.68E-18	1.99E+00	1.68E-02	6.21E-01	1.68E-01	1.39E-03	0.00E+00
2006	1	6	4.10E-02	2.90E-04	6.86E-03	7.01E-05	9.25E-04	1.88E-02	1.87E-02	1.20E+00	5.48E-03	1.90E+00	2.57E-01	3.15E-01	1.03E+00	5.30E-02	8.42E-02
2006	1	7	3.53E-02	5.43E-01	7.40E-02	2.46E-02	2.52E-02	1.18E-01	2.10E-02	3.73E-01	4.25E+00	1.21E+00	4.98E-01	1.95E-01	3.63E-01	2.11E-02	8.70E-02
2006	1	8	4.53E-01	3.49E-01	1.19E-01	7.00E-02	1.35E-01	1.01E-01	2.60E-02	4.97E-01	3.47E+00	1.98E+00	1.42E+00	4.77E-01	6.37E-01	4.51E-02	8.14E-01
2006	1	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.65E-05	0.00E+00	1.22E-03	6.73E-01	5.53E-33	9.34E-01	1.07E-01	1.52E-01	2.97E-01	0.00E+00	0.00E+00
2006	1	10	4.89E-03	0.00E+00	5.98E-06	3.02E-05	1.13E-01	7.65E-05	1.50E-02	1.01E+00	3.14E-03	1.57E+00	8.18E-01	1.58E-01	6.57E-01	3.55E-02	1.16E-02
2006	1	11	4.45E-02	2.14E-01	4.81E-04	2.08E-01	2.23E-01	1.89E-03	1.37E-02	7.37E-01	9.52E-02	2.40E+00	3.32E+00	3.35E-01	5.95E-01	7.01E-02	7.19E-02
2006	1	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-04	0.00E+00	1.96E-02	7.49E-01	8.03E-19	2.09E+00	5.31E-02	9.84E-01	4.43E-01	0.00E+00	0.00E+00
2006	1	13	1.17E-03	0.00E+00	0.00E+00	2.01E-04	7.84E-02	2.91E-04	5.49E-02	1.52E+00	2.83E-04	2.55E+00	9.48E-01	4.57E-01	9.11E-01	8.14E-02	6.65E-03
2006	1	14	1.62E+00	5.68E-03	6.57E-01	6.20E-04	1.60E-03	1.09E+00	6.21E-01	2.80E+00	4.94E+00	8.11E+00	1.25E-01	1.87E+00	3.21E+00	1.21E+00	1.92E+00
2006	1	15	9.55E-02	5.06E-03	3.92E-02	1.59E-03	4.75E-03	6.80E-02	2.35E-01	2.19E+00	6.32E-01	9.46E+00	7.48E-02	1.82E+00	1.12E+00	1.08E-01	1.15E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	1	16	1.78E-01	0.00E+00	1.67E-02	0.00E+00	0.00E+00	5.30E-01	5.99E-01	1.62E+00	9.30E-03	5.13E+00	5.79E-03	6.44E-01	3.05E-01	1.11E+00	2.78E-01
2006	1	17	1.04E-01	0.00E+00	2.10E-02	0.00E+00	0.00E+00	5.16E-01	4.21E-01	1.53E+00	7.37E-03	2.52E+00	3.27E-02	6.14E-01	3.04E-01	8.03E-01	1.37E-01
2006	1	18	2.75E-01	2.21E-04	1.14E-01	1.06E-05	2.21E-04	2.02E+00	1.37E+00	4.44E+00	6.74E-02	1.06E+01	5.93E-03	1.21E+00	9.21E-01	2.19E+00	5.98E-01
2006	1	19	5.15E-01	3.31E-04	2.81E-01	6.56E-06	1.27E-04	2.06E+00	1.64E+00	4.87E+00	1.59E-01	8.98E+00	2.84E-02	1.44E+00	1.01E+00	3.25E+00	8.62E-01
2006	1	20	1.93E+00	3.20E-01	1.02E+00	1.25E-01	2.15E-01	4.41E+00	2.52E+00	7.28E+00	3.76E+00	7.85E+00	7.79E-01	1.85E+00	1.58E+00	6.33E+00	2.55E+00
2006	1	21	1.50E+00	6.59E-01	9.25E-01	1.49E-01	2.37E-01	3.76E+00	2.32E+00	5.93E+00	1.14E+00	1.12E+01	2.57E+00	1.75E+00	1.08E+00	4.45E+00	2.22E+00
2006	1	22	7.01E-02	0.00E+00	7.09E-03	0.00E+00	1.44E-05	3.82E-01	3.90E-01	1.25E+00	6.16E-17	2.49E+00	3.60E-02	5.32E-01	2.43E-01	6.67E-01	1.01E-01
2006	1	23	8.18E-02	0.00E+00	7.74E-03	0.00E+00	0.00E+00	6.22E-01	4.06E-01	1.78E+00	3.72E-04	1.35E+00	1.91E-02	6.68E-01	2.32E-01	7.49E-01	1.38E-01
2006	1	24	2.24E-01	9.15E-07	4.69E-02	1.87E-05	3.81E-02	6.24E-01	6.54E-01	1.98E+00	1.71E-03	5.02E+00	4.14E-01	7.85E-01	4.27E-01	1.19E+00	3.16E-01
2006	1	25	3.26E-01	0.00E+00	6.05E-02	0.00E+00	3.24E-05	1.55E+00	9.89E-01	3.35E+00	4.04E-02	2.61E+00	6.66E-02	1.07E+00	6.39E-01	2.04E+00	5.12E-01
2006	1	26	9.87E-02	0.00E+00	1.18E-01	0.00E+00	0.00E+00	1.44E+00	8.82E-01	2.55E+00	7.96E-03	1.70E+00	6.55E-02	8.02E-01	4.76E-01	1.42E+00	2.26E-01
2006	1	27	1.37E-01	0.00E+00	6.72E-02	0.00E+00	1.61E-05	1.15E+00	9.74E-01	2.63E+00	4.88E-03	4.16E+00	1.11E-01	8.98E-01	5.65E-01	1.43E+00	2.90E-01
2006	1	28	1.61E-01	8.31E-03	8.61E-02	1.22E-01	1.29E-01	8.53E-01	7.95E-01	2.42E+00	3.83E-02	1.95E+00	4.20E+00	5.51E-01	4.88E-01	1.11E+00	2.38E-01
2006	1	29	1.62E-01	7.09E-06	6.41E-02	1.09E-01	1.37E-01	1.03E+00	9.52E-01	2.57E+00	3.91E-03	4.06E+00	1.44E+00	7.62E-01	4.84E-01	1.23E+00	2.89E-01
2006	1	30	4.29E-01	2.43E-05	1.56E-01	2.88E-02	1.06E-01	1.92E+00	6.68E-01	3.32E+00	6.07E-02	1.88E+00	7.57E-01	8.77E-02	6.21E-01	2.15E+00	7.45E-01
2006	1	31	1.70E-01	0.00E+00	3.38E-02	1.67E-05	8.00E-02	9.03E-01	7.49E-01	2.77E+00	3.23E-03	2.07E+00	3.66E-01	8.52E-01	4.57E-01	1.28E+00	3.12E-01
2006	2	1	3.43E-02	0.00E+00	1.80E-02	0.00E+00	3.36E-03	4.38E-01	2.76E-01	8.28E-01	4.33E-04	9.93E-01	1.03E-01	2.86E-01	3.24E-01	5.45E-01	8.21E-02
2006	2	2	1.12E-01	0.00E+00	1.50E-02	0.00E+00	0.00E+00	7.43E-01	6.77E-01	2.04E+00	2.46E-19	2.92E+00	2.01E-02	9.95E-01	3.42E-01	1.03E+00	1.80E-01
2006	2	3	7.49E-01	5.66E-03	4.79E-01	1.51E-03	2.79E-02	2.06E+00	1.96E+00	4.61E+00	2.12E-01	8.88E+00	1.22E+00	1.45E+00	9.06E-01	2.77E+00	1.21E+00
2006	2	4	6.31E-01	2.87E-02	2.64E-01	2.65E-01	2.66E-01	1.67E+00	6.19E-01	2.43E+00	9.31E-02	1.59E+00	4.83E+00	2.18E-01	4.62E-01	1.18E+00	9.21E-01
2006	2	5	1.28E-01	1.48E-07	8.08E-02	0.00E+00	0.00E+00	1.21E+00	8.93E-01	3.54E+00	3.37E-02	3.84E+00	1.32E-02	1.08E+00	3.69E-01	2.08E+00	2.40E-01
2006	2	6	1.83E-01	0.00E+00	2.40E-02	0.00E+00	0.00E+00	6.45E-01	7.57E-01	2.19E+00	5.34E-03	8.58E+00	9.19E-04	8.53E-01	8.47E-01	1.42E+00	2.56E-01
2006	2	7	1.35E-01	0.00E+00	2.36E-02	0.00E+00	0.00E+00	4.83E-01	4.07E-01	1.49E+00	1.48E-06	4.96E+00	6.11E-03	4.56E-01	2.54E-01	8.94E-01	1.55E-01
2006	2	8	1.16E-01	0.00E+00	1.74E-03	0.00E+00	0.00E+00	5.78E-01	3.62E-01	1.92E+00	1.11E-16	3.89E+00	6.46E-03	3.95E-01	4.86E-01	1.06E+00	1.79E-01
2006	2	9	2.51E+00	2.20E-03	1.78E+00	4.15E-04	9.53E-04	6.09E+00	1.80E+00	8.52E+00	6.02E+00	7.45E+00	7.14E-03	1.53E+00	2.52E+00	6.62E+00	3.15E+00
2006	2	10	2.44E+00	3.36E-02	1.32E+00	3.04E-02	7.80E-02	4.11E+00	1.76E+00	6.48E+00	2.36E+00	4.24E+00	1.99E-01	1.14E+00	6.00E-01	6.01E+00	3.18E+00
2006	2	11	4.81E-02	0.00E+00	4.22E-03	0.00E+00	0.00E+00	5.54E-01	8.82E-01	1.97E+00	0.00E+00	7.81E+00	7.87E-04	1.41E+00	4.73E-01	1.07E+00	8.47E-02
2006	2	12	3.47E-01	0.00E+00	1.30E-01	0.00E+00	0.00E+00	1.00E+00	7.00E-01	1.99E+00	1.68E-03	6.29E+00	5.28E-04	8.78E-01	2.58E-01	1.38E+00	4.19E-01
2006	2	13	1.50E-01	6.43E-07	2.81E-02	0.00E+00	6.92E-09	8.65E-01	6.03E-01	3.26E+00	9.34E-03	5.79E+00	1.17E-03	5.23E-01	8.65E-01	1.83E+00	2.87E-01
2006	2	14	3.31E+00	5.66E-05	2.59E+00	4.16E-07	3.63E-06	4.53E+00	9.06E-01	4.99E+00	6.75E+00	3.88E+00	3.55E-04	1.93E+00	2.40E+00	4.86E+00	4.37E+00
2006	2	15	3.59E+00	7.76E-01	2.03E+00	5.28E-03	4.52E-03	3.45E+00	6.59E-01	5.04E+00	5.78E+00	5.79E-02	3.40E-01	4.80E-02	3.82E-02	5.35E+00	4.68E+00
2006	2	16	1.04E+00	0.00E+00	6.85E-01	0.00E+00	0.00E+00	9.95E-01	5.41E-03	6.12E-01	3.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E+00	1.24E+00
2006	2	17	3.33E+00	2.58E-01	2.35E+00	3.43E-02	9.58E-02	5.42E+00	3.13E+00	9.74E+00	6.03E+00	5.46E+00	1.18E+00	2.40E+00	2.04E+00	7.74E+00	4.25E+00
2006	2	18	1.84E+00	3.74E-02	9.63E-01	6.79E-03	1.89E-02	7.16E+00	4.91E+00	1.14E+01	2.47E+00	1.38E+01	1.08E-01	5.89E+00	5.35E+00	8.26E+00	2.26E+00
2006	2	19	2.45E-01	2.15E-03	3.19E-01	6.03E-04	1.46E-03	3.91E+00	2.23E+00	6.20E+00	1.34E-01	9.80E+00	1.20E-02	1.61E+00	3.51E-01	3.80E+00	3.28E-01
2006	2	20	7.52E-02	0.00E+00	7.59E-03	0.00E+00	0.00E+00	4.80E-01	5.07E-01	1.56E+00	1.30E-16	4.67E+00	2.82E-03	6.62E-01	2.30E-01	8.30E-01	1.29E-01
2006	2	21	1.37E-01	1.65E-06	2.07E-02	0.00E+00	2.43E-06	7.92E-01	5.33E-01	1.95E+00	2.74E-02	3.20E+00	2.52E-02	6.99E-01	3.62E-01	9.32E-01	2.28E-01
2006	2	22	2.25E-01	1.77E-03	3.84E-02	4.10E-04	8.81E-03	6.17E-01	5.88E-01	1.27E+00	4.23E-02	3.08E+00	7.59E-01	3.46E-01	3.63E-01	9.09E-01	3.47E-01
2006	2	23	2.25E+00	5.09E-01	1.50E+00	2.19E-01	1.84E-01	2.53E+00	1.09E+00	2.96E+00	1.59E+00	6.76E+00	2.17E-01	3.67E-01	6.88E-01	2.79E+00	2.76E+00
2006	2	24	1.29E+00	5.64E-01	9.99E-01	6.90E-02	7.05E-02	4.66E+00	2.80E+00	8.13E+00	2.36E+00	1.08E+01	1.21E+00	1.40E+00	5.09E-01	6.59E+00	1.79E+00
2006	2	25	2.00E+00	7.51E-02	1.22E+00	2.32E-01	2.61E-01	5.05E+00	2.63E+00	7.44E+00	4.14E+00	1.31E+01	1.48E+00	1.22E+00	1.15E+00	6.53E+00	2.43E+00
2006	2	26	7.56E-01	1.08E-01	2.79E-01	2.93E-02	4.43E-01	1.78E+00	1.64E+00	4.71E+00	5.85E-01	2.55E+00	3.01E+00	7.89E-01	7.60E-01	3.05E+00	1.06E+00
2006	2	27	1.07E+00	9.33E-03	4.48E-01	1.17E-01	1.92E-01	3.86E+00	1.81E+00	5.55E+00	1.75E-01	2.47E+00	2.02E+00	5.28E-01	9.40E-01	3.46E+00	1.49E+00
2006	2	28	8.06E-01	3.45E-01	4.90E-01	8.66E-02	1.51E-01	1.87E+00	1.24E+00	3.69E+00	8.68E-01	2.06E+00	1.23E+00	5.67E-01	5.80E-01	3.09E+00	1.08E+00
2006	3	1	2.05E+00	4.20E-01	8.86E-01	8.86E-02	1.56E-01	2.42E+00	1.08E+00	3.56E+00	1.11E+00	2.57E+00	7.04E-01	1.23E-01	7.35E-01	3.05E+00	2.58E+00
2006	3	2	2.61E+00	1.19E-04	1.36E+00	1.37E-06	5.16E-06	2.42E+00	1.22E-01	1.91E+00	4.30E+00	1.16E-03	7.51E-04	1.29E-03	1.04E-03	3.05E+00	3.30E+00
2006	3	3	2.75E+00	2.08E-03	1.69E+00	8.90E-05	1.87E-04	2.72E+00	3.91E-01	3.83E+00	8.20E+00	3.07E-02	1.12E-02	1.42E-02	9.91E-03	3.96E+00	3.61E+00
2006	3	4	2.50E+00	1.12E+00	1.51E+00	2.45E-01	2.66E-01	3.17E+00	1.43E+00	5.33E+00	4.72E+00	2.85E+00	2.70E+00	3.11E-01	5.50E-01	4.42E+00	3.48E+00
2006	3	5	1.88E+00	5.95E-01	9.50E-01	1.29E-01	1.92E-01	3.05E+00	2.09E+00	5.79E+00	7.89E-01	8.07E+00	1.71E+00	1.08E+00	6.89E-01	4.12E+00	2.58E+00
2006	3	6	8.63E-01	7.58E-01	4.80E-01	2.02E-01	2.89E-01	1.77E+00	1.47E+00	3.72E+00	9.44E-02	6.25E+00	4.79E+00	9.90E-01	1.32E+00	2.81E+00	1.19E+00
2006	3	7	1.20E-01	0.00E+00	1.12E-02	0.00E+00	0.00E+00	6.31E-01	5.34E-01	1.50E+00	1.65E-04	1.73E+00	5.10E-02	7.20E-01	3.12E-01	9.37E-01	1.67E-01
2006	3	8	7.44E-02	0.00E+00	5.52E-02	0.00E+00	9.87E-05	9.83E-01	6.22E-01	2.07E+00	9.62E-03	2.58E+00	9.62E-02	7.20E-01	3.48E-01	1.02E+00	1.19E-01
2006	3	9	7.32E-02	0.00E+00	2.59E-02	0.00E+00	2.59E-11	6.47E-01	3.71E-01	1.45E+00	5.58E-03	1.46E+00	5.87E-02	4.34E-01	3.01E-01	7.58E-01	1.36E-01
2006	3	10	1.47E+00	7.16E-03	7.86E-01	7.67E-04	4.00E-03	4.05E+00	3.07E+00	6.94E+00	4.25E-01	1.68E+01	5.31E-01	1.77E+00	1.09E+00	5.34E+00	2.12E+00
2006	3	11	2.64E+00	1.30E-02	1.75E+00	3.32E-04	1.06E-03	3.15E+00	4.26E-01	3.25E+00	5.96E+00	5.02E-01	6.72E-02	1.14E-01	1.43E-01	4.36E+00	3.38E+00
2006	3	12	3.01E+00	1.15E+00	1.63E+00	5.51E-02	4.80E-02	4.00E+00	1.40E+00	6.92E+00	4.84E+00	1.91E+00	1.33E+00	2.48E-01	4.15E-01	6.26E+00	4.35E+00
2006	3	13	2.74E-01	2.18E-04	2.42E-01	4.51E-05	5.71E-04	3.44E+00	2.27E+00	6.71E+00	1.31E-01	5.73E+00	1.11E-01	1.29E+00	1.00E+00	4.10E+00	3.87E-01
2006	3	14	2.24E+00	1.30E+00	1.11E+00	2.46E-01	7.13E-01	4.58E+00	2.89E+00	7.26E+00	3.23E-01	7.04E+00	6.35E+00	5.28E-01	1.59E+00	4.80E+00	3.31E+00
2006	3	15	6.17E-01	2.21E-03	5.21E-01	3.64E-04	9.08E-04	2.06E+00	1.87E+00	4.31E+00	4.05E-02	1.07E+01	1.60E-02	2.09E+00	5.12E-01	3.18E+00	8.61E-01
2006	3	16	2.92E+00	2.94E-01	1.51E+00	1.45E-01	3.11E-01	3.33E+00	1.37E+00	3.91E+00	2.05E+00	5.46E+00	7.35E-01	8.54E-01	6.58E-01	4.02E+00	3.75E+00
2006	3	17	2.92E+00	7.20E-01	1.17E+00	1.81E-01	1.65E-01	4.85E+00	1.89E+00	5.90E+00	1.03E+00	2.94E+00	3.97E+00	3.07E-01	7.04E-01	4.73E+00	4.20E+00
2006	3	18	1.19E+00	7.58E-02	1.25E+00	2.04E-02	4.87E-02	3.24E+00	1.76E+00	5.07E+00	2.95E+00	6.84E+00	2.36E-01	1.34E+00	8.08E-01	3.91E+00	1.69E+00
2006	3	19	9.78E-01	0.00E+00	9.57E-01	0.00E+00	0.00E+00	1.18E+00	3.33E-03	8.34E-01	4.79E+00	1.21E-09	0.00E+00	0.00E+00	0.00E+00	2.42E+00	1.28E+00
2006	3	20	3.26E+00	3.53E-04	1.79E+00	0.00E+00	1.77E-06	2.86E+00	6.20E-01	3.34E+00	1.01E+01	5.02E-03	2.00E-03	6.55E-03	4.27E-03	4.21E+00	4.48E+00
2006	3	21	4.74E+00	1.94E-01	2.55E+00	1.13E-03	1.95E-03	4.35E+00	6.98E-01	5.20E+00	8.29E+00	1.58E-01	7.60E-01	3.16E-02	4.13E-02	5.40E+00	6.08E+00
2006	3	22	1.72E+00	1.46E+00	1.18E+00	3.66E-01	5.26E-01	5.13E+00	3.60E+00	8.31E+00	5.02E-01	6.83E+00	1.02E+01	1.07E+00	1.89E+00	4.90E+00	2.67E+00
2006	3	23	2.40E+00	4.22E-01	1.54E+00	1.07E-01	1.87E-01	5.38E+00	2.57E+00	7.94E+00	3.28E+00	7.86E+00	9.39E-01	8.22E-01	1.29E+00	7.42E+00	3.38E+00
2006	3	24	2.17E+00	1.84E+00	1.30E+00	2.14E-01	2.65E-01	5.29E+00	2.51E+00	5.81E+00	1.58E+00	2.59E+00	6.39E+00	3.47E-01	6.57E-01	4.97E+00	3.21E+00
2006	3	25	1.22E+00	1.32E+00	8.29E-01	1.10E-01	1.58E-01	4.05E+00	4.12E+00	1.00E+01	6.23E-01	1.17E+01	5.37E+00	2.95E+00	4.47E+00	5.53E+00	1.87E+00
2006	3	26	1.05E+00	8.61E-05	3.19E-01	4.01E-06	3.73E-05	1.80E+00	1.52E+00	3.31E+00	3.46E-01	5.36E+00	1.82E-02	9.15E-01	7.94E-01	2.87E+00	1.42E+00
2006	3	27	1.85E+00	4.98E-01	1.12E+00	6.77E-02	1.11E-01	2.24E+00	1.94E+00	4.25E+00	9.57E-01	2.91E+00	1.94E+00	6.24E-01	1.31E+00	2.89E+00	2.41E+00
2006	3	28	3.95E+00	1.84E-01	2.18E+00	2.98E-02	4.37E-02	5.45E+00	2.59E+00	9.08E+00	7.23E+00	5.83E+00	3.88E-01	1.01E+00	1.28E+00	7.85E+00	5.26E+00
2006	3	29	3.77E+00	1.17E+00	2.57E+00	2.59E-01	3.76E-01	5.25E+00	3.25E+00	8.41E+00	7.37E+00	7.00E+00	1.88E+00	1.82E+00	2.46E+00	7.40E+00	4.97E+00
2006	3	30	7.80E-01	4.21E-04	4.65E-01	1.62E-04	1.94E-03	4.13E+00	3.27E+00	7.38E+00	7.78E-02	1.29E+01	2.45E-01	1.87E+00	2.30E+00	4.97E+00	1.25E+00
2006	3	31	1.38E+00	1.08E+00	4.42E-01	3.00E-01	4.78E-01	4.53E+00	2.91E+00	7.50E+00	2.71E-01	9.32E+00	6.70E+00	1.08E+00	1.22E+00	4.70E+00	1.87E+00
2006	4	1	1.62E+00	3.04E-02	9.00E-01	5.72E-03	1.33E-02	2.83E+00	1.34E+00	4.67E+00	2.70E+00	7.26E+00	1.30E-01	9.95E-01	1.24E+00	3.92E+00	2.13E+00
2006	4	2	2.15E+00	1.61E+00	1.09E+00	1.91E-01	2.64E-01	4.03E+00	2.79E+00	6.34E+00	2.12E+00	7.85E+00	6.49E+00	8.93E-01	1.47E+00	4.90E+00	2.95E+00
2006	4	3	3.31E+00	3.23E-01	1.54E+00	4.17E-02	7.04E-02	4.35E+00	1.75E+00	7.19E+00	4.42E+00	6.89E+00	6.63E-01	1.42E+00	1.89E+00	5.75E+00	4.74E+00
2006	4	4	2.90E+00	4.76E-01	1.63E+00	8.28E-02	1.43E-01	4.70E+00	2.33E+00	7.26E+00	4.54E+00	1.00E+01	2.01E+00	1.85E+00	2.30E+00	5.80E+00	3.90E+00
2006	4	5	4.50E+00	4.70E-04	3.47E+00	8.40E-07	3.60E-06	3.90E+00	1.36E-01	3.91E+00	6.49E+00	5.54E-03	6.12E-04	7.23E-03	4.02E-03	4.87E+00	5.09E+00
2006	4	6	4.24E+00	3.32E-01	2.16E+00	5.49E-02	1.13E-01	5.19E+00	1.28E+00	5.65E+00	4.72E+00	1.32E+00	3.04E+00	1.73E-01	2.59E-01	6.63E+00	5.23E+00
2006	4	7	2.93E+00	1.07E-01	1.83E+00	9.97E-02	2.07E-01	5.66E+00	1.37E+00	6.86E+00	3.19E+00	3.43E+00	1.90E+00	5.58E-01	1.13E+00	4.99E+00	4.04E+00

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	1	16	1.77E-01	0.00E+00	1.67E-02	0.00E+00	0.00E+00	5.30E-01	5.13E-01	1.06E+00	9.12E-03	9.82E-04	9.08E-06	3.05E-03	2.67E-03	1.08E+00	2.76E-01
2006	1	17	1.04E-01	0.00E+00	2.10E-02	0.00E+00	0.00E+00	5.16E-01	4.09E-01	9.53E-01	7.37E-03	1.93E-05	0.00E+00	9.71E-04	1.81E-04	8.01E-01	1.37E-01
2006	1	18	2.75E-01	2.21E-04	1.14E-01	1.06E-05	2.21E-04	2.02E+00	1.23E+00	3.35E+00	6.74E-02	1.31E-02	3.30E-03	2.18E-02	1.88E-02	2.17E+00	5.97E-01
2006	1	19	4.67E-01	3.06E-04	2.79E-01	5.21E-06	1.18E-04	2.05E+00	1.56E+00	3.96E+00	1.57E-01	2.16E-02	4.78E-03	3.36E-02	3.02E-02	3.22E+00	7.72E-01
2006	1	20	1.51E+00	1.31E-02	7.36E-01	5.89E-03	7.51E-03	4.10E+00	2.25E+00	5.72E+00	1.15E-01	3.68E-02	1.84E-02	7.87E-02	5.50E-02	6.02E+00	1.87E+00
2006	1	21	1.23E+00	1.79E-02	6.52E-01	6.38E-03	9.67E-03	3.53E+00	2.10E+00	4.77E+00	1.66E-01	5.08E-02	2.90E-02	8.34E-02	6.33E-02	4.25E+00	1.75E+00
2006	1	22	7.01E-02	0.00E+00	7.09E-03	0.00E+00	0.00E+00	3.82E-01	3.59E-01	5.94E-01	0.00E+00	0.00E+00	0.00E+00	5.28E-05	0.00E+00	6.67E-01	1.01E-01
2006	1	23	8.18E-02	0.00E+00	7.74E-03	0.00E+00	0.00E+00	6.22E-01	3.91E-01	1.04E+00	3.72E-04	9.76E-08	0.00E+00	2.05E-03	2.72E-04	7.49E-01	1.38E-01
2006	1	24	2.24E-01	9.15E-07	4.67E-02	1.28E-05	1.24E-04	6.18E-01	6.04E-01	1.50E+00	1.62E-03	5.19E-04	3.74E-04	1.63E-03	1.52E-03	1.18E+00	3.16E-01
2006	1	25	3.26E-01	0.00E+00	6.05E-02	0.00E+00	3.24E-05	1.55E+00	8.70E-01	2.61E+00	4.04E-02	5.36E-03	5.35E-04	1.46E-02	1.25E-02	1.85E+00	5.12E-01
2006	1	26	9.86E-02	0.00E+00	1.18E-01	0.00E+00	0.00E+00	1.44E+00	8.45E-01	1.94E+00	7.96E-03	9.94E-04	1.31E-07	1.86E-02	7.10E-03	1.42E+00	2.24E-01
2006	1	27	1.37E-01	0.00E+00	6.72E-02	0.00E+00	0.00E+00	1.15E+00	8.86E-01	1.55E+00	4.88E-03	2.50E-04	0.00E+00	1.11E-02	2.37E-03	1.43E+00	2.90E-01
2006	1	28	1.61E-01	4.44E-03	8.61E-02	7.28E-03	8.06E-03	8.53E-01	7.82E-01	1.50E+00	3.38E-02	1.86E-02	1.08E-02	3.59E-02	2.85E-02	1.11E+00	2.38E-01
2006	1	29	1.62E-01	7.09E-06	6.41E-02	7.60E-04	2.81E-03	1.03E+00	8.64E-01	1.92E+00	3.91E-03	4.70E-03	9.59E-04	2.84E-02	2.03E-02	1.23E+00	2.89E-01
2006	1	30	4.24E-01	2.43E-05	1.56E-01	4.63E-04	2.00E-03	1.92E+00	6.60E-01	2.05E+00	5.99E-02	1.36E-02	4.79E-03	2.73E-02	1.95E-02	2.10E+00	7.30E-01
2006	1	31	1.70E-01	0.00E+00	3.38E-02	6.77E-06	1.76E-04	9.03E-01	7.29E-01	1.63E+00	3.23E-03	1.50E-03	3.67E-04	9.15E-03	6.33E-03	1.28E+00	3.12E-01
2006	2	1	3.43E-02	0.00E+00	1.80E-02	0.00E+00	0.00E+00	4.38E-01	2.72E-01	6.43E-01	4.33E-04	1.29E-04	0.00E+00	8.31E-04	7.38E-04	5.45E-01	8.21E-02
2006	2	2	1.12E-01	0.00E+00	1.50E-02	0.00E+00	0.00E+00	7.43E-01	6.38E-01	1.30E+00	0.00E+00	0.00E+00	0.00E+00	1.64E-03	6.82E-05	1.03E+00	1.80E-01
2006	2	3	7.40E-01	3.70E-03	4.73E-01	6.15E-04	2.43E-03	2.03E+00	1.88E+00	3.58E+00	9.41E-02	2.62E-02	1.11E-02	3.68E-02	3.19E-02	2.73E+00	1.18E+00
2006	2	4	6.31E-01	1.05E-02	2.64E-01	7.44E-03	1.03E-02	1.66E+00	6.17E-01	1.77E+00	7.67E-02	2.21E-02	1.36E-02	4.19E-02	3.09E-02	1.18E+00	9.20E-01
2006	2	5	1.28E-01	1.48E-07	8.08E-02	0.00E+00	0.00E+00	1.21E+00	8.11E-01	2.52E+00	3.37E-02	3.47E-03	1.48E-04	9.58E-03	7.60E-03	2.06E+00	2.40E-01
2006	2	6	1.83E-01	0.00E+00	2.40E-02	0.00E+00	0.00E+00	6.45E-01	6.70E-01	1.33E+00	5.34E-03	8.25E-04	5.16E-05	4.06E-03	2.04E-03	1.38E+00	2.56E-01
2006	2	7	1.35E-01	0.00E+00	2.36E-02	0.00E+00	0.00E+00	4.83E-01	3.29E-01	1.18E+00	1.48E-06	0.00E+00	0.00E+00	1.57E-04	4.09E-05	8.26E-01	1.55E-01
2006	2	8	1.16E-01	0.00E+00	1.74E-03	0.00E+00	0.00E+00	5.78E-01	3.14E-01	1.15E+00	0.00E+00	0.00E+00	0.00E+00	6.73E-06	0.00E+00	1.03E+00	1.79E-01
2006	2	9	1.86E+00	2.11E-03	1.29E+00	4.14E-04	9.50E-04	5.10E+00	1.65E+00	7.22E+00	8.52E-02	1.64E-02	6.63E-03	3.30E-02	2.29E-02	6.26E+00	2.35E+00
2006	2	10	1.86E+00	9.03E-04	9.32E-01	9.22E-05	2.62E-04	3.68E+00	1.44E+00	5.16E+00	9.84E-02	1.40E-02	3.71E-03	3.71E-02	2.30E-02	5.59E+00	2.36E+00
2006	2	11	4.81E-02	0.00E+00	4.22E-03	0.00E+00	0.00E+00	5.54E-01	7.91E-01	1.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E+00	8.47E-02
2006	2	12	3.26E-01	0.00E+00	1.29E-01	0.00E+00	0.00E+00	9.98E-01	6.19E-01	1.49E+00	1.66E-03	1.05E-04	0.00E+00	9.93E-04	3.75E-04	1.34E+00	3.59E-01
2006	2	13	1.49E-01	6.43E-07	2.81E-02	0.00E+00	6.92E-09	8.65E-01	5.52E-01	2.59E+00	8.59E-03	4.74E-04	3.36E-05	2.78E-03	1.18E-03	1.78E+00	2.83E-01
2006	2	14	2.99E+00	5.54E-05	1.51E+00	4.16E-07	3.63E-06	3.39E+00	6.84E-01	4.52E+00	2.35E-02	1.59E-03	3.37E-04	8.41E-03	3.62E-03	4.67E+00	3.84E+00
2006	2	15	3.28E+00	1.73E-02	1.81E+00	2.17E-03	2.54E-03	3.34E+00	6.56E-01	4.98E+00	1.10E-01	2.59E-02	1.50E-02	4.37E-02	3.10E-02	5.33E+00	4.13E+00
2006	2	16	1.04E+00	0.00E+00	6.54E-01	0.00E+00	0.00E+00	9.61E-01	5.41E-03	6.12E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E+00	1.24E+00
2006	2	17	2.00E+00	4.20E-03	1.60E+00	3.75E-04	1.09E-03	4.51E+00	2.12E+00	7.51E+00	1.51E-01	3.33E-02	1.31E-02	5.93E-02	4.44E-02	6.51E+00	2.67E+00
2006	2	18	1.36E+00	4.09E-03	5.58E-01	6.99E-04	2.29E-03	6.70E+00	3.73E+00	8.84E+00	1.92E-01	4.17E-02	1.46E-02	1.04E-01	6.75E-02	7.52E+00	1.71E+00
2006	2	19	2.43E-01	1.58E-03	3.18E-01	1.72E-04	7.15E-04	3.90E+00	2.08E+00	4.71E+00	1.33E-01	2.81E-02	8.93E-03	6.69E-02	4.53E-02	3.74E+00	3.27E-01
2006	2	20	7.52E-02	0.00E+00	7.59E-03	0.00E+00	0.00E+00	4.80E-01	4.30E-01	1.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-01	1.29E-01
2006	2	21	1.37E-01	1.65E-06	2.07E-02	0.00E+00	2.43E-06	7.92E-01	4.77E-01	1.16E+00	2.74E-02	2.86E-03	2.49E-04	4.12E-03	5.00E-03	9.30E-01	2.28E-01
2006	2	22	2.25E-01	4.06E-04	3.84E-02	7.48E-05	6.67E-04	6.17E-01	5.56E-01	9.60E-01	3.92E-02	1.03E-02	7.58E-03	1.71E-02	1.15E-02	9.09E-01	3.47E-01
2006	2	23	2.10E+00	2.10E-02	1.35E+00	1.66E-02	1.40E-02	2.40E+00	1.07E+00	2.86E+00	7.41E-02	2.85E-02	2.23E-02	3.29E-02	3.34E-02	2.78E+00	2.49E+00
2006	2	24	1.25E+00	1.73E-02	9.52E-01	5.04E-03	7.19E-03	4.61E+00	2.73E+00	6.99E+00	1.21E-01	3.22E-02	1.96E-02	5.03E-02	3.87E-02	6.51E+00	1.66E+00
2006	2	25	1.99E+00	8.76E-03	1.15E+00	1.20E-02	1.72E-02	4.92E+00	2.55E+00	6.00E+00	1.58E-01	4.84E-02	2.59E-02	8.12E-02	6.41E-02	6.44E+00	2.39E+00
2006	2	26	7.35E-01	3.38E-03	2.72E-01	3.39E-03	4.70E-03	1.76E+00	1.57E+00	3.48E+00	4.49E-02	1.58E-02	7.68E-03	3.06E-02	2.13E-02	2.93E+00	1.03E+00
2006	2	27	1.06E+00	6.91E-03	4.40E-01	4.16E-03	5.35E-03	3.81E+00	1.76E+00	4.29E+00	1.71E-01	4.09E-02	1.88E-02	6.46E-02	5.39E-02	3.34E+00	1.45E+00
2006	2	28	7.01E-01	4.64E-03	4.16E-01	1.62E-03	3.33E-03	1.77E+00	1.16E+00	3.03E+00	1.07E-01	2.56E-02	9.90E-03	4.73E-02	3.82E-02	2.99E+00	9.70E-01
2006	3	1	1.94E+00	4.11E-03	8.71E-01	1.41E-03	3.79E-03	2.36E+00	1.07E+00	3.40E+00	1.01E-01	4.03E-02	1.67E-02	3.08E-02	3.52E-02	3.02E+00	2.38E+00
2006	3	2	2.37E+00	1.10E-04	1.30E+00	1.37E-06	5.16E-06	2.32E+00	1.22E-01	1.91E+00	1.41E-02	6.80E-04	2.12E-04	1.21E-03	9.06E-04	3.05E+00	2.83E+00
2006	3	3	2.66E+00	1.04E-03	1.58E+00	8.90E-05	1.87E-04	2.58E+00	3.91E-01	3.81E+00	4.32E-02	6.01E-03	2.30E-03	1.37E-02	8.79E-03	3.96E+00	3.45E+00
2006	3	4	2.28E+00	3.06E-02	1.36E+00	1.14E-02	1.57E-02	3.01E+00	1.39E+00	4.95E+00	1.46E-01	5.42E-02	3.90E-02	5.15E-02	5.21E-02	4.37E+00	3.03E+00
2006	3	5	1.79E+00	1.68E-02	9.30E-01	6.07E-03	7.66E-03	3.00E+00	2.00E+00	4.91E+00	1.59E-01	3.46E-02	1.87E-02	6.18E-02	4.36E-02	4.08E+00	2.41E+00
2006	3	6	7.62E-01	2.17E-02	4.79E-01	1.20E-02	1.59E-02	1.77E+00	1.38E+00	2.89E+00	4.44E-02	4.19E-02	2.85E-02	7.14E-02	5.58E-02	2.62E+00	9.51E-01
2006	3	7	1.20E-01	0.00E+00	1.12E-02	0.00E+00	0.00E+00	6.31E-01	5.06E-01	9.10E-01	1.65E-04	0.00E+00	0.00E+00	4.06E-03	3.96E-04	9.37E-01	1.67E-01
2006	3	8	7.44E-02	0.00E+00	5.52E-02	0.00E+00	0.00E+00	9.83E-01	5.92E-01	1.26E+00	9.62E-03	5.78E-04	0.00E+00	1.04E-02	3.13E-03	1.02E+00	1.19E-01
2006	3	9	7.32E-02	0.00E+00	2.59E-02	0.00E+00	0.00E+00	6.47E-01	3.59E-01	9.86E-01	5.58E-03	7.26E-04	0.00E+00	4.97E-03	2.51E-03	7.55E-01	1.36E-01
2006	3	10	1.45E+00	7.03E-03	7.79E-01	7.61E-04	3.27E-03	4.01E+00	3.02E+00	5.93E+00	2.03E-01	6.72E-02	3.28E-02	7.35E-02	7.06E-02	5.19E+00	2.06E+00
2006	3	11	2.31E+00	4.79E-03	1.15E+00	3.09E-04	9.41E-04	2.63E+00	3.95E-01	2.98E+00	8.94E-02	1.64E-02	7.81E-03	2.93E-02	2.13E-02	4.23E+00	2.93E+00
2006	3	12	2.71E+00	1.20E-02	1.54E+00	4.78E-03	5.97E-03	3.92E+00	1.39E+00	6.46E+00	1.38E-01	3.11E-02	1.69E-02	3.89E-02	3.48E-02	6.22E+00	3.70E+00
2006	3	13	2.74E-01	2.18E-04	2.42E-01	4.50E-05	3.07E-04	3.44E+00	2.13E+00	4.76E+00	1.31E-01	2.55E-02	5.68E-03	6.07E-02	4.06E-02	4.07E+00	3.87E-01
2006	3	14	2.07E+00	3.26E-02	1.09E+00	1.80E-02	2.71E-02	4.51E+00	2.87E+00	6.31E+00	2.43E-01	1.10E-01	6.65E-02	1.66E-01	1.34E-01	4.69E+00	2.85E+00
2006	3	15	5.56E-01	1.98E-03	5.11E-01	3.24E-04	8.16E-04	2.04E+00	1.73E+00	3.00E+00	2.63E-02	8.15E-03	4.27E-03	2.07E-02	1.13E-02	3.14E+00	7.17E-01
2006	3	16	2.58E+00	6.98E-03	1.48E+00	7.68E-03	1.02E-02	3.26E+00	1.34E+00	3.47E+00	4.94E-02	2.06E-02	1.38E-02	2.98E-02	2.49E-02	4.01E+00	3.18E+00
2006	3	17	2.73E+00	3.16E-02	1.14E+00	8.92E-03	1.13E-02	4.82E+00	1.88E+00	5.45E+00	3.13E-01	9.14E-02	4.64E-02	1.37E-01	1.12E-01	4.71E+00	3.84E+00
2006	3	18	1.13E+00	1.91E-03	9.75E-01	2.17E-04	1.11E-03	3.11E+00	1.67E+00	4.19E+00	1.15E-01	3.00E-02	1.01E-02	6.60E-02	4.54E-02	3.85E+00	1.58E+00
2006	3	19	9.78E-01	0.00E+00	6.58E-01	0.00E+00	0.00E+00	1.06E+00	3.33E-03	8.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E+00	1.28E+00
2006	3	20	3.20E+00	1.29E-04	1.63E+00	0.00E+00	1.73E-06	2.72E+00	6.20E-01	3.33E+00	5.41E-02	2.84E-03	3.94E-04	6.51E-03	4.17E-03	4.21E+00	4.30E+00
2006	3	21	4.53E+00	1.91E-03	2.43E+00	1.79E-04	4.46E-04	4.16E+00	6.97E-01	5.12E+00	8.86E-02	1.20E-02	3.97E-03	2.53E-02	1.73E-02	5.39E+00	5.71E+00
2006	3	22	1.64E+00	4.37E-02	1.16E+00	1.98E-02	3.14E-02	5.11E+00	3.51E+00	6.82E+00	3.93E-01	1.48E-01	8.10E-02	2.55E-01	1.99E-01	4.78E+00	2.48E+00
2006	3	23	2.19E+00	2.73E-02	1.43E+00	1.22E-02	1.74E-02	5.24E+00	2.50E+00	6.76E+00	2.75E-01	8.14E-02	4.53E-02	1.37E-01	1.04E-01	7.25E+00	2.94E+00
2006	3	24	2.03E+00	5.81E-02	1.25E+00	3.08E-02	4.01E-02	5.22E+00	2.47E+00	5.03E+00	2.97E-01	1.40E-01	8.91E-02	2.29E-01	1.82E-01	4.89E+00	2.86E+00
2006	3	25	1.17E+00	5.66E-02	8.20E-01	1.70E-02	2.44E-02	4.03E+00	3.94E+00	8.15E+00	3.34E-01	1.30E-01	7.79E-02	2.18E-01	1.68E-01	5.38E+00	1.78E+00
2006	3	26	1.03E+00	7.28E-05	3.15E-01	3.72E-06	3.31E-05	1.78E+00	1.45E+00	2.50E+00	1.26E-02	1.50E-03	3.31E-04	9.24E-03	3.89E-03	2.84E+00	1.36E+00
2006	3	27	1.81E+00	9.03E-03	1.08E+00	2.58E-03	4.04E-03	2.16E+00	1.92E+00	3.56E+00	8.76E-02	2.83E-02	1.42E-02	6.14E-02	3.99E-02	2.89E+00	2.37E+00
2006	3	28	3.57E+00	1.64E-02	1.76E+00	6.17E-03	8.92E-03	5.04E+00	2.47E+00	7.86E+00	2.41E-01	5.17E-02	2.66E-02	9.41E-02	6.97E-02	7.57E+00	4.72E+00
2006	3	29	3.26E+00	2.93E-02	1.95E+00	1.31E-02	1.96E-02	4.56E+00	2.97E+00	7.45E+00	2.35E-01	7.93E-02	4.61E-02	1.51E-01	1.07E-01	7.04E+00	4.29E+00
2006	3	30	7.78E-01	4.20E-04	4.65E-01	1.59E-04	9.79E-04	4.13E+00	3.14E+00	5.88E+00	6.92E-02	2.05E-02	6.11E-03	6.66E-02	3.83E-02	4.88E+00	1.24E+00
2006	3	31	1.36E+00	2.13E-02	4.42E-01	1.61E-02	2.32E-02	4.53E+00	2.84E+00	6.02E+00	2.48E-01	8.57E-02	4.50E-02	1.53E-01	1.16E-01	4.57E+00	1.82E+00
2006	4	1	1.47E+00	2.95E-03	8.52E-01	4.20E-04	1.39E-03	2.75E+00	1.27E+00	4.15E+00	8.47E-02	2.22E-02	9.82E-03	4.14E-02	2.99E-02	3.86E+00	1.84E+00
2006	4	2	2.12E+00	4.08E-02	1.08E+00	1.33E-02	1.86E-02	4.00E+00	2.76E+00	5.53E+00	2.69E-01	8.71E-02	5.58E-02	1.22E-01	9.65E-02	4.81E+00	2.89E+00
2006	4	3	2.94E+00	2.44E-02	1.36E+00	6.83E-03	1.01E-02	4.09E+00	1.59E+00	6.67E+00	2.09E-01	5.95E-02	3.60E-02	8.18E-02	6.87E-02	5.55E+00	4.11E+00
2006	4	4	2.66E+00	2.37E-02	1.36E+00	9.27E-03	1.46E-02	4.45E+00	2.14E+00	6.25E+00	2.36E-01	7.45E-02	4.05E-02	1.35E-01	9.85E-02	5.54E+00	3.52E+00
2006	4	5	4.09E+00	4.69E-04	2.41E+00	8.40E-07	3.60E-06	3.17E+00	1.35E-01	3.87E+00	8.09E-02	2.91E-03	6.11E-04	6.58E-03	3.84E-03	4.83E+00	4.42E+00
2006	4	6	2.90E+00	6.44E-03	1.68E+00	1.66E-03	3.19E-03	4.79E+00	1.27E+00	5.31E+00	1.22E-01	2.89E-02	1.31E-02	6.33E-02	4.31E-02	6.46E+00	3.58E+00
2006	4	7	2.73E+00	7.62E-03	1.80E+00	3.29E-03	5.87E-03	5.64E+00	1.33E+00	5.96E+00	2.16E-01	4.58E-02	1.90E-02	9.49E-02	6.73E-02	4.91E+00	3.62E+00

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	1	16	5.53E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.64E-02	5.66E-01	1.79E-04	5.13E+00	5.78E-03	6.41E-01	3.02E-01	2.31E-02	1.19E-03
2006	1	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-02	5.73E-01	1.37E-18	2.52E+00	3.27E-02	6.13E-01	3.04E-01	2.30E-03	0.00E+00
2006	1	18	7.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-01	1.10E+00	0.00E+00	1.06E+01	2.63E-03	1.19E+00	9.02E-01	1.45E-02	1.09E-03
2006	1	19	4.83E-02	2.46E-05	2.05E-03	1.35E-06	9.27E-06	4.57E-03	7.95E-02	9.10E-01	1.70E-03	8.96E+00	2.36E-02	1.40E+00	9.84E-01	3.03E-02	8.98E-02
2006	1	20	4.28E-01	3.07E-01	2.80E-01	1.19E-01	2.08E-01	3.12E-01	2.70E-01	1.56E+00	3.65E+00	7.81E+00	7.60E-01	1.77E+00	1.53E+00	3.08E-01	6.78E-01
2006	1	21	2.76E-01	6.41E-01	2.73E-01	1.43E-01	2.28E-01	2.35E-01	2.19E-01	1.15E+00	9.72E-01	1.12E+01	2.54E+00	1.67E+00	1.02E+00	1.95E-01	4.68E-01
2006	1	22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-05	0.00E+00	3.14E-02	6.59E-01	6.16E-17	2.49E+00	3.60E-02	5.32E-01	2.43E-01	0.00E+00	0.00E+00
2006	1	23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-02	7.41E-01	3.67E-17	1.35E+00	1.91E-02	6.66E-01	2.31E-01	0.00E+00	0.00E+00
2006	1	24	9.39E-07	0.00E+00	2.18E-04	5.94E-06	3.80E-02	6.34E-03	5.01E-02	4.85E-01	9.19E-05	5.02E+00	4.14E-01	7.83E-01	4.26E-01	9.47E-03	9.92E-06
2006	1	25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-10	0.00E+00	1.19E-01	7.40E-01	3.86E-06	2.60E+00	6.61E-02	1.06E+00	6.26E-01	1.86E-01	4.10E-10
2006	1	26	1.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-02	6.13E-01	6.38E-20	1.70E+00	6.55E-02	7.84E-01	4.69E-01	3.12E-03	1.11E-03
2006	1	27	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-05	0.00E+00	8.77E-02	1.08E+00	3.84E-37	4.16E+00	1.11E-01	8.87E-01	5.63E-01	2.18E-05	0.00E+00
2006	1	28	0.00E+00	3.87E-03	0.00E+00	1.15E-01	1.21E-01	0.00E+00	1.24E-02	9.20E-01	4.51E-03	1.93E+00	4.19E+00	5.15E-01	4.59E-01	4.21E-03	0.00E+00
2006	1	29	0.00E+00	0.00E+00	0.00E+00	1.08E-01	1.34E-01	0.00E+00	8.89E-02	6.46E-01	1.62E-19	4.05E+00	1.44E+00	7.34E-01	4.64E-01	0.00E+00	0.00E+00
2006	1	30	5.26E-03	0.00E+00	0.00E+00	2.83E-02	1.04E-01	7.57E-05	8.01E-03	1.27E+00	8.08E-04	1.87E+00	7.52E-01	6.03E-02	6.01E-01	4.95E-02	1.45E-02
2006	1	31	0.00E+00	0.00E+00	0.00E+00	9.92E-06	7.98E-02	0.00E+00	1.95E-02	1.14E+00	1.51E-19	2.07E+00	3.66E-01	8.43E-01	4.51E-01	0.00E+00	0.00E+00
2006	2	1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E-03	0.00E+00	3.58E-03	1.85E-01	1.46E-19	9.93E-01	1.03E-01	2.85E-01	3.23E-01	0.00E+00	0.00E+00
2006	2	2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E-02	7.46E-01	2.46E-19	2.92E+00	2.01E-02	9.94E-01	3.42E-01	1.35E-03	0.00E+00
2006	2	3	8.76E-03	1.96E-03	5.45E-03	9.00E-04	2.54E-02	2.81E-02	7.52E-02	1.03E+00	1.18E-01	8.85E+00	1.21E+00	1.42E+00	8.74E-01	3.66E-02	3.27E-02
2006	2	4	1.24E-05	1.83E-02	4.88E-04	2.58E-01	2.55E-01	4.14E-03	1.50E-03	6.56E-01	1.64E-02	1.57E+00	4.81E+00	1.76E-01	4.31E-01	2.22E-03	7.50E-04
2006	2	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.18E-02	1.02E+00	4.38E-20	3.84E+00	1.30E-02	1.07E+00	3.61E-01	2.27E-02	0.00E+00
2006	2	6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.65E-02	8.70E-01	1.20E-18	8.58E+00	8.68E-04	8.49E-01	8.45E-01	4.55E-02	1.61E-05
2006	2	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.81E-02	3.11E-01	3.41E-16	4.96E+00	6.11E-03	4.56E-01	2.54E-01	6.81E-02	0.00E+00
2006	2	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.85E-02	7.67E-01	1.11E-16	3.89E+00	6.46E-03	3.95E-01	4.86E-01	2.57E-02	0.00E+00
2006	2	9	6.49E-01	9.50E-05	4.96E-01	2.27E-07	2.78E-06	9.83E-01	1.48E-01	1.30E+00	5.94E+00	7.43E+00	5.08E-04	1.50E+00	2.49E+00	3.55E-01	8.09E-01
2006	2	10	5.79E-01	3.26E-02	3.89E-01	3.03E-02	7.77E-02	4.29E-01	3.20E-01	1.32E+00	2.27E+00	4.23E+00	1.95E-01	1.10E+00	5.77E-01	4.13E-01	8.12E-01
2006	2	11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.10E-02	7.64E-01	0.00E+00	7.81E+00	7.87E-04	1.41E+00	4.73E-01	0.00E+00	0.00E+00
2006	2	12	2.12E-02	0.00E+00	1.05E-03	0.00E+00	0.00E+00	5.23E-03	8.03E-02	4.95E-01	2.00E-05	6.29E+00	5.28E-04	8.77E-01	2.58E-01	4.12E-02	6.04E-02
2006	2	13	8.83E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.16E-02	6.63E-01	7.49E-04	5.79E+00	1.14E-03	5.20E-01	8.63E-01	4.76E-02	4.21E-03
2006	2	14	3.18E-01	1.17E-06	1.09E+00	0.00E+00	0.00E+00	1.14E+00	2.22E-01	4.64E-01	6.72E+00	3.88E+00	1.80E-05	1.92E+00	2.40E+00	1.88E-01	5.24E-01
2006	2	15	3.05E-01	7.58E-01	2.20E-01	3.11E-03	1.98E-03	1.10E-01	3.48E-03	5.28E-02	5.67E+00	3.20E-02	3.25E-01	4.30E-03	7.19E-03	1.50E-02	5.49E-01
2006	2	16	0.00E+00	0.00E+00	3.10E-02	0.00E+00	0.00E+00	3.44E-02	0.00E+00	0.00E+00	3.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2006	2	17	1.34E+00	2.53E-01	7.50E-01	3.40E-02	9.47E-02	9.01E-01	1.01E+00	2.23E+00	5.88E+00	5.43E+00	1.17E+00	2.34E+00	2.00E+00	1.23E+00	1.58E+00
2006	2	18	4.81E-01	3.33E-02	4.04E-01	6.09E-03	1.66E-02	4.53E-01	1.18E+00	2.61E+00	2.28E+00	1.37E+01	9.36E-02	5.78E+00	5.28E+00	7.47E-01	5.55E-01
2006	2	19	1.68E-03	5.74E-04	1.07E-03	4.31E-04	7.40E-04	1.21E-03	1.51E-01	1.49E+00	1.45E-03	9.77E+00	3.07E-03	1.55E+00	3.06E-01	5.35E-02	1.70E-03
2006	2	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.77E-02	4.68E-01	1.30E-16	4.67E+00	2.82E-03	6.62E-01	2.30E-01	0.00E+00	0.00E+00
2006	2	21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.60E-02	7.85E-01	5.69E-17	3.20E+00	2.50E-02	6.94E-01	3.57E-01	2.23E-03	0.00E+00
2006	2	22	0.00E+00	1.36E-03	0.00E+00	3.36E-04	8.15E-03	0.00E+00	3.14E-02	3.08E-01	3.20E-03	3.07E+00	7.52E-01	3.29E-01	3.52E-01	1.40E-06	0.00E+00
2006	2	23	1.52E-01	4.88E-01	1.52E-01	2.02E-01	1.70E-01	1.29E-01	1.61E-02	1.01E-01	1.51E+00	6.73E+00	1.94E-01	3.34E-01	6.55E-01	8.11E-03	2.71E-01
2006	2	24	4.55E-02	5.46E-01	4.66E-02	6.39E-02	6.33E-02	5.60E-02	7.13E-02	1.14E+00	2.24E+00	1.08E+01	1.19E+00	1.35E+00	4.71E-01	8.07E-02	1.37E-01
2006	2	25	7.01E-03	6.63E-02	6.74E-02	2.20E-01	2.44E-01	1.29E-01	8.70E-02	1.45E+00	3.98E+00	1.31E+01	1.45E+00	1.14E+00	1.09E+00	9.38E-02	3.15E-02
2006	2	26	2.10E-02	1.04E-01	7.17E-03	2.59E-02	4.39E-01	1.92E-02	6.91E-02	1.23E+00	5.40E-01	2.54E+00	3.00E+00	7.59E-01	7.39E-01	1.25E-01	3.65E-02
2006	2	27	7.47E-03	2.42E-03	7.90E-03	1.13E-01	1.87E-01	5.28E-02	4.20E-02	1.26E+00	4.37E-03	2.43E+00	2.00E+00	4.63E-01	8.86E-01	1.22E-01	3.36E-02
2006	2	28	1.06E-01	3.40E-01	7.46E-02	8.50E-02	1.47E-01	1.04E-01	8.71E-02	6.52E-01	7.61E-01	2.04E+00	1.22E+00	5.20E-01	5.42E-01	1.07E-01	1.15E-01
2006	3	1	1.10E-01	4.16E-01	1.52E-02	8.71E-02	1.52E-01	5.64E-02	6.06E-03	1.54E-01	1.01E+00	2.53E+00	6.88E-01	9.25E-02	7.00E-01	2.23E-02	2.06E-01
2006	3	2	2.45E-01	9.12E-06	5.75E-02	0.00E+00	0.00E+00	9.71E-02	3.22E-07	6.05E-04	4.29E+00	4.76E-04	5.39E-04	7.96E-05	1.32E-04	3.69E-04	4.73E-01
2006	3	3	8.37E-02	1.03E-03	1.06E-01	8.97E-10	7.16E-08	1.46E-01	2.91E-08	1.70E-02	8.16E+00	2.47E-02	8.87E-03	4.68E-04	1.11E-03	1.81E-03	1.60E-01
2006	3	4	2.17E-01	1.09E+00	1.52E-01	2.34E-01	2.50E-01	1.63E-01	3.77E-02	3.82E-01	4.57E+00	2.80E+00	2.66E+00	2.59E-01	4.98E-01	4.72E-02	4.54E-01
2006	3	5	8.61E-02	5.78E-01	1.93E-02	1.23E-01	1.85E-01	5.29E-02	8.73E-02	8.73E-01	6.30E-01	8.04E+00	1.69E+00	1.02E+00	6.45E-01	3.69E-02	1.66E-01
2006	3	6	1.00E-01	7.36E-01	8.28E-04	1.90E-01	2.73E-01	3.00E-03	8.97E-02	8.33E-01	4.99E-02	6.21E+00	4.76E+00	9.19E-01	1.26E+00	1.84E-01	2.34E-01
2006	3	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-02	5.93E-01	2.76E-19	1.73E+00	5.10E-02	7.16E-01	3.12E-01	0.00E+00	0.00E+00
2006	3	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.87E-05	0.00E+00	2.96E-02	8.03E-01	1.13E-17	2.58E+00	9.62E-02	7.09E-01	3.45E-01	6.27E-03	0.00E+00
2006	3	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.59E-11	0.00E+00	1.22E-02	4.63E-01	3.60E-18	1.46E+00	5.87E-02	4.29E-01	2.99E-01	2.80E-03	0.00E+00
2006	3	10	2.35E-02	1.21E-04	6.75E-03	5.84E-06	7.25E-04	3.93E-02	4.69E-02	1.01E+00	2.22E-01	1.68E+01	4.98E-01	1.70E+00	1.02E+00	1.57E-01	5.60E-02
2006	3	11	3.28E-01	8.19E-03	5.97E-01	2.27E-05	1.20E-04	5.23E-01	3.11E-02	2.72E-01	5.87E+00	4.86E-01	5.94E-02	8.49E-02	1.22E-01	1.27E-01	4.50E-01
2006	3	12	3.04E-01	1.14E+00	9.22E-02	5.04E-02	4.20E-02	7.56E-02	1.45E-02	4.54E-01	4.71E+00	1.88E+00	1.32E+00	2.09E-01	3.80E-01	3.75E-02	6.50E-01
2006	3	13	3.07E-06	1.59E-07	2.67E-07	1.14E-07	2.64E-04	4.72E-07	1.41E-01	1.95E+00	4.54E-04	5.71E+00	1.05E-01	1.23E+00	9.63E-01	3.35E-02	1.18E-04
2006	3	14	1.74E-01	1.26E+00	2.67E-02	2.28E-01	6.86E-01	7.77E-02	2.24E-02	9.55E-01	8.04E-02	6.93E+00	6.29E+00	3.62E-01	1.46E+00	1.02E-01	4.62E-01
2006	3	15	6.11E-02	2.34E-04	1.07E-02	3.97E-05	9.20E-05	2.13E-02	1.42E-01	1.31E+00	1.42E-02	1.07E+01	1.17E-02	2.07E+00	5.01E-01	4.27E-02	1.44E-01
2006	3	16	3.40E-01	2.87E-01	3.17E-02	1.38E-01	3.01E-01	6.69E-02	3.01E-02	4.42E-01	2.00E+00	5.44E+00	7.21E-01	8.24E-01	6.33E-01	1.36E-02	5.70E-01
2006	3	17	1.88E-01	6.88E-01	2.55E-02	1.73E-01	1.54E-01	3.55E-02	1.21E-02	4.51E-01	7.18E-01	2.85E+00	3.92E+00	1.69E-01	5.92E-01	2.57E-02	3.56E-01
2006	3	18	5.88E-02	7.39E-02	2.80E-01	2.02E-02	4.76E-02	1.26E-01	8.99E-02	8.82E-01	2.83E+00	6.81E+00	2.26E-01	1.28E+00	7.63E-01	5.86E-02	1.15E-01
2006	3	19	1.10E-04	0.00E+00	2.99E-01	0.00E+00	0.00E+00	1.24E-01	0.00E+00	0.00E+00	4.79E+00	1.21E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2006	3	20	6.07E-02	2.24E-04	1.55E-01	0.00E+00	4.05E-08	1.36E-01	5.09E-08	4.04E-03	1.01E+01	2.18E-03	1.60E-03	3.55E-05	1.03E-04	1.55E-03	1.80E-01
2006	3	21	2.06E-01	1.92E-01	1.25E-01	9.53E-04	1.50E-03	1.97E-01	8.58E-04	7.70E-02	8.20E+00	1.46E-01	7.56E-01	6.29E-03	2.40E-02	8.00E-03	3.68E-01
2006	3	22	7.76E-02	1.41E+00	1.11E-02	3.46E-01	4.95E-01	2.52E-02	8.71E-02	1.50E+00	1.09E-01	6.68E+00	1.01E+01	8.13E-01	1.69E+00	1.14E-01	1.96E-01
2006	3	23	2.02E-01	3.95E-01	1.13E-01	9.43E-02	1.70E-01	1.40E-01	7.47E-02	1.19E+00	3.01E+00	7.77E+00	8.93E-01	6.85E-01	1.19E+00	1.68E-01	4.33E-01
2006	3	24	1.33E-01	1.78E+00	4.61E-02	1.83E-01	2.24E-01	6.12E-02	3.61E-02	7.79E-01	1.28E+00	2.45E+00	6.31E+00	1.18E-01	4.74E-01	7.49E-02	3.49E-01
2006	3	25	4.89E-02	1.26E+00	9.21E-03	9.33E-02	1.34E-01	1.72E-02	1.80E-01	1.87E+00	2.89E-01	1.16E+01	5.29E+00	2.74E+00	4.30E+00	1.48E-01	9.22E-02
2006	3	26	2.38E-02	1.33E-05	4.01E-03	2.90E-07	4.16E-06	1.97E-02	7.17E-02	8.12E-01	3.33E-01	5.36E+00	1.79E-02	9.06E-01	7.90E-01	3.00E-02	6.18E-02
2006	3	27	3.09E-02	4.89E-01	3.40E-02	6.52E-02	1.07E-01	8.19E-02	2.10E-02	6.91E-01	8.69E-01	2.89E+00	1.93E+00	5.63E-01	1.27E+00	4.01E-03	4.68E-02
2006	3	28	3.82E-01	1.67E-01	4.16E-01	2.36E-02	3.48E-02	4.09E-01	1.16E-01	1.22E+00	6.99E+00	5.78E+00	3.61E-01	9.21E-01	1.21E+00	2.76E-01	5.45E-01
2006	3	29	5.11E-01	1.14E+00	6.22E-01	2.46E-01	3.57E-01	6.89E-01	2.75E-01	9.59E-01	7.14E+00	6.92E+00	1.83E+00	1.67E+00	2.35E+00	3.56E-01	6.82E-01
2006	3	30	1.90E-03	9.08E-07	9.07E-06	2.94E-06	9.61E-04	1.70E-04	1.29E-01	1.49E+00	8.59E-03	1.29E+01	2.39E-01	1.81E+00	2.26E+00	9.40E-02	7.00E-03
2006	3	31	1.78E-02	1.06E+00	1.81E-04	2.83E-01	4.55E-01	7.20E-04	6.41E-02	1.48E+00	2.34E-02	9.24E+00	6.65E+00	9.31E-01	1.10E+00	1.31E-01	5.19E-02
2006	4	1	1.46E-01	2.74E-02	4.79E-02	5.30E-03	1.19E-02	8.06E-02	6.68E-02	5.19E-01	2.62E+00	7.23E+00	1.20E-01	9.54E-01	1.21E+00	6.17E-02	2.85E-01
2006	4	2	3.16E-02	1.56E+00	1.57E-02	1.78E-01	2.45E-01	2.88E-02	2.93E-02	8.05E-01	1.85E+00	7.76E+00	6.43E+00	7.71E-01	1.37E+00	8.47E-02	6.42E-02
2006	4	3	3.71E-01	2.99E-01	1.87E-01	3.48E-02	6.02E-02	2.66E-01	1.63E-01	5.21E-01	4.21E+00	6.83E+00	6.27E-01	1.34E+00	1.82E+00	1.98E-01	6.29E-01
2006	4	4	2.43E-01	4.52E-01	2.69E-01	7.36E-02	1.29E-01	2.59E-01	1.93E-01	1.01E+00	4.30E+00	9.97E+00	1.97E+00	1.71E+00	2.20E+00	2.59E-01	3.87E-01
2006	4	5	4.10E-01	8.58E-07	1.06E+00	0.00E+00	0.00E+00	7.33E-01	1.03E-03	4.48E-02	6.40E+00	2.63E-03	9.42E-07	6.47E-04	1.76E-04	4.37E-02	6.74E-01
2006	4	6	1.34E+00	3.26E-01	4.72E-01	5.32E-02	1.10E-01	3.92E-01	8.40E-03	3.31E-01	4.59E+00	1.30E+00	3.03E+00	1.09E-01	2.16E-01	1.67E-01	1.65E+00
2006	4	7	2.02E-01	9.91E-02	2.58E-02	9.64E-02	2.01E-01	2.93E-02	4.14E-02	8.98E-01	2.98E+00	3.39E+00	1.88E+00	4.63E-01	1.06E+00	8.14E-02	4.20E-01

Table C.5 - Timeseries Data for PM10

Application

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	4	8	2.59E+00	9.85E-02	1.97E+00	2.37E-02	3.68E-02	4.10E+00	8.06E-01	6.29E+00	2.54E+00	1.15E+00	5.63E-01	1.81E-01	3.54E-01	6.12E+00	3.62E+00
2006	4	9	7.32E-02	0.00E+00	1.42E-02	0.00E+00	1.55E-13	5.79E-01	4.17E-01	1.76E+00	6.97E-21	1.90E+00	3.80E-02	6.15E-01	2.48E-01	8.26E-01	1.11E-01
2006	4	10	1.32E+00	1.01E-03	6.82E-01	8.35E-05	4.37E-04	2.77E+00	1.31E+00	5.05E+00	1.55E-01	5.88E+00	5.64E-02	8.05E-01	7.70E-01	2.99E+00	1.98E+00
2006	4	11	3.15E-01	3.36E-04	3.11E-01	5.47E-05	3.07E-04	3.63E+00	1.16E+00	6.26E+00	1.24E-01	2.31E+00	8.58E-02	4.89E-01	9.63E-01	3.43E+00	8.03E-01
2006	4	12	5.05E-01	4.14E-04	1.09E-01	1.14E-02	6.95E-02	1.80E+00	1.09E+00	3.32E+00	5.53E-02	2.31E+00	5.13E-01	7.95E-01	6.27E-01	2.83E+00	7.04E-01
2006	4	13	1.54E-02	0.00E+00	1.20E-02	0.00E+00	3.15E-05	3.85E-01	1.67E-01	6.08E-01	6.43E-06	8.55E-01	9.45E-02	1.03E-01	2.65E-01	3.57E-01	4.46E-02
2006	4	14	2.83E-01	4.83E-06	4.94E-02	2.00E-04	1.38E-01	9.31E-01	1.66E-01	6.95E-01	1.04E-02	1.22E+00	8.62E-01	3.66E-02	2.40E-01	6.87E-01	4.63E-01
2006	4	15	2.98E-01	3.39E-06	1.31E-01	3.17E-04	9.95E-02	1.68E+00	4.39E-01	2.16E+00	4.88E-02	1.53E+00	8.70E-01	4.03E-02	4.29E-01	1.35E+00	5.15E-01
2006	4	16	2.62E-01	5.42E-05	8.91E-02	2.07E-04	9.19E-02	1.32E+00	8.52E-01	2.69E+00	4.00E-02	4.04E+00	7.79E-01	6.74E-01	3.65E-01	1.91E+00	5.11E-01
2006	4	17	1.34E+00	1.86E-02	4.15E-01	1.63E-02	5.92E-02	3.65E+00	2.82E+00	8.17E+00	6.30E-01	9.41E+00	6.60E-01	1.89E+00	1.81E+00	6.22E+00	1.94E+00
2006	4	18	1.08E+00	2.84E-03	6.70E-01	1.19E-01	1.79E-01	3.29E+00	2.62E+00	5.22E+00	2.66E-01	9.39E+00	2.62E+00	1.12E+00	2.33E+00	4.84E+00	1.59E+00
2006	4	19	5.13E-01	2.09E-04	3.72E-01	9.32E-06	3.28E-05	2.13E+00	1.23E+00	4.36E+00	4.30E-02	6.10E+00	3.13E-02	1.20E+00	6.30E-01	2.87E+00	1.17E+00
2006	4	20	1.09E+00	3.11E-01	4.72E-01	4.49E-02	8.51E-02	2.62E+00	1.35E+00	4.77E+00	1.55E-01	5.07E+00	1.68E+00	9.15E-01	6.88E-01	2.63E+00	1.65E+00
2006	4	21	7.57E-01	6.22E-03	2.08E-01	2.69E-02	2.69E-01	2.57E+00	9.62E-01	3.34E+00	1.53E-01	2.98E+00	2.35E+00	1.85E-01	3.76E-01	2.29E+00	1.06E+00
2006	4	22	1.27E+00	1.42E-02	7.01E-01	1.41E-04	6.87E-04	2.61E+00	7.09E-01	3.30E+00	1.85E+00	3.81E+00	1.04E-01	6.41E-01	8.13E-01	2.56E+00	1.42E+00
2006	4	23	3.58E+00	3.34E-03	2.14E+00	5.65E-04	1.09E-03	3.83E+00	1.15E-01	4.17E+00	3.41E+00	1.86E-02	6.63E-03	3.06E-02	2.25E-02	4.84E+00	4.28E+00
2006	4	24	3.78E+00	9.81E-03	2.48E+00	1.13E-05	5.53E-05	3.51E+00	2.00E-01	3.98E+00	2.35E+00	1.03E-02	6.86E-02	1.45E-02	1.15E-02	4.72E+00	4.80E+00
2006	4	25	1.41E+00	7.29E-02	1.02E+00	8.18E-03	1.72E-02	3.32E+00	1.15E+00	5.82E+00	1.89E+00	4.97E+00	2.85E-01	8.88E-01	1.54E+00	4.02E+00	1.77E+00
2006	4	26	2.78E-02	0.00E+00	1.11E-02	0.00E+00	0.00E+00	6.37E-01	3.11E-01	1.19E+00	3.76E-05	1.73E+00	4.42E-02	3.54E-01	2.78E-01	6.02E-01	1.05E-01
2006	4	27	1.05E+00	6.38E-05	3.61E-01	0.00E+00	2.79E-06	2.34E+00	1.32E+00	4.05E+00	7.99E-02	8.59E+00	1.59E-03	8.78E-01	1.08E+00	3.26E+00	1.35E+00
2006	4	28	5.61E-01	2.80E-03	5.71E-01	3.56E-04	1.55E-03	3.77E+00	2.30E+00	8.27E+00	1.82E-01	1.08E+01	4.57E-02	1.14E+00	1.39E+00	5.12E+00	8.37E-01
2006	4	29	6.73E-01	3.88E-02	2.28E-01	2.34E-01	2.16E-01	2.43E+00	1.49E+00	4.53E+00	1.05E-01	6.11E+00	6.32E+00	1.06E+00	7.09E-01	3.12E+00	1.02E+00
2006	4	30	1.69E+00	6.77E-01	1.35E+00	1.50E-02	6.69E-02	2.74E+00	9.63E-01	4.01E+00	1.82E+00	1.90E+00	2.38E+00	1.28E-01	3.35E-01	4.10E+00	2.46E+00
2006	5	1	2.18E+00	6.87E-02	6.52E-01	7.05E-02	7.05E-02	1.34E+01	4.70E+00	1.33E+01	1.73E-01	9.45E+00	4.39E-01	9.73E-01	1.02E+00	1.53E+01	2.43E+00
2006	5	2	6.46E+00	6.83E-02	2.78E+00	1.00E-04	1.73E-03	1.54E+01	7.03E+00	1.62E+01	3.11E+00	1.57E+01	3.00E-01	1.74E+00	3.47E+00	1.96E+01	7.92E+00
2006	5	3	1.41E+01	1.26E-02	6.55E+00	7.90E-04	2.10E-03	2.09E+01	3.38E+00	3.01E+01	9.29E+00	2.63E-01	3.83E-02	6.00E-01	4.06E-01	2.19E+01	1.85E+01
2006	5	4	2.95E+00	5.38E-02	2.18E+00	2.68E-02	8.92E-02	2.91E+01	1.16E+01	4.03E+01	9.21E-01	2.28E+01	7.05E-01	2.96E+00	5.16E+00	3.87E+01	5.37E+00
2006	5	5	6.68E-01	1.32E-03	6.99E-01	2.63E-04	6.74E-04	1.58E+01	4.96E+00	1.46E+01	3.18E-01	7.69E+00	9.04E-02	1.18E+00	9.52E-01	1.42E+01	1.07E+00
2006	5	6	4.22E-01	0.00E+00	8.48E-02	0.00E+00	0.00E+00	4.96E+00	2.11E+00	8.01E+00	2.16E-02	2.85E+00	1.24E-01	5.26E-01	5.93E-01	5.53E+00	8.19E-01
2006	5	7	1.45E-01	0.00E+00	2.51E-02	0.00E+00	1.45E-08	2.83E+00	1.30E+00	3.70E+00	6.81E-28	4.18E+00	2.07E-01	3.90E-01	4.51E-01	2.53E+00	4.29E-01
2006	5	8	6.91E-01	0.00E+00	4.62E-02	0.00E+00	0.00E+00	6.88E+00	1.93E+00	1.07E+01	1.66E-03	6.44E+00	3.32E-02	6.51E-01	8.21E-01	6.75E+00	8.78E-01
2006	5	9	2.14E+00	7.98E-03	1.40E+00	1.92E-03	4.97E-03	1.55E+01	9.27E+00	2.82E+01	4.31E-01	1.68E+01	2.29E-01	3.79E+00	3.62E+00	2.20E+01	3.29E+00
2006	5	10	1.84E+00	1.33E-02	8.56E-01	1.20E-02	5.61E-02	2.33E+01	1.20E+01	3.15E+01	5.98E-01	1.60E+01	4.62E-01	5.57E+00	7.67E+00	2.79E+01	2.49E+00
2006	5	11	2.07E+00	3.10E-01	1.00E+00	6.70E-02	1.18E-01	2.05E+01	7.24E+00	1.60E+01	3.78E-01	1.35E+01	1.28E+00	1.38E+00	1.34E+00	2.56E+01	3.06E+00
2006	5	12	6.76E-01	0.00E+00	1.49E-01	0.00E+00	5.67E-05	4.82E+00	1.68E+00	5.49E+00	8.68E-03	3.71E+00	2.27E-01	5.20E-01	4.51E-01	3.92E+00	1.33E+00
2006	5	13	9.90E+00	6.81E-01	5.41E+00	1.26E-02	1.47E-02	2.27E+01	6.86E+00	3.17E+01	4.69E+00	4.58E+00	7.68E-01	6.48E-01	7.61E-01	2.94E+01	1.38E+01
2006	5	14	1.10E+01	6.81E-01	5.80E+00	1.15E-01	1.78E-01	2.51E+01	9.71E+00	3.02E+01	5.11E+00	1.01E+01	1.74E+00	2.73E+00	3.27E+00	3.24E+01	1.62E+01
2006	5	15	7.05E+00	2.23E-01	2.75E+00	4.84E-02	7.59E-02	2.59E+01	7.57E+00	3.66E+01	2.68E+00	1.01E+01	8.06E-01	2.17E+00	3.05E+00	2.57E+01	1.13E+01
2006	5	16	5.04E+00	1.20E+00	2.12E+00	1.10E-01	1.46E-01	2.10E+01	9.10E+00	2.99E+01	1.27E+00	1.86E+01	5.72E+00	2.74E+00	4.63E+00	2.01E+01	8.73E+00
2006	5	17	1.62E+00	1.82E-02	1.10E+00	3.26E-02	5.08E-02	2.44E+01	1.22E+01	3.38E+01	4.66E-01	2.44E+01	2.86E-01	3.11E+00	4.71E+00	3.41E+01	1.84E+00
2006	5	18	5.52E+00	1.20E-01	2.62E+00	8.32E-03	5.33E-02	2.28E+01	1.14E+01	1.97E+01	2.81E+00	1.36E+01	1.45E+00	1.97E+00	1.78E+00	2.34E+01	7.57E+00
2006	5	19	7.63E+00	5.98E-02	3.32E+00	2.05E-02	8.07E-02	1.90E+01	1.31E+01	1.85E+01	1.09E+00	1.66E+01	1.51E+00	1.31E+00	2.32E+00	2.07E+01	1.08E+01
2006	5	20	6.44E+00	2.47E+00	1.65E+00	6.08E-02	8.00E-02	1.29E+01	5.57E+00	1.51E+01	1.44E+00	2.71E+00	6.26E+00	5.40E-01	8.10E-01	1.21E+01	9.03E+00
2006	5	21	8.47E+00	3.41E-01	3.08E+00	5.64E-02	6.37E-02	1.44E+01	4.11E+00	1.82E+01	1.82E+00	3.73E+00	2.93E+00	4.28E-01	7.30E-01	1.29E+01	1.15E+01
2006	5	22	6.60E+00	5.82E-01	2.73E+00	2.04E-01	3.73E-01	1.50E+01	8.55E+00	1.54E+01	1.56E+00	5.33E+00	7.13E+00	7.76E-01	8.76E-01	1.95E+01	9.34E+00
2006	5	23	8.04E-01	0.00E+00	2.75E-01	0.00E+00	0.00E+00	3.96E+00	1.73E+00	7.49E+00	1.51E-02	2.73E+00	6.93E-02	5.75E-01	5.33E-01	4.55E+00	1.07E+00
2006	5	24	1.74E+00	1.10E-04	7.91E-01	8.59E-04	7.01E-02	1.07E+01	3.34E+00	1.52E+01	2.12E-01	5.89E+00	6.02E-01	5.33E-01	8.91E-01	1.10E+01	2.64E+00
2006	5	25	1.48E+00	0.00E+00	1.63E-01	0.00E+00	0.00E+00	6.73E+00	4.48E+00	1.13E+01	1.60E-01	5.83E+00	1.76E-01	8.61E-01	8.81E-01	7.81E+00	2.22E+00
2006	5	26	4.58E+00	1.87E-03	1.38E+00	4.49E-04	5.76E-03	1.47E+01	4.25E+00	1.34E+01	5.41E-01	8.10E+00	5.95E-01	3.25E-01	1.03E+00	1.23E+01	6.70E+00
2006	5	27	1.04E+01	2.01E-02	5.41E+00	1.47E-03	5.73E-03	1.59E+01	7.88E+00	2.57E+01	6.58E+00	1.36E+01	1.80E-01	2.84E+00	4.02E+00	2.53E+01	1.40E+01
2006	5	28	1.30E+01	3.40E-01	9.47E+00	1.32E-01	1.83E-01	2.22E+01	4.03E+00	1.96E+01	4.36E+00	1.36E+00	2.28E+00	3.17E-01	7.31E-01	2.16E+01	1.36E+01
2006	5	29	5.61E+00	6.30E-03	1.66E+00	1.03E-02	4.33E-02	1.62E+01	6.67E+00	2.21E+01	4.56E-01	1.35E+01	1.21E+00	1.32E+00	1.72E+00	2.16E+01	5.27E+00
2006	5	30	3.04E+00	8.77E-04	1.56E+00	5.35E-06	4.99E-04	1.48E+01	5.57E+00	2.11E+01	5.98E-01	8.02E+00	8.35E-02	5.99E-01	1.72E+00	1.37E+01	4.30E+00
2006	5	31	1.61E+00	3.76E-03	7.65E-01	1.07E-03	2.91E-02	2.02E+01	7.90E+00	2.26E+01	4.92E-01	8.47E+00	3.82E-01	1.17E+00	1.90E+00	1.53E+01	2.91E+00
2006	6	1	5.43E+00	1.53E+00	1.69E+00	1.57E-01	1.33E-01	2.49E+01	9.36E+00	2.20E+01	5.33E-01	1.19E+01	6.64E+00	1.30E+00	1.41E+00	2.63E+01	7.64E+00
2006	6	2	1.47E+00	2.37E-02	9.82E-01	1.58E-01	2.08E-01	1.14E+01	5.36E+00	1.48E+01	4.81E-01	4.65E+00	2.91E+00	6.68E-01	1.25E+00	9.43E+00	2.79E+00
2006	6	3	1.37E+00	3.98E-05	6.32E-01	0.00E+00	0.00E+00	5.94E+00	2.07E+00	7.56E+00	4.03E-02	3.59E+00	1.61E-01	2.75E-01	6.73E-01	6.61E+00	2.32E+00
2006	6	4	2.06E+00	1.76E-03	8.99E-01	3.48E-04	8.67E-03	1.18E+01	4.49E+00	1.35E+01	2.83E-01	6.98E+00	3.91E-01	6.23E-01	1.56E+00	1.11E+01	3.37E+00
2006	6	5	3.38E-01	0.00E+00	5.34E-02	0.00E+00	0.00E+00	4.34E+00	1.91E+00	4.61E+00	7.81E-04	3.55E+00	1.98E-01	6.99E-01	5.72E-01	3.71E+00	6.77E-01
2006	6	6	8.44E+00	2.14E-04	4.98E+00	1.44E-09	1.93E-06	1.29E+01	5.35E+00	1.67E+01	3.90E+00	5.90E+00	6.33E-03	6.82E-01	7.03E-01	1.83E+01	1.05E+01
2006	6	7	1.10E+01	4.55E-04	5.49E+00	4.11E-05	6.00E-05	1.37E+01	4.02E-02	1.20E+01	1.91E+00	8.62E-03	1.57E-03	9.14E-03	6.80E-03	1.70E+01	1.18E+01
2006	6	8	5.82E+00	2.53E-01	3.01E+00	1.14E-01	3.41E-01	1.45E+01	4.22E+00	2.45E+01	4.85E+00	1.98E+00	1.82E+00	6.22E-01	7.58E-01	2.52E+01	8.10E+00
2006	6	9	6.30E+00	1.75E-01	3.39E+00	3.14E-02	3.95E-02	1.72E+01	3.92E+00	2.56E+01	3.60E+00	9.33E+00	1.96E-01	1.09E+00	1.58E+00	2.24E+01	9.32E+00
2006	6	10	1.14E+01	1.78E-01	6.56E+00	1.78E-03	3.84E-03	1.44E+01	1.56E+00	2.31E+01	6.29E+00	2.05E-01	2.38E-01	1.11E-01	1.02E-01	2.23E+01	1.37E+01
2006	6	11	1.11E+01	7.50E-01	4.80E+00	1.59E-01	2.85E-01	1.97E+01	9.34E+00	2.48E+01	4.31E+00	1.56E+01	2.37E+00	2.38E+00	3.74E+00	2.64E+01	1.56E+01
2006	6	12	1.27E+01	0.00E+00	6.90E+00	0.00E+00	0.00E+00	1.71E+01	4.99E-02	1.41E+01	4.88E+00	1.80E-04	0.00E+00	9.78E-04	4.59E-04	1.72E+01	1.43E+01
2006	6	13	8.95E+00	1.30E-04	6.60E+00	0.00E+00	0.00E+00	1.26E+01	7.35E-02	1.34E+01	3.08E+00	5.87E-01	2.00E-04	4.05E-02	1.42E-01	1.68E+01	9.78E+00
2006	6	14	3.79E+00	4.60E-01	1.68E+00	9.83E-02	1.26E-01	9.11E+00	3.15E+00	1.32E+01	1.21E+00	9.70E+00	8.84E-01	1.71E+00	2.92E+00	1.27E+01	4.53E+00
2006	6	15	2.06E-01	0.00E+00	8.25E-03	0.00E+00	0.00E+00	3.69E+00	1.13E+00	4.81E+00	3.68E-16	2.00E+00	6.18E-02	5.29E-01	4.01E-01	2.91E+00	3.33E-01
2006	6	16	2.54E-01	0.00E+00	2.09E-02	0.00E+00	0.00E+00	3.47E+00	1.09E+00	3.67E+00	7.49E-04	2.42E+00	1.40E-01	3.52E-01	4.28E-01	2.56E+00	4.09E-01
2006	6	17	6.09E-01	0.00E+00	4.76E-02	0.00E+00	0.00E+00	5.90E+00	1.52E+00	6.18E+00	1.97E-02	4.18E+00	4.35E-02	5.89E-01	4.32E-01	4.09E+00	1.33E+00
2006	6	18	3.49E+00	8.48E-04	2.21E+00	1.83E-04	4.90E-03	1.82E+01	7.76E+00	2.02E+01	4.93E-01	1.52E+01	1.91E-01	1.14E+00	2.04E+00	1.66E+01	6.45E+00
2006	6	19	1.29E+00	2.53E-01	1.18E+00	4.45E-02	6.52E-02	1.77E+01	6.85E+00	2.82E+01	4.79E-01	1.61E+01	7.18E-01	3.10E+00	4.28E+00	1.89E+01	2.17E+00
2006	6	20	1.80E+00	4.28E-04	7.58E-01	5.16E-06	7.20E-05	7.68E+00	2.52E+00	1.32E+01	1.30E-01	8.00E+00	1.18E-02	7.78E-01	7.45E-01	1.10E+01	2.67E+00
2006	6	21	1.06E+00	1.44E-01	8.32E-01	5.75E-02	8.80E-02	1.93E+01	7.37E+00	2.97E+01	8.40E-01	1.15E+01	5.37E-01	2.56E+00	3.30E+00	2.13E+01	2.62E+00
2006	6	22	1.59E+00	3.56E-04	5.79E-01	1.22E-04	3.25E-02	1.46E+01	6.43E+00	1.92E+01	3.51E-01	9.16E+00	1.10E+00	1.22E+00	1.42E+00	1.53E+01	2.73E+00
2006	6	23	6.55E+00	1.02E-01	2.72E+00	1.61E-02	3.14E-02	1.48E+01	4.07E+00	1.61E+01	3.30E+00	6.20E+00	2.90E-01	5.78E-01	8.62E-01	1.87E+01	9.20E+00
2006	6	24	1.25E+01	9.43E-01	6.02E+00	6.02E-03	9.67E-03	1.97E+01	3.83E+00	2.54E+01	4.44E+00	5.00E-01	2.91E+00	3.60E-01	2.80E-01	2.42E+01	1.66E+01
2006	6	25	6.10E+00	1.52E+00	1.92E+00	2.36E-01	3.42E-01	1.89E+01	6.70E+00	2.57E+01	3.16E+00	9.60E+00	8.25E+00	8.75E-01	1.65E+00	2.45E+01	9.09E+00
2006	6	26	8.58E+00	1.39E+00	3.65E+00	9.41E-02	1.33E-01	1.75E+01	1.04E+01	2.07E+01	3.93E+00	5.38E+00	3.65E+00	1.46E+00	1.93E+00	2.08E+01	1.14E+01
2006	6	27	4.18E+00	1.20E+00	1.55E+00	3.54E-01	6.31E-01	2.03E+01	7.48E+00	1.99E+01	7.93E-01	9.94E+00	9.96E+00	8.57E-01	1.61E+00	1.63E+01	5.54E+00
2006	6	28	9.01E-01	1.59E-03	5.64E-01	2.75E-04	2.04E-03	9.35E+00	4.30E+00	1.30E+01	2.50E-01	3.85E+00	2.40E-01	4.80E-01	1.21E+00	1.01E+01	1.66E+00

Baseline

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	4	8	2.31E+00	1.16E-02	1.67E+00	3.22E-03	4.83E-03	3.82E+00	7.91E-01	5.56E+00	1.72E-01	4.56E-02	2.02E-02	8.74E-02	6.51E-02	5.99E+00	3.07E+00
2006	4	9	7.32E-02	0.00E+00	1.42E-02	0.00E+00	0.00E+00	5.79E-01	3.95E-01	1.01E+00	0.00E+00	0.00E+00	0.00E+00	3.75E-05	0.00E+00	8.25E-01	1.11E-01
2006	4	10	1.16E+00	9.58E-04	6.72E-01	7.72E-05	4.18E-04	2.75E+00	1.28E+00	4.06E+00	9.78E-02	1.92E-02	5.28E-03	3.55E-02	2.78E-02	2.92E+00	1.61E+00
2006	4	11	2.99E-01	3.33E-04	3.10E-01	5.30E-05	3.03E-04	3.63E+00	1.11E+00	5.04E+00	1.24E-01	2.47E-02	5.03E-03	5.18E-02	4.08E-02	3.36E+00	7.40E-01
2006	4	12	5.05E-01	4.14E-04	1.09E-01	1.58E-04	9.15E-04	1.80E+00	1.01E+00	2.42E+00	5.53E-02	1.51E-02	4.56E-03	3.50E-02	2.43E-02	2.78E+00	7.04E-01
2006	4	13	1.54E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	3.85E-01	1.65E-01	4.90E-01	6.43E-06	0.00E+00	0.00E+00	4.28E-04	2.82E-05	3.57E-01	4.46E-02
2006	4	14	2.82E-01	4.83E-06	4.94E-02	1.06E-04	1.37E-03	9.31E-01	1.66E-01	6.12E-01	1.04E-02	4.02E-03	2.75E-03	8.92E-03	6.73E-03	6.82E-01	4.55E-01
2006	4	15	2.90E-01	3.39E-06	1.31E-01	2.58E-04	1.38E-03	1.68E+00	4.30E-01	1.76E+00	4.88E-02	1.14E-02	2.19E-03	1.52E-02	1.65E-02	1.31E+00	4.85E-01
2006	4	16	2.50E-01	4.67E-05	8.83E-02	1.82E-04	1.11E-03	1.31E+00	8.05E-01	2.18E+00	3.70E-02	8.82E-03	2.70E-03	1.35E-02	1.32E-02	1.86E+00	4.89E-01
2006	4	17	9.13E-01	9.80E-04	4.11E-01	2.08E-04	4.47E-04	3.64E+00	2.57E+00	6.62E+00	7.65E-02	1.33E-02	3.80E-03	4.35E-02	2.39E-02	5.89E+00	1.43E+00
2006	4	18	1.00E+00	5.74E-04	6.63E-01	9.08E-04	2.21E-03	3.26E+00	2.52E+00	4.19E+00	3.76E-02	9.24E-03	3.13E-03	4.76E-02	2.15E-02	4.78E+00	1.38E+00
2006	4	19	4.50E-01	2.00E-04	3.59E-01	9.32E-06	3.28E-05	2.10E+00	1.18E+00	3.47E+00	3.60E-02	6.21E-03	1.49E-03	1.77E-02	1.07E-02	2.85E+00	1.01E+00
2006	4	20	1.05E+00	9.76E-03	4.68E-01	2.66E-03	4.25E-03	2.60E+00	1.31E+00	3.79E+00	1.12E-01	2.90E-02	1.59E-02	4.61E-02	3.60E-02	2.59E+00	1.51E+00
2006	4	21	7.31E-01	5.97E-03	2.07E-01	3.60E-03	7.85E-03	2.57E+00	9.17E-01	2.56E+00	1.48E-01	4.25E-02	2.08E-02	6.94E-02	5.55E-02	2.15E+00	9.93E-01
2006	4	22	1.03E+00	2.62E-04	3.97E-01	7.36E-06	3.62E-05	2.35E+00	6.66E-01	2.82E+00	1.71E-02	4.02E-03	9.68E-04	1.45E-02	7.64E-03	2.39E+00	1.09E+00
2006	4	23	3.17E+00	3.14E-03	1.71E+00	5.24E-04	1.01E-03	3.40E+00	1.08E-01	4.04E+00	8.08E-02	1.49E-02	6.28E-03	2.88E-02	2.14E-02	4.77E+00	3.59E+00
2006	4	24	3.14E+00	8.11E-04	1.98E+00	6.78E-06	3.06E-05	3.10E+00	2.00E-01	3.92E+00	8.12E-02	7.15E-03	2.12E-03	1.20E-02	9.30E-03	4.69E+00	3.67E+00
2006	4	25	1.27E+00	3.28E-03	9.64E-01	8.81E-04	1.88E-03	3.26E+00	1.06E+00	4.69E+00	8.30E-02	1.66E-02	7.80E-03	4.18E-02	2.58E-02	3.92E+00	1.55E+00
2006	4	26	2.78E-02	0.00E+00	1.11E-02	0.00E+00	0.00E+00	6.37E-01	2.94E-01	7.73E-01	3.76E-05	0.00E+00	0.00E+00	2.11E-03	1.49E-04	6.02E-01	1.05E-01
2006	4	27	1.03E+00	5.98E-05	3.49E-01	0.00E+00	2.79E-06	2.28E+00	1.27E+00	3.31E+00	3.02E-02	3.51E-03	5.92E-04	1.15E-02	6.87E-03	3.22E+00	1.28E+00
2006	4	28	5.28E-01	2.74E-03	5.68E-01	3.56E-04	1.53E-03	3.77E+00	2.23E+00	6.90E+00	1.71E-01	3.93E-02	1.38E-02	7.28E-02	5.53E-02	5.02E+00	7.36E-01
2006	4	29	6.58E-01	2.63E-03	2.28E-01	5.97E-03	9.88E-03	2.43E+00	1.41E+00	3.37E+00	9.05E-02	3.39E-02	1.59E-02	7.63E-02	5.14E-02	3.04E+00	9.68E-01
2006	4	30	1.55E+00	5.14E-03	7.54E-01	8.94E-04	3.48E-03	2.23E+00	9.23E-01	3.62E+00	1.24E-01	3.28E-02	1.53E-02	6.07E-02	4.48E-02	4.02E+00	2.18E+00
2006	5	1	2.17E+00	4.19E-03	6.51E-01	1.79E-03	3.02E-03	1.34E+01	4.64E+00	1.25E+01	1.68E-01	3.17E-02	1.02E-02	1.12E-01	6.69E-02	1.52E+01	2.42E+00
2006	5	2	6.21E+00	4.36E-04	2.55E+00	1.37E-06	4.02E-05	1.50E+01	6.84E+00	1.53E+01	1.31E-01	1.65E-02	2.81E-03	6.32E-02	3.30E-02	1.94E+01	7.61E+00
2006	5	3	1.24E+01	7.67E-03	5.44E+00	7.70E-04	2.03E-03	1.98E+01	2.83E+00	2.87E+01	4.69E-01	6.32E-02	1.96E-02	1.65E-01	1.01E-01	2.07E+01	1.65E+01
2006	5	4	2.83E+00	9.22E-03	2.11E+00	2.31E-03	5.60E-03	2.90E+01	1.13E+01	3.89E+01	4.26E-01	9.45E-02	3.26E-02	2.40E-01	1.52E-01	3.84E+01	5.18E+00
2006	5	5	6.68E-01	1.32E-03	6.99E-01	2.62E-04	6.64E-04	1.58E+01	4.89E+00	1.35E+01	3.18E-01	5.89E-02	1.20E-02	1.80E-01	1.12E-01	1.42E+01	1.06E+00
2006	5	6	4.22E-01	0.00E+00	8.48E-02	0.00E+00	0.00E+00	4.96E+00	2.09E+00	7.10E+00	2.16E-02	5.74E-04	3.53E-08	9.85E-03	3.62E-03	5.52E+00	8.19E-01
2006	5	7	1.45E-01	0.00E+00	2.51E-02	0.00E+00	0.00E+00	2.83E+00	1.29E+00	3.48E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	3.36E-07	2.53E+00	4.29E-01
2006	5	8	6.91E-01	0.00E+00	4.62E-02	0.00E+00	0.00E+00	6.88E+00	1.88E+00	1.00E+01	1.66E-03	0.00E+00	0.00E+00	4.43E-03	5.36E-04	6.73E+00	8.78E-01
2006	5	9	2.10E+00	6.74E-03	1.39E+00	1.76E-03	3.65E-03	1.55E+01	9.08E+00	2.69E+01	1.78E-01	4.43E-02	1.72E-02	1.29E-01	7.43E-02	2.20E+01	3.19E+00
2006	5	10	1.79E+00	3.68E-03	8.52E-01	6.43E-04	2.32E-03	2.33E+01	1.14E+01	3.00E+01	4.99E-01	7.60E-02	2.25E-02	2.27E-01	1.37E-01	2.77E+01	2.41E+00
2006	5	11	2.06E+00	9.49E-03	1.00E+00	6.11E-03	1.12E-02	2.05E+01	7.17E+00	1.47E+01	3.42E-01	9.18E-02	3.54E-02	2.41E-01	1.55E-01	2.54E+01	3.04E+00
2006	5	12	6.74E-01	0.00E+00	1.49E-01	0.00E+00	0.00E+00	4.82E+00	1.66E+00	5.23E+00	8.68E-03	1.09E-03	9.82E-06	6.33E-03	4.30E-03	3.85E+00	1.32E+00
2006	5	13	9.32E+00	1.59E-02	4.50E+00	8.79E-03	1.15E-02	2.17E+01	6.79E+00	3.09E+01	6.30E-01	7.00E-02	2.89E-02	1.32E-01	9.44E-02	2.91E+01	1.29E+01
2006	5	14	1.04E+01	4.88E-02	5.54E+00	1.35E-02	2.10E-02	2.48E+01	9.27E+00	2.92E+01	6.44E-01	1.45E-01	7.65E-02	2.69E-01	1.84E-01	3.19E+01	1.53E+01
2006	5	15	6.78E+00	2.53E-02	2.60E+00	8.92E-03	1.36E-02	2.57E+01	7.34E+00	3.52E+01	5.64E-01	1.16E-01	4.98E-02	2.82E-01	1.81E-01	2.53E+01	1.10E+01
2006	5	16	4.97E+00	5.25E-02	2.09E+00	1.36E-02	2.40E-02	2.09E+01	8.90E+00	2.89E+01	6.90E-01	2.14E-01	1.02E-01	4.15E-01	2.98E-01	2.00E+01	8.65E+00
2006	5	17	1.62E+00	7.60E-03	1.10E+00	4.36E-03	7.39E-03	2.44E+01	1.21E+01	3.20E+01	4.62E-01	9.77E-02	2.69E-02	2.85E-01	1.84E-01	3.39E+01	1.83E+00
2006	5	18	5.35E+00	1.08E-02	2.53E+00	1.27E-03	3.74E-03	2.27E+01	1.12E+01	1.87E+01	5.95E-01	1.11E-01	3.64E-02	3.01E-01	1.79E-01	2.32E+01	7.23E+00
2006	5	19	7.50E+00	1.68E-02	3.27E+00	4.98E-03	1.32E-02	1.89E+01	1.30E+01	1.77E+01	5.87E-01	1.49E-01	5.63E-02	2.69E-01	2.13E-01	2.06E+01	1.05E+01
2006	5	20	6.43E+00	1.40E-01	1.65E+00	3.84E-02	5.07E-02	1.29E+01	5.57E+00	1.47E+01	1.03E+00	3.42E-01	1.95E-01	4.67E-01	3.96E-01	1.20E+01	9.00E+00
2006	5	21	8.36E+00	2.31E-02	3.07E+00	5.13E-03	8.59E-03	1.43E+01	4.10E+00	1.76E+01	4.36E-01	7.12E-02	3.32E-02	1.30E-01	1.09E-01	1.29E+01	1.12E+01
2006	5	22	6.48E+00	7.46E-02	2.71E+00	2.61E-02	3.73E-02	1.50E+01	8.53E+00	1.50E+01	6.52E-01	2.06E-01	1.19E-01	3.01E-01	2.46E-01	1.95E+01	9.06E+00
2006	5	23	7.99E-01	0.00E+00	2.75E-01	0.00E+00	0.00E+00	3.96E+00	1.72E+00	7.18E+00	1.51E-02	2.26E-04	0.00E+00	5.44E-03	2.39E-03	4.55E+00	1.04E+00
2006	5	24	1.72E+00	9.84E-05	7.88E-01	2.97E-05	4.53E-04	1.07E+01	3.31E+00	1.45E+01	2.08E-01	2.37E-02	4.36E-03	1.16E-01	5.75E-02	1.09E+01	2.60E+00
2006	5	25	1.48E+00	0.00E+00	1.63E-01	0.00E+00	0.00E+00	6.73E+00	4.42E+00	1.07E+01	1.60E-01	1.31E-02	7.84E-04	5.81E-02	3.81E-02	7.76E+00	2.22E+00
2006	5	26	4.48E+00	1.84E-03	1.38E+00	4.41E-04	3.56E-03	1.46E+01	4.22E+00	1.30E+01	5.13E-01	1.07E-01	2.74E-02	1.32E-01	1.36E-01	1.23E+01	6.44E+00
2006	5	27	1.01E+01	1.12E-02	4.80E+00	1.40E-03	4.96E-03	1.53E+01	7.53E+00	2.50E+01	6.18E-01	1.31E-01	4.47E-02	2.21E-01	1.80E-01	2.51E+01	1.36E+01
2006	5	28	1.27E+01	6.42E-03	8.65E+00	4.56E-03	8.09E-03	2.17E+01	3.99E+00	1.86E+01	1.75E-01	3.57E-02	1.29E-02	9.36E-02	6.21E-02	2.15E+01	1.31E+01
2006	5	29	5.57E+00	3.97E-03	1.65E+00	6.69E-04	2.14E-03	1.62E+01	6.63E+00	2.08E+01	3.59E-01	6.09E-02	1.71E-02	1.60E-01	1.03E-01	2.15E+01	5.14E+00
2006	5	30	2.93E+00	8.21E-04	1.55E+00	2.65E-06	4.82E-04	1.47E+01	5.54E+00	2.04E+01	5.84E-01	9.71E-02	1.87E-02	1.50E-01	1.38E-01	1.37E+01	4.07E+00
2006	5	31	1.60E+00	3.75E-03	7.65E-01	6.31E-04	2.24E-03	2.02E+01	7.82E+00	2.11E+01	4.92E-01	9.58E-02	2.30E-02	2.84E-01	1.70E-01	1.52E+01	2.90E+00
2006	6	1	5.38E+00	3.54E-02	1.69E+00	1.78E-02	2.70E-02	2.49E+01	9.29E+00	2.11E+01	5.12E-01	1.74E-01	8.14E-02	3.48E-01	2.56E-01	2.62E+01	7.53E+00
2006	6	2	1.45E+00	2.05E-02	9.81E-01	1.42E-02	2.29E-02	1.14E+01	5.32E+00	1.39E+01	4.73E-01	1.44E-01	6.62E-02	2.44E-01	1.93E-01	9.39E+00	2.71E+00
2006	6	3	1.34E+00	3.98E-05	6.28E-01	0.00E+00	0.00E+00	5.93E+00	2.07E+00	7.39E+00	3.82E-02	3.38E-03	2.55E-04	1.77E-02	6.84E-03	6.61E+00	2.22E+00
2006	6	4	2.05E+00	1.74E-03	8.98E-01	3.46E-04	1.60E-03	1.18E+01	4.45E+00	1.28E+01	2.80E-01	6.15E-02	1.51E-02	1.47E-01	1.07E-01	1.10E+01	3.33E+00
2006	6	5	3.38E-01	0.00E+00	5.34E-02	0.00E+00	0.00E+00	4.34E+00	1.90E+00	4.12E+00	7.81E-04	6.52E-05	0.00E+00	7.51E-03	1.09E-03	3.71E+00	6.77E-01
2006	6	6	8.20E+00	9.73E-05	4.41E+00	1.44E-09	1.02E-06	1.23E+01	5.31E+00	1.64E+01	1.66E-01	1.79E-02	2.41E-03	6.51E-02	3.44E-02	1.82E+01	1.01E+01
2006	6	7	1.05E+01	4.55E-04	5.24E+00	4.11E-05	6.00E-05	1.35E+01	3.99E-02	1.20E+01	7.78E-02	5.12E-03	1.49E-03	9.08E-03	6.74E-03	1.69E+01	1.10E+01
2006	6	8	5.19E+00	1.12E-02	2.45E+00	8.35E-03	1.57E-02	1.39E+01	3.89E+00	2.31E+01	2.55E-01	6.01E-02	3.09E-02	9.15E-02	7.88E-02	2.45E+01	7.39E+00
2006	6	9	6.12E+00	7.61E-03	2.94E+00	1.87E-03	2.82E-03	1.68E+01	3.86E+00	2.51E+01	3.29E-01	6.69E-02	1.95E-02	1.42E-01	1.08E-01	2.22E+01	9.01E+00
2006	6	10	1.12E+01	9.07E-03	5.73E+00	1.08E-03	2.34E-03	1.40E+01	1.56E+00	2.30E+01	2.12E-01	4.43E-02	1.75E-02	8.87E-02	6.59E-02	2.23E+01	1.33E+01
2006	6	11	1.09E+01	5.17E-02	4.70E+00	1.80E-02	3.64E-02	1.95E+01	9.19E+00	2.43E+01	8.73E-01	2.65E-01	1.27E-01	5.05E-01	3.60E-01	2.63E+01	1.55E+01
2006	6	12	1.22E+01	0.00E+00	6.77E+00	0.00E+00	0.00E+00	1.70E+01	4.98E-02	1.41E+01	5.82E-02	1.42E-04	0.00E+00	9.17E-04	4.15E-04	1.72E+01	1.34E+01
2006	6	13	8.52E+00	1.29E-04	6.24E+00	0.00E+00	0.00E+00	1.23E+01	7.25E-02	1.34E+01	3.11E-02	1.06E-03	1.97E-04	1.67E-03	1.18E-03	1.68E+01	9.08E+00
2006	6	14	3.65E+00	1.66E-02	1.55E+00	5.72E-03	7.39E-03	8.95E+00	2.99E+00	1.27E+01	1.03E-01	3.09E-02	1.81E-02	6.22E-02	4.16E-02	1.25E+01	4.34E+00
2006	6	15	2.06E-01	0.00E+00	8.25E-03	0.00E+00	0.00E+00	3.69E+00	1.11E+00	4.41E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E+00	3.33E-01
2006	6	16	2.54E-01	0.00E+00	2.09E-02	0.00E+00	0.00E+00	3.47E+00	1.08E+00	3.41E+00	7.49E-04	0.00E+00	0.00E+00	9.00E-03	1.75E-03	2.56E+00	4.09E-01
2006	6	17	6.09E-01	0.00E+00	4.76E-02	0.00E+00	0.00E+00	5.90E+00	1.49E+00	5.63E+00	1.97E-02	5.31E-04	0.00E+00	1.33E-02	4.12E-03	4.06E+00	1.33E+00
2006	6	18	3.38E+00	7.82E-04	2.20E+00	3.92E-05	9.51E-04	1.82E+01	7.73E+00	1.95E+01	4.66E-01	8.50E-02	2.00E-02	1.79E-01	1.30E-01	1.66E+01	6.16E+00
2006	6	19	1.26E+00	7.18E-03	1.17E+00	2.75E-03	5.00E-03	1.77E+01	6.68E+00	2.69E+01	4.03E-01	8.52E-02	2.22E-02	2.36E-01	1.58E-01	1.88E+01	2.12E+00
2006	6	20	1.78E+00	4.27E-04	7.50E-01	5.16E-06	7.20E-05	7.66E+00	2.49E+00	1.28E+01	1.27E-01	1.84E-02	3.70E-03	4.79E-02	3.11E-02	1.10E+01	2.60E+00
2006	6	21	9.49E-01	2.89E-03	8.00E-01	7.10E-04	2.18E-03	1.93E+01	7.07E+00	2.81E+01	3.18E-01	6.13E-02	1.60E-02	1.93E-01	1.15E-01	2.10E+01	2.47E+00
2006	6	22	1.59E+00	3.49E-04	5.79E-01	7.53E-05	1.90E-03	1.46E+01	6.34E+00	1.80E+01	3.51E-01	5.75E-02	1.28E-02	1.85E-01	1.17E-01	1.52E+01	2.73E+00
2006	6	23	6.52E+00	4.39E-03	2.70E+00	9.23E-04	2.25E-03	1.48E+01	4.02E+00	1.55E+01	2.04E-01	2.67E-02	9.86E-03	9.54E-02	5.75E-02	1.86E+01	9.14E+00
2006	6	24	1.23E+01	4.28E-02	5.99E+00	2.79E-03	7.58E-03	1.96E+01	3.83E+00	2.51E+01	7.47E-01	1.78E-01	7.81E-02	3.31E-01	2.38E-01	2.41E+01	1.61E+01
2006	6	25	5.99E+00	7.24E-02	1.72E+00	3.32E-02	5.21E-02	1.88E+01	6.66E+00	2.48E+01	7.90E-01	2.38E-01	1.35E-01	3.89E-01	3.04E-01	2.43E+01	8.89E+00
2006	6	26	8.24E+00	1.00E-01	3.43E+00	2.52E-02	4.14E-02	1.72E+01	1.03E+01	2.04E+01	1.17E+00	3.25E-01	1.70E-01	5.27E-01	4.10E-01	2.06E+01	1.09E+01
2006	6	27	4.16E+00	8.74E-02	1.55E+00	4.55E-02	6.62E-02	2.03E+01	7.45E+00	1.90E+01	7.53E-01	2.77E-01	1.56E-01	4.71E-01	3.63E-01	1.61E+01	5.50E+00
2006	6	28	8.81E-01	1.59E-03	5.64E-01	2.66E-04	1.76E-03	9.35E+00	4.26E+00	1.23E+01	2.44E-01	5.13E-02	1.52E-02	9.97E-02	7.37E-02	1.01E+01	1.58E+00

Project

Year	Month	Day	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	4	8	2.76E-01	8.69E-02	3.00E-01	2.05E-02	3.20E-02	2.85E-01	1.50E-02	7.32E-01	2.37E+00	1.10E+00	5.43E-01	9.39E-02	2.89E-01	1.30E-01	5.57E-01
2006	4	9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-13	0.00E+00	2.23E-02	7.53E-01	6.97E-21	1.90E+00	3.80E-02	6.15E-01	2.48E-01	9.41E-04	0.00E+00
2006	4	10	1.65E-01	5.33E-05	9.69E-03	6.26E-06	1.88E-05	2.48E-02	3.52E-02	9.95E-01	5.69E-02	5.86E+00	5.12E-02	7.70E-01	7.42E-01	7.17E-02	3.72E-01
2006	4	11	1.61E-02	3.00E-06	5.74E-04	1.72E-06	3.80E-06	5.23E-03	5.34E-02	1.21E+00	4.96E-05	2.28E+00	8.08E-02	4.37E-01	9.23E-01	6.63E-02	6.24E-02
2006	4	12	3.45E-06	0.00E+00	0.00E+00	1.12E-02	6.86E-02	0.00E+00	7.94E-02	9.01E-01	1.66E-33	2.29E+00	5.08E-01	7.60E-01	6.03E-01	5.46E-02	7.41E-06
2006	4	13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E-05	0.00E+00	1.78E-03	1.19E-01	7.94E-21	8.55E-01	9.45E-02	1.03E-01	2.65E-01	0.00E+00	0.00E+00
2006	4	14	8.98E-04	0.00E+00	0.00E+00	9.45E-05	1.36E-01	0.00E+00	1.22E-04	8.28E-02	1.70E-05	1.22E+00	8.60E-01	2.76E-02	2.33E-01	5.63E-03	8.25E-03
2006	4	15	8.42E-03	0.00E+00	0.00E+00	5.94E-05	9.81E-02	0.00E+00	8.34E-03	4.02E-01	4.18E-31	1.52E+00	8.68E-01	2.51E-02	4.12E-01	4.36E-02	2.98E-02
2006	4	16	1.25E-02	7.52E-06	7.68E-04	2.58E-05	9.07E-02	2.21E-03	4.72E-02	5.09E-01	3.06E-03	4.03E+00	7.77E-01	6.61E-01	3.51E-01	4.65E-02	2.21E-02
2006	4	17	4.22E-01	1.77E-02	4.10E-03	1.60E-02	5.88E-02	1.07E-02	2.57E-01	1.55E+00	5.53E-01	9.40E+00	6.56E-01	1.85E+00	1.78E+00	3.21E-01	5.10E-01
2006	4	18	8.41E-02	2.26E-03	7.76E-03	1.18E-01	1.76E-01	3.20E-02	9.24E-02	1.03E+00	2.28E-01	9.38E+00	2.61E+00	1.07E+00	2.31E+00	6.50E-02	2.11E-01
2006	4	19	6.26E-02	8.94E-06	1.27E-02	0.00E+00	0.00E+00	2.78E-02	4.77E-02	8.91E-01	7.03E-03	6.09E+00	2.98E-02	1.18E+00	6.19E-01	1.59E-02	1.61E-01
2006	4	20	3.85E-02	3.02E-01	4.12E-03	4.22E-02	8.09E-02	2.10E-02	3.82E-02	9.88E-01	4.33E-02	5.04E+00	1.67E+00	8.69E-01	6.52E-01	4.20E-02	1.34E-01
2006	4	21	2.61E-02	2.54E-04	1.35E-03	2.33E-02	2.61E-01	3.75E-03	4.47E-02	7.82E-01	5.21E-03	2.94E+00	2.33E+00	1.16E-01	3.21E-01	1.43E-01	6.47E-02
2006	4	22	2.46E-01	1.39E-02	3.04E-01	1.34E-04	6.50E-04	2.57E-01	4.33E-02	4.78E-01	1.83E+00	3.80E+00	1.03E-01	6.27E-01	8.05E-01	1.67E-01	3.23E-01
2006	4	23	4.08E-01	1.97E-04	4.28E-01	4.09E-05	7.49E-05	4.30E-01	6.85E-03	1.34E-01	3.32E+00	3.70E-03	3.54E-04	1.78E-03	1.10E-03	6.75E-02	6.97E-01
2006	4	24	6.40E-01	9.00E-03	5.01E-01	4.52E-06	2.47E-05	4.03E-01	9.54E-06	5.83E-02	2.27E+00	3.17E-03	6.65E-02	2.51E-03	2.19E-03	3.62E-02	1.13E+00
2006	4	25	1.36E-01	6.96E-02	5.16E-02	7.30E-03	1.53E-02	5.61E-02	8.48E-02	1.13E+00	1.81E+00	4.95E+00	2.77E-01	8.46E-01	1.51E+00	1.06E-01	2.22E-01
2006	4	26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E-02	4.15E-01	1.85E-16	1.73E+00	4.42E-02	3.52E-01	2.78E-01	1.92E-04	0.00E+00
2006	4	27	1.97E-02	3.94E-06	1.20E-02	0.00E+00	0.00E+00	5.86E-02	5.44E-02	7.34E-01	4.97E-02	8.58E+00	1.00E-03	8.67E-01	1.08E+00	4.57E-02	7.15E-02
2006	4	28	3.35E-02	6.78E-05	2.42E-03	6.80E-08	1.74E-05	6.23E-03	6.82E-02	1.37E+00	1.11E-02	1.07E+01	3.19E-02	1.07E+00	1.33E+00	1.02E-01	1.01E-01
2006	4	29	1.50E-02	3.61E-02	1.86E-04	2.28E-01	2.06E-01	7.98E-04	7.96E-02	1.16E+00	1.44E-02	6.08E+00	6.31E+00	9.89E-01	6.58E-01	8.14E-02	5.03E-02
2006	4	30	1.42E-01	6.71E-01	5.99E-01	1.41E-02	6.34E-02	5.11E-01	4.04E-02	3.93E-01	1.70E+00	1.87E+00	2.36E+00	6.75E-02	2.90E-01	7.63E-02	2.78E-01
2006	5	1	5.31E-03	6.45E-02	7.09E-04	6.87E-02	6.74E-02	1.78E-03	6.08E-02	7.47E-01	4.44E-03	9.42E+00	4.29E-01	8.61E-01	9.54E-01	6.52E-02	1.67E-02
2006	5	2	2.50E-01	6.79E-02	2.31E-01	9.89E-05	1.69E-03	3.06E-01	1.94E-01	8.96E-01	2.98E+00	1.56E+01	2.97E-01	1.68E+00	3.44E+00	2.31E-01	3.09E-01
2006	5	3	1.67E+00	4.97E-03	1.10E+00	1.95E-05	7.83E-05	1.13E+00	5.51E-01	1.43E+00	8.82E+00	1.99E-01	1.86E-02	4.36E-01	3.06E-01	1.22E+00	1.98E+00
2006	5	4	1.22E-01	4.46E-02	6.63E-02	2.45E-02	8.36E-02	8.16E-02	2.47E-01	1.43E+00	4.95E-01	2.27E+01	6.73E-01	2.72E+00	5.00E+00	3.17E-01	1.86E-01
2006	5	5	3.05E-04	5.65E-06	1.85E-04	1.07E-06	9.78E-06	2.74E-04	7.20E-02	1.09E+00	2.76E-04	7.64E+00	7.85E-02	9.98E-01	8.40E-01	4.96E-02	3.88E-03
2006	5	6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	9.16E-01	4.60E-17	2.85E+00	1.24E-01	5.16E-01	5.89E-01	1.05E-02	0.00E+00
2006	5	7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-08	0.00E+00	1.56E-02	2.22E-01	6.81E-28	4.18E+00	2.07E-01	3.89E-01	4.51E-01	1.77E-03	0.00E+00
2006	5	8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E-02	7.38E-01	3.26E-16	6.44E+00	3.32E-02	6.46E-01	8.21E-01	2.44E-02	0.00E+00
2006	5	9	3.68E-02	1.24E-03	5.48E-03	1.60E-04	1.33E-03	1.02E-02	1.91E-01	1.27E+00	2.53E-01	1.68E+01	2.12E-01	3.66E+00	3.55E+00	4.29E-02	1.02E-01
2006	5	10	4.93E-02	9.63E-03	3.44E-03	1.13E-02	5.38E-02	8.21E-03	5.64E-01	1.44E+00	9.82E-02	1.59E+01	4.40E-01	5.34E+00	7.53E+00	1.63E-01	8.51E-02
2006	5	11	9.13E-03	3.01E-01	1.19E-04	6.09E-02	1.07E-01	2.96E-04	6.42E-02	1.36E+00	3.61E-02	1.35E+01	1.25E+00	1.14E+00	1.18E+00	1.41E-01	2.20E-02
2006	5	12	1.97E-03	0.00E+00	0.00E+00	0.00E+00	5.67E-05	0.00E+00	2.11E-02	2.66E-01	7.43E-16	3.71E+00	2.27E-01	5.13E-01	4.47E-01	7.39E-02	7.69E-03
2006	5	13	5.78E-01	6.65E-01	9.10E-01	3.82E-03	3.22E-03	9.56E-01	7.10E-02	7.51E-01	4.06E+00	4.51E+00	7.39E-01	5.17E-01	6.66E-01	2.74E-01	9.08E-01
2006	5	14	6.13E-01	6.32E-01	2.63E-01	1.02E-01	1.57E-01	3.33E-01	4.43E-01	9.77E-01	4.47E+00	9.99E+00	1.66E+00	2.46E+00	3.09E+00	4.68E-01	9.23E-01
2006	5	15	2.73E-01	1.98E-01	1.57E-01	3.95E-02	6.23E-02	1.96E-01	2.31E-01	1.31E+00	2.11E+00	9.97E+00	7.56E-01	1.89E+00	2.86E+00	3.21E-01	3.86E-01
2006	5	16	6.75E-02	1.15E+00	2.75E-02	9.60E-02	1.22E-01	4.20E-02	1.97E-01	1.07E+00	5.79E-01	1.84E+01	5.62E+00	2.33E+00	4.33E+00	1.94E-01	8.61E-02
2006	5	17	4.33E-03	1.06E-02	5.62E-04	2.82E-02	4.34E-02	8.34E-04	1.32E-01	1.84E+00	3.65E-03	2.43E+01	2.59E-01	2.83E+00	4.53E+00	1.85E-01	1.48E-02
2006	5	18	1.68E-01	1.10E-01	8.40E-02	7.06E-03	4.95E-02	9.59E-02	1.55E-01	1.00E+00	2.21E+00	1.35E+01	1.42E+00	1.67E+00	1.60E+00	1.95E-01	3.38E-01
2006	5	19	1.32E-01	4.30E-02	5.82E-02	1.55E-02	6.75E-02	9.23E-02	9.27E-02	7.73E-01	5.08E-01	1.64E+01	1.45E+00	1.04E+00	2.11E+00	1.32E-01	2.38E-01
2006	5	20	1.65E-02	2.33E+00	2.21E-03	2.24E-02	2.93E-02	7.22E-03	5.96E-03	3.84E-01	4.10E-01	2.37E+00	6.06E+00	7.37E-02	4.13E-01	2.67E-02	3.34E-02
2006	5	21	1.09E-01	3.18E-01	1.08E-02	5.13E-02	5.51E-02	2.54E-02	1.44E-02	6.13E-01	1.39E+00	3.66E+00	2.90E+00	2.98E-01	6.21E-01	5.62E-02	2.55E-01
2006	5	22	1.11E-01	5.08E-01	2.36E-02	1.78E-01	3.35E-01	4.00E-02	2.38E-02	3.77E-01	9.10E-01	5.13E+00	7.01E+00	4.75E-01	6.29E-01	2.01E-02	2.86E-01
2006	5	23	4.47E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-04	1.40E-02	3.11E-01	1.06E-05	2.73E+00	6.93E-02	5.69E-01	5.31E-01	4.42E-04	3.09E-02
2006	5	24	1.42E-02	1.11E-05	2.40E-03	8.30E-04	6.96E-02	6.10E-03	2.57E-02	6.57E-01	3.94E-03	5.87E+00	5.98E-01	4.17E-01	8.34E-01	8.08E-02	4.04E-02
2006	5	25	1.79E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.74E-02	6.49E-01	8.95E-20	5.82E+00	1.75E-01	8.03E-01	8.43E-01	5.33E-02	3.56E-03
2006	5	26	1.01E-01	3.51E-05	5.68E-03	7.58E-06	2.20E-03	1.81E-02	2.42E-02	4.27E-01	2.73E-02	7.99E+00	5.67E-01	1.93E-01	8.91E-01	5.59E-02	2.58E-01
2006	5	27	2.62E-01	8.86E-03	6.09E-01	7.13E-05	7.73E-04	5.84E-01	3.42E-01	7.01E-01	5.96E+00	1.34E+01	1.35E-01	2.62E+00	3.84E+00	2.34E-01	3.31E-01
2006	5	28	2.68E-01	3.34E-01	8.20E-01	1.28E-01	1.75E-01	4.74E-01	4.16E-02	9.69E-01	4.18E+00	1.32E+00	2.26E+00	2.23E-01	6.69E-01	1.52E-01	4.52E-01
2006	5	29	3.98E-02	2.33E-03	1.32E-03	9.61E-03	4.12E-02	3.94E-03	4.78E-02	1.30E+00	9.70E-02	1.34E+01	1.19E+00	1.16E+00	1.62E+00	1.13E-01	1.28E-01
2006	5	30	1.04E-01	5.56E-05	4.93E-03	2.70E-06	1.79E-05	1.36E-02	2.68E-02	6.91E-01	1.47E-02	7.92E+00	6.48E-02	4.48E-01	1.58E+00	4.85E-02	2.31E-01
2006	5	31	2.16E-03	1.61E-05	6.09E-05	4.40E-04	2.69E-02	9.00E-05	7.84E-02	1.44E+00	3.28E-04	8.37E+00	3.59E-01	8.81E-01	1.73E+00	4.36E-02	7.58E-03
2006	6	1	4.73E-02	1.49E+00	1.00E-03	1.39E-01	1.06E-01	3.76E-03	6.32E-02	8.97E-01	2.04E-02	1.17E+01	6.56E+00	9.48E-01	1.15E+00	1.31E-01	1.15E-01
2006	6	2	1.80E-02	3.23E-03	1.54E-03	1.44E-01	1.85E-01	4.30E-03	3.64E-02	9.08E-01	8.04E-03	4.51E+00	2.84E+00	4.24E-01	1.06E+00	3.38E-02	7.79E-02
2006	6	3	3.20E-02	0.00E+00	3.62E-03	0.00E+00	0.00E+00	1.05E-02	2.27E-03	1.71E-01	2.13E-03	3.58E+00	1.61E-01	2.58E-01	6.66E-01	6.95E-03	1.00E-01
2006	6	4	1.54E-02	1.88E-05	6.60E-04	2.15E-06	7.06E-03	5.46E-03	4.24E-02	6.77E-01	3.27E-03	6.92E+00	3.76E-01	4.75E-01	1.45E+00	5.26E-02	4.38E-02
2006	6	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-02	4.92E-01	5.26E-16	3.55E+00	1.98E-01	6.91E-01	5.71E-01	0.00E+00	0.00E+00
2006	6	6	2.45E-01	1.17E-04	5.74E-01	0.00E+00	9.08E-07	5.62E-01	3.77E-02	2.54E-01	3.74E+00	5.88E+00	3.92E-03	6.17E-01	6.69E-01	9.20E-02	4.27E-01
2006	6	7	4.79E-01	0.00E+00	2.52E-01	0.00E+00	0.00E+00	1.67E-01	2.32E-04	3.42E-02	1.84E+00	3.50E-03	7.73E-05	5.61E-05	6.03E-05	3.02E-02	7.36E-01
2006	6	8	6.25E-01	2.41E-01	5.61E-01	1.06E-01	3.25E-01	5.88E-01	3.22E-01	1.37E+00	4.60E+00	1.92E+00	1.79E+00	5.31E-01	6.79E-01	6.56E-01	7.01E-01
2006	6	9	1.83E-01	1.68E-01	4.54E-01	2.95E-02	3.67E-02	3.65E-01	5.77E-02	5.13E-01	3.27E+00	9.26E+00	1.77E-01	9.47E-01	1.47E+00	1.56E-01	3.10E-01
2006	6	10	1.73E-01	1.69E-01	8.30E-01	7.02E-04	1.50E-03	4.46E-01	2.17E-03	8.20E-02	6.08E+00	1.60E-01	2.21E-01	2.24E-02	3.61E-02	1.03E-02	3.63E-01
2006	6	11	1.20E-01	6.98E-01	1.01E-01	1.41E-01	2.48E-01	1.24E-01	1.44E-01	5.30E-01	3.44E+00	1.53E+01	2.24E+00	1.87E+00	3.38E+00	1.23E-01	1.82E-01
2006	6	12	4.76E-01	0.00E+00	1.30E-01	0.00E+00	0.00E+00	1.40E-01	8.07E-05	5.50E-02	4.83E+00	3.84E-05	0.00E+00	6.14E-05	4.40E-05	1.33E-02	9.12E-01
2006	6	13	4.29E-01	1.23E-06	3.65E-01	0.00E+00	0.00E+00	3.18E-01	9.72E-04	7.67E-02	3.04E+00	5.86E-01	2.60E-06	3.89E-02	1.41E-01	4.70E-02	6.99E-01
2006	6	14	1.40E-01	4.43E-01	1.31E-01	9.26E-02	1.19E-01	1.67E-01	1.59E-01	4.24E-01	1.11E+00	9.67E+00	8.66E-01	1.65E+00	2.88E+00	1.31E-01	1.93E-01
2006	6	15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-02	4.03E-01	3.68E-16	2.00E+00	6.18E-02	5.29E-01	4.01E-01	4.46E-07	0.00E+00
2006	6	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-02	2.60E-01	1.61E-14	2.42E+00	1.40E-01	3.43E-01	4.27E-01	1.84E-04	0.00E+00
2006	6	17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-02	5.51E-01	9.82E-15	4.18E+00	4.35E-02	5.76E-01	4.28E-01	3.14E-02	0.00E+00
2006	6	18	1.12E-01	6.57E-05	6.36E-03	1.43E-04	3.95E-03	1.67E-02	3.34E-02	7.53E-01	2.74E-02	1.51E+01	1.71E-01	9.65E-01	1.91E+00	6.00E-02	2.85E-01
2006	6	19	3.17E-02	2.46E-01	8.49E-03	4.17E-02	6.02E-02	1.30E-02	1.65E-01	1.31E+00	7.65E-02	1.60E+01	6.96E-01	2.86E+00	4.12E+00	1.27E-01	5.09E-02
2006	6	20	1.82E-02	1.12E-06	7.53E-03	0.00E+00	0.00E+00	2.18E-02	2.20E-02	4.01E-01	2.52E-03	7.98E+00	8.07E-03	7.30E-01	7.14E-01	1.31E-02	7.16E-02
2006	6	21	1.14E-01	1.41E-01	3.17E-02	5.68E-02	8.58E-02	6.35E-02	2.96E-01	1.54E+00	5.22E-01	1.14E+01	5.21E-01	2.37E+00	3.18E+00	2.52E-01	1.53E-01
2006	6	22	3.20E-04	6.61E-06	0.00E+00	4.65E-05	3.06E-02	1.07E-06	9.12E-02	1.24E+00	2.44E-04	9.10E+00	1.09E+00	1.03E+00	1.30E+00	6.08E-02	5.77E-03
2006	6	23	2.58E-02	9.72E-02	1.97E-02	1.52E-02	2.92E-02	2.84E-02	4.83E-02	5.95E-01	3.10E+00	6.17E+00	2.80E-01	4.83E-01	8.04E-01	7.30E-02	6.40E-02
2006	6	24	2.08E-01	9.00E-01	2.76E-02	3.22E-03	2.09E-03	4.89E-02	3.78E-03	2.73E-01	3.69E+00	3.22E-01	2.84E+00	2.88E-02	4.23E-02	6.45E-02	4.79E-01
2006	6	25	1.17E-01	1.44E+00	2.06E-01	2.03E-01	2.90E-01	1.83E-01	4.01E-02	9.26E-01	2.37E+00	9.36E+00	8.11E+00	4.86E-01	1.34E+00	1.84E-01	2.02E-01
2006	6	26	3.42E-01	1.29E+00	2.25E-01	6.89E-02	9.18E-02	2.47E-01	1.15E-01	3.89E-01	2.76E+00	5.05E+00	3.48E+00	9.37E-01	1.52E+00	1.79E-01	5.53E-01
2006	6	27	1.42E-02	1.11E+00	3.59E-03	3.08E-01	5.65E-01	1.47E-02	3.62E-02	9.22E-01	4.01E-02	9.66E+00	9.80E+00	3.86E-01	1.24E+00	1.52E-01	3.48E-02
2006	6	28	2.05E-02	5.53E-08	3.22E-04	8.53E-06	2.80E-04	1.14E-03	4.11E-02	7.26E-01	5.82E-03	3.80E+00	2.25E-01	3.80E-01	1.14E+00	3.77E-02	8.33E-02

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	6	29	5.68E+00	1.93E-01	2.37E+00	2.34E-02	3.04E-02	9.81E+00	3.17E+00	1.28E+01	9.54E-01	4.44E+00	3.89E-01	3.25E-01	6.27E-01	1.19E+01	7.90E+00
2006	6	30	1.26E+00	4.91E-02	6.81E-01	1.77E-02	2.70E-02	1.33E+01	4.37E+00	2.25E+01	5.31E-01	7.57E+00	2.97E-01	8.34E-01	9.69E-01	1.30E+01	3.29E+00
2006	7	1	1.55E+00	8.20E-01	1.02E+00	1.40E-01	2.27E-01	1.71E+01	7.88E+00	2.25E+01	5.33E-01	1.52E+01	2.24E+00	1.99E+00	2.85E+00	1.64E+01	2.11E+00
2006	7	2	7.15E+00	6.60E-02	4.01E+00	2.64E-03	6.25E-03	1.60E+01	6.86E+00	2.81E+01	2.89E+00	1.45E+01	1.91E-01	1.40E+00	2.09E+00	2.51E+01	9.58E+00
2006	7	3	1.03E+01	1.49E+00	5.12E+00	9.25E-02	1.11E-01	2.20E+01	7.47E+00	2.79E+01	4.82E+00	2.60E+00	3.16E+00	8.87E-01	1.08E+00	3.01E+01	1.37E+01
2006	7	4	4.89E+00	4.75E-01	1.65E+00	1.14E-01	1.46E-01	2.28E+01	9.08E+00	2.79E+01	1.13E+00	1.93E+01	1.15E+00	1.93E+00	3.32E+00	2.32E+01	7.97E+00
2006	7	5	5.36E+00	1.10E+00	1.21E+00	3.26E-01	5.94E-01	1.72E+01	9.78E+00	1.71E+01	9.61E-01	1.56E+01	8.00E+00	1.44E+00	1.29E+00	1.92E+01	7.10E+00
2006	7	6	3.40E+00	5.52E-05	6.97E-01	2.48E-05	2.17E-02	8.78E+00	5.21E+00	1.24E+01	2.48E-01	9.84E+00	9.60E-01	8.68E-01	1.35E+00	1.05E+01	5.26E+00
2006	7	7	8.66E-01	7.03E-05	4.93E-01	0.00E+00	2.40E-05	8.88E+00	2.56E+00	1.09E+01	1.23E-01	4.90E+00	1.11E-01	5.94E-01	7.27E-01	7.29E+00	1.86E+00
2006	7	8	3.17E+00	4.90E-01	7.86E-01	2.75E-01	2.66E-01	1.44E+01	5.94E+00	1.18E+01	4.21E-01	8.37E+00	8.04E+00	6.40E-01	1.09E+00	1.10E+01	4.45E+00
2006	7	9	2.29E+00	3.05E-02	1.03E+00	5.27E-02	3.69E-01	1.77E+01	7.83E+00	2.23E+01	3.76E-01	1.25E+01	2.99E+00	1.03E+00	1.73E+00	1.89E+01	3.85E+00
2006	7	10	2.54E+00	9.21E-03	1.56E+00	9.59E-02	2.99E-01	2.15E+01	6.68E+00	2.28E+01	3.98E-01	4.67E+00	1.80E+00	4.82E-01	1.26E+00	2.11E+01	4.25E+00
2006	7	11	2.66E+00	7.48E-03	1.23E+00	1.90E-03	1.64E-01	1.74E+01	6.82E+00	2.44E+01	5.49E-01	7.45E+00	2.09E+00	4.12E-01	1.56E+00	1.66E+01	5.61E+00
2006	7	12	9.40E-01	0.00E+00	3.01E-01	1.03E-07	4.62E-03	7.25E+00	3.76E+00	8.34E+00	1.60E-01	5.94E+00	3.24E-01	7.18E-01	9.74E-01	6.99E+00	2.15E+00
2006	7	13	7.65E-02	0.00E+00	1.48E-02	0.00E+00	0.00E+00	2.34E+00	9.67E-01	2.31E+00	1.08E-14	2.06E+00	1.83E-01	3.83E-01	4.21E-01	1.94E+00	1.73E-01
2006	7	14	9.59E-02	0.00E+00	6.88E-02	0.00E+00	3.20E-09	3.81E+00	1.34E+00	3.98E+00	9.83E-05	2.34E+00	1.79E-01	2.57E-01	5.84E-01	2.70E+00	4.69E-01
2006	7	15	9.12E-01	0.00E+00	6.99E-01	0.00E+00	0.00E+00	4.66E+00	3.08E+00	6.91E+00	4.87E-03	5.00E+00	1.45E-01	6.24E-01	6.64E-01	4.89E+00	1.33E+00
2006	7	16	4.88E+00	2.40E-01	1.80E+00	5.30E-02	6.14E-02	1.21E+01	4.98E+00	1.89E+01	9.15E-01	1.06E+01	4.50E-01	1.78E+00	1.69E+00	1.65E+01	6.43E+00
2006	7	17	2.42E+00	1.12E-01	9.30E-01	5.10E-02	1.19E-01	1.77E+01	7.42E+00	2.20E+01	4.01E-01	7.83E+00	1.53E+00	9.30E-01	1.42E+00	1.84E+01	3.35E+00
2006	7	18	3.61E+00	8.42E-02	1.36E+00	1.93E-02	3.25E-02	1.02E+01	8.03E+00	1.57E+01	1.72E+00	1.34E+01	7.36E-01	2.33E+00	3.52E+00	1.70E+01	4.80E+00
2006	7	19	5.73E+00	1.94E-02	2.55E+00	5.19E-04	2.06E-03	1.01E+01	3.32E+00	1.70E+01	3.76E+00	3.93E+00	5.49E-02	7.56E-01	8.65E-01	1.95E+01	7.99E+00
2006	7	20	4.85E+00	1.24E+00	1.59E+00	1.43E-01	1.79E-01	1.65E+01	8.74E+00	2.67E+01	1.08E+00	9.77E+00	2.81E+00	4.49E+00	4.75E+00	1.64E+01	7.59E+00
2006	7	21	9.37E+00	2.47E+00	3.76E+00	3.33E-01	4.44E-01	1.96E+01	1.23E+01	2.07E+01	3.46E+00	9.02E+00	9.42E+00	1.21E+00	1.86E+00	1.92E+01	1.23E+01
2006	7	22	1.45E+00	2.77E-01	1.31E+00	1.68E-01	4.05E-01	2.84E+01	1.06E+01	3.57E+01	7.19E-01	2.48E+01	3.01E+00	2.02E+00	3.45E+00	2.45E+01	2.13E+00
2006	7	23	5.82E+00	1.77E-02	2.15E+00	5.18E-03	4.84E-02	1.31E+01	6.63E+00	2.39E+01	2.12E+00	2.17E+01	1.55E+00	2.38E+00	4.59E+00	2.08E+01	6.85E+00
2006	7	24	8.10E+00	2.02E-01	4.17E+00	3.25E-02	6.43E-02	1.49E+01	6.42E+00	2.34E+01	1.86E+00	1.12E+01	8.37E-01	1.30E+00	1.62E+00	1.92E+01	1.07E+01
2006	7	25	4.70E+00	1.02E+00	2.14E+00	1.82E-01	3.45E-01	1.49E+01	7.20E+00	1.58E+01	9.58E-01	7.08E+00	6.19E+00	8.76E-01	9.41E-01	1.29E+01	5.99E+00
2006	7	26	4.48E+00	1.98E-03	1.68E+00	5.42E-05	6.29E-04	1.44E+01	8.23E+00	2.09E+01	4.65E-01	1.54E+01	5.48E-02	1.47E+00	1.85E+00	1.75E+01	5.84E+00
2006	7	27	8.99E-01	1.03E-01	7.39E-01	3.16E-02	1.36E-01	1.48E+01	6.04E+00	2.24E+01	5.76E-01	9.90E+00	2.02E+00	1.42E+00	1.35E+00	1.54E+01	1.41E+00
2006	7	28	2.24E+00	3.16E-02	1.58E+00	2.31E-01	2.69E-01	1.88E+01	9.17E+00	2.83E+01	5.86E-01	9.99E+00	2.02E+00	1.18E+00	1.77E+00	1.98E+01	4.02E+00
2006	7	29	3.21E+00	5.61E-02	1.32E+00	2.13E-02	8.05E-02	1.51E+01	7.12E+00	1.77E+01	7.89E-01	5.88E+00	1.78E+00	9.16E-01	1.48E+00	1.80E+01	4.72E+00
2006	7	30	9.10E-01	1.73E-07	2.72E-01	0.00E+00	9.21E-05	8.50E+00	1.89E+00	9.53E+00	1.65E-01	2.42E+00	2.05E-01	3.53E-01	6.46E-01	7.66E+00	1.38E+00
2006	7	31	4.95E-01	3.15E-04	4.04E-01	7.53E-07	1.24E-04	8.50E+00	4.24E+00	1.82E+01	1.71E-01	8.99E+00	4.56E-02	7.01E-01	9.83E-01	9.34E+00	2.37E+00
2006	8	1	6.33E-01	2.32E-04	7.75E-01	5.88E-07	9.02E-05	1.88E+01	6.85E+00	2.51E+01	4.55E-01	1.24E+01	7.70E-02	1.47E+00	1.39E+00	1.78E+01	9.42E-01
2006	8	2	2.28E+00	6.06E-04	1.08E+00	4.92E-05	2.15E-04	1.82E+01	7.60E+00	2.36E+01	5.24E-01	1.37E+01	9.41E-02	1.60E+00	1.30E+00	1.98E+01	3.99E+00
2006	8	3	3.09E+00	3.40E-02	1.89E+00	3.66E-02	8.77E-02	2.07E+01	1.01E+01	2.67E+01	1.05E+00	1.50E+01	5.75E-01	2.40E+00	2.58E+00	2.81E+01	5.20E+00
2006	8	4	3.83E+00	8.21E-01	1.34E+00	4.28E-01	8.50E-01	1.37E+01	8.02E+00	1.12E+01	1.63E+00	7.15E+00	8.62E+00	7.97E-01	1.17E+00	8.93E+00	6.30E+00
2006	8	5	3.82E+00	1.29E+00	2.14E+00	2.46E-01	3.69E-01	1.45E+01	5.58E+00	1.92E+01	1.52E+00	1.04E+01	5.32E+00	1.15E+00	2.16E+00	1.58E+01	5.59E+00
2006	8	6	4.22E+00	1.40E+00	1.57E+00	2.72E-01	3.33E-01	2.27E+01	1.18E+01	3.17E+01	1.12E+00	1.85E+01	8.66E+00	2.64E+00	3.50E+00	2.32E+01	5.55E+00
2006	8	7	2.99E+00	5.87E-02	1.49E+00	3.82E-01	6.88E-01	2.50E+01	9.84E+00	2.77E+01	1.00E+00	1.72E+01	7.59E+00	1.59E+00	1.75E+00	2.69E+01	4.04E+00
2006	8	8	5.00E+00	9.80E-01	2.57E+00	1.72E-01	2.57E-01	2.20E+01	1.04E+01	2.92E+01	1.14E+00	1.94E+01	2.86E+00	3.12E+00	3.52E+00	2.97E+01	7.02E+00
2006	8	9	1.01E+00	8.54E-03	4.46E-01	5.71E-04	7.47E-03	8.84E+00	3.12E+00	1.12E+01	1.92E-01	9.47E+00	9.93E-01	8.24E-01	1.58E+00	7.64E+00	1.83E+00
2006	8	10	5.16E+00	6.58E-01	1.48E+00	2.22E-01	4.38E-01	1.00E+01	6.54E+00	1.92E+01	9.25E-01	7.54E+00	7.74E+00	3.40E-01	8.36E-01	1.74E+01	7.82E+00
2006	8	11	1.89E+00	3.80E-02	4.83E-01	3.08E-02	9.81E-02	7.25E+00	6.43E+00	1.13E+01	3.15E-01	9.00E+00	2.67E+00	1.90E+00	1.73E+00	9.22E+00	3.34E+00
2006	8	12	4.66E+00	9.68E-02	2.10E+00	1.03E-01	1.91E-01	2.08E+01	8.64E+00	2.36E+01	1.97E+00	1.90E+01	1.61E+00	2.91E+00	3.23E+00	2.77E+01	7.22E+00
2006	8	13	8.69E-01	3.07E-03	1.28E+00	5.11E-04	1.52E-03	2.67E+01	1.05E+01	4.10E+01	4.21E-01	1.98E+01	6.59E-02	2.13E+00	3.98E+00	2.77E+01	3.75E+00
2006	8	14	1.14E+00	1.56E-03	1.39E+00	1.60E-04	1.72E-03	2.44E+01	1.06E+01	3.37E+01	7.23E-01	1.80E+01	1.58E-01	1.83E+00	2.55E+00	2.41E+01	3.08E+00
2006	8	15	2.25E+00	3.69E-01	1.10E+00	1.34E-01	1.09E-01	1.36E+01	5.14E+00	1.95E+01	8.34E-01	6.48E+00	9.27E-01	8.42E-01	1.15E+00	2.08E+01	3.24E+00
2006	8	16	6.62E+00	1.24E-03	2.82E+00	1.76E-06	2.10E-05	9.80E+00	5.97E-01	1.30E+01	5.61E+00	6.33E-03	1.23E-03	6.33E-03	4.15E-03	1.77E+01	8.24E+00
2006	8	17	7.89E+00	6.23E-01	2.81E+00	9.99E-02	1.68E-01	2.45E+01	1.44E+01	3.23E+01	5.74E+00	1.14E+01	3.82E+00	2.94E+00	2.76E+00	2.85E+01	1.19E+01
2006	8	18	1.26E+00	1.81E-03	1.09E+00	2.23E-04	2.15E-03	2.40E+01	9.36E+00	3.09E+01	7.65E-01	1.04E+01	7.73E-02	1.51E+00	2.26E+00	2.21E+01	2.76E+00
2006	8	19	1.75E+00	2.00E-03	1.43E+00	2.64E-04	1.34E-03	2.15E+01	8.38E+00	2.48E+01	7.01E-01	1.35E+01	1.47E-01	1.56E+00	1.37E+00	3.27E+01	2.30E+00
2006	8	20	1.47E+01	7.72E-01	6.52E+00	2.79E-02	3.95E-02	2.14E+01	5.15E+00	2.17E+01	5.51E+00	1.43E+00	1.74E+00	3.06E-01	3.52E-01	2.94E+01	1.85E+01
2006	8	21	3.02E+00	3.88E-01	1.41E+00	4.03E-01	4.39E-01	3.12E+01	1.10E+01	3.11E+01	1.09E+00	1.65E+01	1.08E+01	1.70E+00	2.73E+00	2.64E+01	5.80E+00
2006	8	22	3.74E+00	7.73E-02	2.09E+00	2.15E-01	2.70E-01	2.32E+01	9.40E+00	2.88E+01	7.58E-01	2.05E+01	2.65E+00	1.82E+00	1.57E+00	2.83E+01	4.69E+00
2006	8	23	3.95E+00	9.10E-03	1.56E+00	1.78E-03	7.10E-03	1.71E+01	7.68E+00	1.86E+01	1.02E+00	1.06E+01	3.23E-01	1.04E+00	1.55E+00	1.71E+01	4.93E+00
2006	8	24	5.10E+00	4.75E-02	2.83E+00	1.31E-02	3.33E-02	1.99E+01	6.73E+00	2.85E+01	2.32E+00	1.59E+01	7.67E-01	1.74E+00	2.62E+00	2.21E+01	6.74E+00
2006	8	25	8.78E+00	8.36E-01	3.20E+00	1.21E-01	5.31E-02	1.29E+01	4.25E+00	1.39E+01	3.74E+00	4.10E-01	6.53E+00	2.21E-01	1.71E-01	1.62E+01	1.03E+01
2006	8	26	1.86E+00	1.45E-02	1.23E+00	4.63E-02	8.34E-02	2.62E+01	1.13E+01	3.59E+01	6.81E-01	1.63E+01	3.56E-01	2.10E+00	1.55E+00	2.94E+01	2.29E+00
2006	8	27	5.65E+00	1.27E+00	2.22E+00	1.25E-01	1.60E-01	2.68E+01	1.06E+01	3.60E+01	3.04E+00	1.18E+01	3.44E+00	2.71E+00	2.96E+00	2.56E+01	7.88E+00
2006	8	28	4.27E+00	7.70E-01	1.67E+00	1.99E-01	1.87E-01	2.01E+01	9.10E+00	2.81E+01	1.13E+00	9.39E+00	7.54E+00	1.16E+00	2.08E+00	1.81E+01	6.65E+00
2006	8	29	4.21E+00	1.42E-02	1.15E+00	9.07E-02	5.40E-01	1.42E+01	4.72E+00	1.81E+01	5.12E-01	3.99E+00	4.32E+00	3.23E-01	7.94E-01	1.22E+01	6.57E+00
2006	8	30	1.44E+00	7.13E-07	1.79E-01	1.95E-05	2.00E-02	6.16E+00	1.35E+00	5.65E+00	6.90E-02	2.74E+00	4.24E-01	3.67E-01	5.34E-01	4.83E+00	1.89E+00
2006	8	31	4.26E+00	3.33E-03	2.21E+00	2.60E-04	1.19E-03	2.03E+01	1.18E+01	2.62E+01	5.57E-01	2.60E+01	1.09E-01	2.54E+00	3.90E+00	2.39E+01	7.08E+00
2006	9	1	5.20E+00	7.00E-01	2.93E+00	4.15E-02	7.40E-02	2.68E+01	1.19E+01	3.45E+01	8.50E-01	1.93E+01	3.96E+00	1.81E+00	2.69E+00	2.84E+01	8.02E+00
2006	9	2	4.56E+00	1.03E+00	2.09E+00	3.37E-01	5.30E-01	2.77E+01	1.44E+01	2.85E+01	1.14E+00	1.97E+01	5.20E+00	1.98E+00	2.47E+00	2.97E+01	6.91E+00
2006	9	3	7.59E+00	9.27E-03	3.19E+00	3.25E-03	5.53E-03	2.48E+01	1.03E+01	2.99E+01	2.70E+00	8.76E+00	4.54E-02	2.06E+00	1.42E+00	3.52E+01	9.31E+00
2006	9	4	7.40E+00	1.26E-01	3.74E+00	1.39E-02	2.70E-02	2.46E+01	1.18E+01	4.33E+01	1.02E+01	9.87E-01	2.76E-01	2.03E+00	1.32E+00	3.51E+01	9.86E+00
2006	9	5	6.25E+00	6.33E-01	4.06E+00	2.14E-02	3.73E-02	2.82E+01	1.31E+01	3.25E+01	7.60E+00	3.47E+00	2.23E+00	2.08E+00	1.88E+00	3.11E+01	1.05E+01
2006	9	6	1.06E+01	1.02E-01	5.16E+00	8.17E-03	1.66E-02	2.59E+01	7.19E+00	2.85E+01	5.10E+00	2.98E+00	2.68E-01	1.15E+00	1.16E+00	3.51E+01	1.36E+01
2006	9	7	1.27E+01	7.96E-03	6.39E+00	7.17E-04	2.32E-03	2.13E+01	4.61E+00	2.62E+01	6.16E+00	2.03E+00	5.24E-02	7.68E-01	7.94E-01	2.85E+01	1.64E+01
2006	9	8	1.29E+01	5.55E-01	6.90E+00	2.72E-01	4.62E-01	2.86E+01	1.03E+01	3.47E+01	5.45E+00	1.16E+01	2.95E+00	1.73E+00	2.32E+00	4.05E+01	1.69E+01
2006	9	9	2.66E+00	3.67E-01	1.09E+00	7.83E-02	2.10E-01	1.76E+01	8.43E+00	2.25E+01	4.74E-01	9.51E+00	2.38E+00	1.13E+00	1.99E+00	1.88E+01	3.39E+00
2006	9	10	3.83E+00	9.91E-04	1.48E+00	2.53E-05	7.88E-05	1.18E+01	8.74E+00	2.02E+01	5.20E-01	1.42E+01	2.46E-02	1.57E+00	1.19E+00	1.36E+01	5.65E+00
2006	9	11	1.99E+00	8.94E-03	2.14E+00	9.97E-03	5.51E-02	2.72E+01	1.38E+01	3.88E+01	7.76E-01	2.59E+01	4.73E-01	3.41E+00	3.91E+00	2.69E+01	3.18E+00
2006	9	12	6.63E+00	1.45E+00	1.99E+00	4.21E-02	5.54E-02	1.88E+01	1.14E+01	2.98E+01	2.42E+00	7.86E+00	3.92E+00	1.46E+00	1.60E+00	2.79E+01	1.06E+01
2006	9	13	8.56E+00	9.22E-02	3.27E+00	1.23E-01	4.18E-01	1.33E+01	7.56E+00	2.13E+01	5.63E+00	9.05E+00	4.83E+00	1.28E+00	2.06E+00	2.26E+01	1.22E+01
2006	9	14	1.59E+01	1.19E-01	8.32E+00	2.97E-02	1.01E-01	2.41E+01	7.71E+00	2.51E+01	3.97E+00	1.03E+01	1.08E+00	5.32E-01	1.14E+00	2.72E+01	1.84E+01
2006	9	15	1.27E+01	1.04E-01	9.87E+00	2.18E-02	5.25E-02	1.94E+01	1.09E+01	3.01E+01	9.57E+00	1.10E+01	9.60E-01	4.09E+00	4.40E+00	2.87E+01	1.58E+01
2006	9	16	8.20E+00	1.47E+00	6.89E+00	1.37E-01	2.05E-01	1.12E+01	3.82E+00	1.88E+01	1.13E+01	1.09E+01	1.54E+00	2.40E+00	4.33E+00	2.01E+01	9.99E+00
2006	9	17	1.34E+01	2.35E+00	6.40E+00	4.52E-01	6.07E-01	2.21E+01	8.97E+00	2.74E+01	3.20E+00	1.56E+01	8.78E+00	2.09E+00	4.24E+00	2.42E+01	1.78E+01
2006	9	18	8.95E+00	1.64E+00	4.02E+00	5.20E-01	7.67E-01	2.48E+01	1.53E+01	2.90E+01	1.76E+00	1.46E+01	1.08E+01	1.94E+00	2.24E+00	2.39E+01	1.25E+01

Year	Month	Day	Baseline R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	6	29	5.64E+00	6.92E-03	2.36E+00	1.34E-03	1.73E-03	9.79E+00	3.16E+00	1.27E+01	1.93E-01	2.92E-02	1.02E-02	7.28E-02	4.67E-02	1.19E+01	7.77E+00
2006	6	30	1.26E+00	4.09E-03	6.81E-01	6.47E-04	1.36E-03	1.33E+01	4.33E+00	2.12E+01	5.27E-01	9.40E-02	2.32E-02	1.54E-01	1.36E-01	1.29E+01	3.28E+00
2006	7	1	1.53E+00	6.80E-03	1.02E+00	1.59E-03	5.03E-03	1.71E+01	7.80E+00	2.15E+01	4.71E-01	8.93E-02	2.93E-02	1.72E-01	1.31E-01	1.63E+01	2.06E+00
2006	7	2	7.08E+00	1.28E-03	3.92E+00	6.69E-05	4.65E-04	1.59E+01	6.74E+00	2.71E+01	3.03E-01	5.65E-02	1.03E-02	1.67E-01	1.08E-01	2.51E+01	9.47E+00
2006	7	3	1.00E+01	6.46E-02	4.89E+00	1.10E-02	1.90E-02	2.18E+01	7.38E+00	2.74E+01	8.59E-01	2.21E-01	1.09E-01	3.68E-01	2.80E-01	2.99E+01	1.33E+01
2006	7	4	4.84E+00	5.18E-02	1.65E+00	1.93E-02	3.25E-02	2.28E+01	9.03E+00	2.72E+01	7.95E-01	1.77E-01	1.00E-01	3.14E-01	2.25E-01	2.30E+01	7.88E+00
2006	7	5	5.31E+00	6.25E-02	1.21E+00	3.54E-02	5.67E-02	1.72E+01	9.71E+00	1.65E+01	5.83E-01	2.30E-01	1.28E-01	3.55E-01	2.86E-01	1.91E+01	7.00E+00
2006	7	6	3.39E+00	3.31E-05	6.95E-01	6.67E-06	3.27E-04	8.77E+00	5.17E+00	1.21E+01	2.37E-01	4.19E-02	8.30E-03	7.66E-02	5.79E-02	1.05E+01	5.20E+00
2006	7	7	8.53E-01	7.03E-05	4.92E-01	0.00E+00	2.40E-05	8.88E+00	2.53E+00	1.02E+01	1.21E-01	1.30E-02	2.51E-03	6.32E-02	3.33E-02	7.28E+00	1.80E+00
2006	7	8	3.09E+00	4.18E-02	7.85E-01	1.56E-02	1.81E-02	1.44E+01	5.91E+00	1.14E+01	2.99E-01	9.81E-02	6.16E-02	1.47E-01	1.18E-01	1.09E+01	4.24E+00
2006	7	9	2.28E+00	1.61E-02	1.03E+00	1.18E-02	1.99E-02	1.77E+01	7.78E+00	2.13E+01	3.64E-01	9.27E-02	4.91E-02	1.76E-01	1.28E-01	1.87E+01	3.83E+00
2006	7	10	2.45E+00	8.45E-03	1.56E+00	5.37E-03	1.25E-02	2.15E+01	6.64E+00	2.16E+01	3.63E-01	9.51E-02	3.76E-02	1.85E-01	1.37E-01	2.10E+01	4.06E+00
2006	7	11	2.62E+00	7.37E-03	1.23E+00	1.80E-03	1.17E-02	1.74E+01	6.78E+00	2.33E+01	5.42E-01	1.55E-01	5.54E-02	2.12E-01	1.94E-01	1.65E+01	5.52E+00
2006	7	12	9.40E-01	0.00E+00	3.01E-01	1.03E-07	9.57E-05	7.25E+00	3.71E+00	7.76E+00	1.60E-01	2.37E-02	1.75E-03	9.37E-02	6.72E-02	6.96E+00	2.15E+00
2006	7	13	7.65E-02	0.00E+00	1.48E-02	0.00E+00	0.00E+00	2.34E+00	9.61E-01	2.16E+00	0.00E+00	0.00E+00	0.00E+00	9.91E-05	0.00E+00	1.94E+00	1.73E-01
2006	7	14	9.59E-02	0.00E+00	6.88E-02	0.00E+00	0.00E+00	3.81E+00	1.33E+00	3.78E+00	9.83E-05	0.00E+00	0.00E+00	1.93E-02	1.59E-03	2.70E+00	4.69E-01
2006	7	15	8.37E-01	0.00E+00	6.99E-01	0.00E+00	0.00E+00	4.66E+00	3.06E+00	6.56E+00	7.86E-05	0.00E+00	0.00E+00	3.89E-03	3.65E-04	4.89E+00	1.18E+00
2006	7	16	4.78E+00	1.05E-02	1.75E+00	4.02E-03	5.00E-03	1.20E+01	4.85E+00	1.84E+01	3.46E-01	7.94E-02	2.57E-02	1.37E-01	1.11E-01	1.63E+01	6.21E+00
2006	7	17	2.40E+00	1.28E-02	9.30E-01	5.13E-03	1.01E-02	1.77E+01	7.36E+00	2.08E+01	3.63E-01	1.02E-01	4.12E-02	2.06E-01	1.52E-01	1.83E+01	3.29E+00
2006	7	18	3.50E+00	4.91E-03	1.29E+00	1.27E-03	1.62E-03	1.01E+01	7.78E+00	1.49E+01	3.14E-01	6.49E-02	2.11E-02	1.45E-01	1.09E-01	1.67E+01	4.67E+00
2006	7	19	5.69E+00	3.14E-03	2.44E+00	4.18E-04	9.64E-04	1.00E+01	3.26E+00	1.67E+01	1.86E-01	2.03E-02	6.37E-03	6.59E-02	3.86E-02	1.94E+01	7.94E+00
2006	7	20	4.67E+00	5.49E-02	1.58E+00	1.12E-02	1.61E-02	1.65E+01	7.80E+00	2.57E+01	7.28E-01	1.73E-01	7.94E-02	3.63E-01	2.53E-01	1.60E+01	7.36E+00
2006	7	21	9.12E+00	1.55E-01	3.72E+00	6.58E-02	8.45E-02	1.95E+01	1.23E+01	2.04E+01	9.79E-01	3.50E-01	2.22E-01	4.98E-01	4.10E-01	1.92E+01	1.18E+01
2006	7	22	1.43E+00	4.04E-02	1.31E+00	1.81E-02	3.27E-02	2.84E+01	1.06E+01	3.44E+01	6.80E-01	2.00E-01	9.66E-02	3.28E-01	2.61E-01	2.43E+01	2.08E+00
2006	7	23	5.76E+00	6.31E-03	2.13E+00	1.29E-03	3.72E-03	1.31E+01	6.51E+00	2.30E+01	2.53E-01	6.20E-02	2.37E-02	1.13E-01	8.71E-02	2.07E+01	6.72E+00
2006	7	24	8.00E+00	1.79E-02	4.12E+00	4.49E-03	7.90E-03	1.48E+01	6.32E+00	2.30E+01	2.62E-01	5.65E-02	2.96E-02	1.12E-01	7.58E-02	1.91E+01	1.05E+01
2006	7	25	4.68E+00	7.00E-02	2.13E+00	3.03E-02	4.69E-02	1.49E+01	7.16E+00	1.52E+01	6.36E-01	2.20E-01	1.25E-01	3.32E-01	2.65E-01	1.28E+01	5.95E+00
2006	7	26	4.46E+00	1.94E-03	1.67E+00	5.13E-05	6.15E-04	1.43E+01	8.17E+00	2.02E+01	3.95E-01	7.40E-02	1.80E-02	1.56E-01	1.16E-01	1.75E+01	5.77E+00
2006	7	27	8.89E-01	9.34E-03	7.34E-01	3.30E-03	7.36E-03	1.48E+01	5.96E+00	2.12E+01	4.76E-01	7.68E-02	2.40E-02	1.89E-01	1.29E-01	1.53E+01	1.39E+00
2006	7	28	2.20E+00	2.65E-02	1.58E+00	9.37E-03	1.30E-02	1.88E+01	9.10E+00	2.70E+01	5.56E-01	1.39E-01	5.02E-02	2.64E-01	2.02E-01	1.97E+01	3.92E+00
2006	7	29	3.19E+00	2.01E-02	1.31E+00	5.56E-03	1.34E-02	1.50E+01	7.07E+00	1.68E+01	4.66E-01	1.33E-01	5.81E-02	2.33E-01	1.81E-01	1.79E+01	4.68E+00
2006	7	30	9.10E-01	1.73E-07	2.72E-01	0.00E+00	3.88E-05	8.50E+00	1.87E+00	8.87E+00	1.65E-01	1.84E-02	1.15E-03	4.41E-02	3.93E-02	7.63E+00	1.38E+00
2006	7	31	4.86E-01	3.15E-04	4.04E-01	7.53E-07	1.24E-04	8.50E+00	4.21E+00	1.78E+01	1.71E-01	2.71E-02	7.09E-03	4.71E-02	3.57E-02	9.24E+00	2.35E+00
2006	8	1	6.30E-01	2.32E-04	7.75E-01	5.88E-07	9.02E-05	1.88E+01	6.78E+00	2.37E+01	4.55E-01	6.57E-02	9.59E-03	1.70E-01	1.18E-01	1.76E+01	9.11E-01
2006	8	2	2.26E+00	6.06E-04	1.08E+00	4.92E-05	2.15E-04	1.81E+01	7.52E+00	2.23E+01	5.06E-01	7.80E-02	1.20E-02	2.05E-01	1.42E-01	1.97E+01	3.92E+00
2006	8	3	2.70E+00	8.03E-03	1.79E+00	2.47E-03	4.68E-03	2.05E+01	9.38E+00	2.51E+01	4.29E-01	8.76E-02	2.29E-02	2.69E-01	1.70E-01	2.74E+01	4.65E+00
2006	8	4	3.79E+00	4.58E-02	1.32E+00	1.58E-02	2.51E-02	1.36E+01	7.99E+00	1.09E+01	5.15E-01	1.55E-01	8.40E-02	2.75E-01	2.06E-01	8.88E+00	6.23E+00
2006	8	5	3.63E+00	1.78E-02	1.98E+00	4.43E-03	7.06E-03	1.44E+01	5.43E+00	1.84E+01	4.58E-01	1.02E-01	4.04E-02	1.90E-01	1.41E-01	1.56E+01	5.33E+00
2006	8	6	4.15E+00	3.60E-02	1.55E+00	1.27E-02	2.07E-02	2.27E+01	1.16E+01	3.01E+01	7.23E-01	1.84E-01	7.72E-02	4.16E-01	2.84E-01	2.31E+01	5.41E+00
2006	8	7	2.97E+00	2.33E-02	1.49E+00	1.45E-02	2.91E-02	2.49E+01	9.79E+00	2.64E+01	9.57E-01	2.80E-01	1.14E-01	5.05E-01	3.85E-01	2.68E+01	4.00E+00
2006	8	8	4.56E+00	1.44E-02	2.45E+00	7.87E-03	8.30E-03	2.19E+01	1.00E+01	2.73E+01	3.28E-01	7.46E-02	2.44E-02	2.08E-01	1.31E-01	2.92E+01	6.42E+00
2006	8	9	1.01E+00	3.78E-03	4.46E-01	5.70E-04	2.04E-03	8.84E+00	3.09E+00	1.06E+01	1.29E-01	3.44E-02	1.42E-02	1.18E-01	6.86E-02	7.62E+00	1.83E+00
2006	8	10	5.12E+00	3.83E-02	1.47E+00	1.98E-02	4.36E-02	1.00E+01	6.52E+00	1.90E+01	4.42E-01	1.20E-01	8.21E-02	1.67E-01	1.33E-01	1.74E+01	7.77E+00
2006	8	11	1.87E+00	1.62E-02	4.78E-01	6.64E-03	1.45E-02	7.24E+00	6.22E+00	1.08E+01	1.68E-01	5.84E-02	4.29E-02	1.05E-01	7.46E-02	9.08E+00	3.30E+00
2006	8	12	3.55E+00	3.40E-03	1.97E+00	1.05E-03	2.17E-03	2.05E+01	7.97E+00	2.17E+01	2.87E-01	5.12E-02	1.40E-02	1.84E-01	1.00E-01	2.68E+01	5.86E+00
2006	8	13	8.60E-01	3.07E-03	1.28E+00	5.11E-04	1.52E-03	2.67E+01	1.05E+01	3.94E+01	4.21E-01	7.05E-02	1.87E-02	1.75E-01	1.13E-01	2.75E+01	3.72E+00
2006	8	14	1.14E+00	1.56E-03	1.39E+00	1.60E-04	1.70E-03	2.44E+01	1.05E+01	3.21E+01	7.23E-01	1.37E-01	3.09E-02	3.28E-01	2.29E-01	2.40E+01	3.08E+00
2006	8	15	2.23E+00	1.53E-02	1.10E+00	6.50E-03	7.45E-03	1.36E+01	5.08E+00	1.86E+01	3.39E-01	7.20E-02	2.30E-02	2.04E-01	1.26E-01	2.07E+01	3.21E+00
2006	8	16	6.47E+00	9.74E-04	2.60E+00	1.55E-06	2.07E-05	9.64E+00	5.96E-01	1.28E+01	1.57E-02	2.82E-03	1.19E-03	4.06E-03	3.22E-03	1.76E+01	8.03E+00
2006	8	17	5.85E+00	1.99E-02	1.92E+00	6.84E-03	1.42E-02	2.31E+01	1.35E+01	2.97E+01	8.74E-01	1.97E-01	7.08E-02	4.27E-01	2.91E-01	2.68E+01	9.65E+00
2006	8	18	1.26E+00	1.81E-03	1.09E+00	2.23E-04	2.15E-03	2.40E+01	9.27E+00	2.91E+01	7.65E-01	1.31E-01	2.96E-02	2.69E-01	2.11E-01	2.20E+01	2.76E+00
2006	8	19	1.68E+00	2.00E-03	1.43E+00	2.64E-04	1.34E-03	2.15E+01	8.29E+00	2.34E+01	3.09E-01	5.75E-02	1.45E-02	2.07E-01	1.16E-01	3.26E+01	2.15E+00
2006	8	20	1.44E+01	1.70E-02	6.34E+00	2.49E-03	5.04E-03	2.12E+01	5.14E+00	2.14E+01	4.92E-01	8.70E-02	3.48E-02	1.79E-01	1.21E-01	2.93E+01	1.79E+01
2006	8	21	3.01E+00	5.59E-02	1.41E+00	2.14E-02	3.76E-02	3.12E+01	1.09E+01	2.94E+01	1.02E+00	3.16E-01	1.49E-01	5.44E-01	4.19E-01	2.63E+01	5.78E+00
2006	8	22	3.66E+00	1.70E-02	2.08E+00	1.20E-02	2.24E-02	2.32E+01	9.32E+00	2.76E+01	7.44E-01	1.80E-01	7.33E-02	3.38E-01	2.51E-01	2.82E+01	4.49E+00
2006	8	23	3.92E+00	8.79E-03	1.55E+00	1.69E-03	6.51E-03	1.71E+01	7.62E+00	1.77E+01	4.87E-01	1.27E-01	4.34E-02	2.33E-01	1.82E-01	1.71E+01	4.82E+00
2006	8	24	5.06E+00	1.95E-03	2.74E+00	3.35E-04	6.81E-04	1.98E+01	6.63E+00	2.74E+01	2.81E-01	2.58E-02	6.16E-03	1.15E-01	5.50E-02	2.20E+01	6.66E+00
2006	8	25	8.55E+00	3.77E-02	2.86E+00	8.26E-03	1.38E-02	1.26E+01	4.25E+00	1.38E+01	4.68E-01	1.29E-01	6.67E-02	2.16E-01	1.66E-01	1.61E+01	9.96E+00
2006	8	26	1.85E+00	1.38E-02	1.23E+00	7.02E-03	1.22E-02	2.62E+01	1.12E+01	3.40E+01	6.77E-01	1.52E-01	5.13E-02	3.24E-01	2.31E-01	2.92E+01	2.27E+00
2006	8	27	4.99E+00	4.62E-02	1.97E+00	1.40E-02	2.23E-02	2.64E+01	9.79E+00	3.42E+01	8.30E-01	2.15E-01	9.75E-02	4.37E-01	3.08E-01	2.48E+01	7.09E+00
2006	8	28	4.26E+00	6.53E-02	1.67E+00	2.93E-02	3.82E-02	2.01E+01	9.05E+00	2.70E+01	1.11E+00	3.07E-01	1.53E-01	4.35E-01	3.60E-01	1.80E+01	6.63E+00
2006	8	29	4.16E+00	1.41E-02	1.15E+00	1.34E-02	2.70E-02	1.42E+01	4.70E+00	1.71E+01	5.06E-01	1.61E-01	7.04E-02	2.82E-01	2.35E-01	1.22E+01	6.44E+00
2006	8	30	1.44E+00	7.13E-07	1.79E-01	1.95E-05	9.64E-04	6.16E+00	1.34E+00	5.28E+00	6.90E-02	7.70E-03	3.23E-03	2.33E-02	9.84E-03	4.81E+00	1.89E+00
2006	8	31	4.23E+00	3.30E-03	2.20E+00	2.60E-04	1.09E-03	2.02E+01	1.17E+01	2.54E+01	3.40E-01	6.11E-02	1.69E-02	1.35E-01	9.15E-02	2.38E+01	6.99E+00
2006	9	1	5.18E+00	3.64E-02	2.92E+00	5.73E-03	1.05E-02	2.68E+01	1.19E+01	3.33E+01	7.54E-01	1.93E-01	8.03E-02	3.96E-01	2.80E-01	2.83E+01	7.92E+00
2006	9	2	4.51E+00	6.11E-02	2.09E+00	3.14E-02	4.90E-02	2.77E+01	1.43E+01	2.70E+01	9.36E-01	2.58E-01	1.28E-01	4.82E-01	3.54E-01	2.96E+01	6.82E+00
2006	9	3	7.24E+00	5.41E-03	2.88E+00	2.18E-03	3.63E-03	2.45E+01	9.92E+00	2.79E+01	3.61E-01	6.49E-02	1.69E-02	2.71E-01	1.43E-01	3.45E+01	8.78E+00
2006	9	4	6.60E+00	3.36E-02	2.95E+00	8.75E-03	1.78E-02	2.38E+01	1.12E+01	4.14E+01	7.22E-01	1.84E-01	7.95E-02	3.66E-01	2.61E-01	3.43E+01	8.95E+00
2006	9	5	5.31E+00	4.11E-02	3.10E+00	8.61E-03	1.85E-02	2.70E+01	1.26E+01	3.07E+01	8.64E-01	2.09E-01	8.97E-02	4.77E-01	3.17E-01	3.03E+01	9.53E+00
2006	9	6	9.66E+00	7.15E-03	4.68E+00	1.61E-03	3.61E-03	2.53E+01	6.76E+00	2.69E+01	4.63E-01	6.26E-02	1.87E-02	1.58E-01	9.97E-02	3.43E+01	1.23E+01
2006	9	7	1.18E+01	5.84E-03	6.18E+00	7.10E-04	2.27E-03	2.09E+01	4.45E+00	2.51E+01	4.09E-01	5.50E-02	1.89E-02	1.44E-01	8.96E-02	2.79E+01	1.52E+01
2006	9	8	1.25E+01	4.76E-02	6.82E+00	1.53E-02	2.61E-02	2.86E+01	1.02E+01	3.37E+01	7.75E-01	1.90E-01	9.44E-02	3.38E-01	2.50E-01	4.04E+01	1.63E+01
2006	9	9	2.65E+00	1.97E-02	1.09E+00	9.42E-03	1.99E-02	1.76E+01	8.36E+00	2.11E+01	3.29E-01	1.20E-01	5.22E-02	3.05E-01	1.86E-01	1.86E+01	3.36E+00
2006	9	10	3.82E+00	8.82E-04	1.48E+00	2.20E-05	6.78E-05	1.17E+01	8.70E+00	1.94E+01	4.62E-01	5.95E-02	8.76E-03	1.57E-01	9.98E-02	1.35E+01	5.64E+00
2006	9	11	1.96E+00	7.97E-03	2.14E+00	1.20E-03	3.27E-03	2.71E+01	1.36E+01	3.72E+01	7.44E-01	1.42E-01	4.12E-02	3.06E-01	2.18E-01	2.68E+01	3.08E+00
2006	9	12	5.78E+00	8.61E-02	1.76E+00	1.39E-02	1.70E-02	1.85E+01	1.10E+01	2.80E+01	9.16E-01	1.60E-01	9.06E-02	2.88E-01	1.93E-01	2.71E+01	9.71E+00
2006	9	13	8.35E+00	4.43E-02	3.03E+00	2.75E-02	4.77E-02	1.30E+01	7.45E+00	2.08E+01	5.74E-01	1.60E-01	1.06E-01	2.16E-01	1.80E-01	2.24E+01	1.19E+01
2006	9	14	1.55E+01	1.38E-02	8.22E+00	2.89E-03	6.92E-03	2.41E+01	7.69E+00	2.47E+01	3.78E-01	8.44E-02	3.70E-02	1.33E-01	1.03E-01	2.71E+01	1.78E+01
2006	9	15	1.20E+01	8.28E-02	8.57E+00	2.02E-02	3.24E-02	1.86E+01	9.62E+00	2.91E+01	7.34E-01	2.00E-01	1.20E-01	2.41E-01	2.17E-01	2.79E+01	1.50E+01
2006	9	16	7.89E+00	1.39E-02	4.45E+00	3.58E-03	7.56E-03	9.39E+00	3.44E+00	1.84E+01	1.87E-01	7.56E-02	3.79E-02	1.00E-01	8.46E-02	1.97E+01	9.62E+00
2006	9	17	1.32E+01	5.14E-02	6.22E+00	1.31E-02	2.05E-02	2.19E+01	8.80E+00	2.69E+01	5.81E-01	1.47E-01	7.82E-02	2.61E-01	1.89E-01	2.40E+01	1.75E+01
2006	9	18	8.81E+00	1.26E-01	4.01E+00	4.24E-02	6.60E-02	2.48E+01	1.52E+01	2.77E+01	1.14E+00	3.56E-01	2.07E-01	5.97E-01	4.51E-01	2.39E+01	1.22E+01

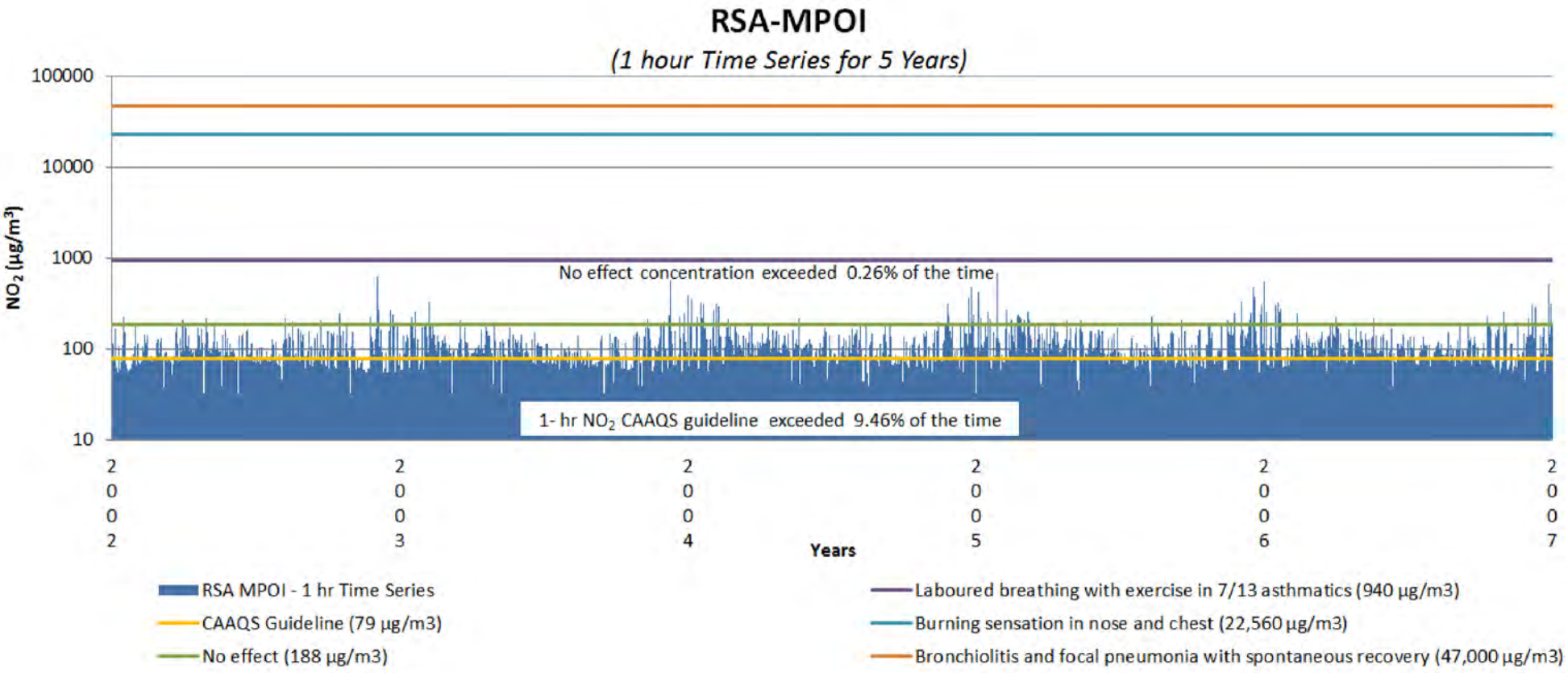
Year	Month	Day	Project R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	6	29	3.93E-02	1.86E-01	4.21E-03	2.20E-02	2.87E-02	2.03E-02	3.16E-03	6.90E-02	7.61E-01	4.41E+00	3.79E-01	2.52E-01	5.81E-01	1.01E-02	1.33E-01
2006	6	30	2.24E-03	4.50E-02	5.87E-04	1.71E-02	2.57E-02	1.44E-03	3.40E-02	1.30E+00	4.10E-03	7.48E+00	2.74E-01	6.80E-01	8.33E-01	5.98E-02	7.45E-03
2006	7	1	1.88E-02	8.14E-01	6.50E-04	1.38E-01	2.22E-01	2.14E-03	8.23E-02	1.04E+00	6.23E-02	1.52E+01	2.22E+00	1.82E+00	2.72E+00	1.13E-01	4.85E-02
2006	7	2	7.12E-02	6.47E-02	9.81E-02	2.57E-03	5.79E-03	1.32E-01	1.17E-01	9.23E-01	2.58E+00	1.44E+01	1.80E-01	1.23E+00	1.98E+00	9.65E-02	1.04E-01
2006	7	3	2.49E-01	1.42E+00	2.28E-01	8.16E-02	9.22E-02	2.39E-01	8.48E-02	5.53E-01	3.97E+00	2.38E+00	3.05E+00	5.19E-01	7.96E-01	1.80E-01	3.96E-01
2006	7	4	4.73E-02	4.24E-01	6.82E-03	9.51E-02	1.14E-01	1.38E-02	5.22E-02	7.27E-01	3.33E-01	1.91E+01	1.05E+00	1.61E+00	3.10E+00	1.44E-01	9.77E-02
2006	7	5	4.80E-02	1.04E+00	2.64E-03	2.90E-01	5.37E-01	8.19E-03	7.22E-02	6.70E-01	3.78E-01	1.54E+01	7.88E+00	1.08E+00	1.01E+00	1.16E-01	9.98E-02
2006	7	6	1.35E-02	2.21E-05	1.53E-03	1.81E-05	2.14E-02	8.89E-03	3.54E-02	3.01E-01	1.19E-02	9.79E+00	9.52E-01	7.92E-01	1.29E+00	2.04E-02	5.71E-02
2006	7	7	1.29E-02	0.00E+00	4.28E-04	0.00E+00	0.00E+00	3.41E-03	2.60E-02	6.84E-01	2.58E-03	4.89E+00	1.09E-01	5.31E-01	6.94E-01	1.94E-02	6.61E-02
2006	7	8	7.79E-02	4.48E-01	1.15E-03	2.60E-01	2.48E-01	4.75E-03	2.86E-02	4.43E-01	1.22E-01	8.27E+00	7.98E+00	4.92E-01	9.67E-01	5.20E-02	2.08E-01
2006	7	9	6.93E-03	1.44E-02	2.60E-04	4.09E-02	3.49E-01	5.04E-04	5.27E-02	1.07E+00	1.26E-02	1.24E+01	2.94E+00	8.52E-01	1.60E+00	1.32E-01	1.95E-02
2006	7	10	9.02E-02	7.64E-04	1.61E-04	9.05E-02	2.86E-01	8.46E-04	4.47E-02	1.16E+00	3.50E-02	4.58E+00	1.76E+00	2.97E-01	1.12E+00	1.31E-01	1.91E-01
2006	7	11	3.74E-02	1.12E-04	7.35E-04	1.05E-04	1.52E-01	1.33E-03	4.18E-02	1.05E+00	7.30E-03	7.29E+00	2.03E+00	2.01E-01	1.37E+00	9.52E-02	9.08E-02
2006	7	12	2.89E-04	0.00E+00	0.00E+00	0.00E+00	4.53E-03	0.00E+00	4.98E-02	5.84E-01	4.81E-05	5.91E+00	3.22E-01	6.24E-01	9.07E-01	2.63E-02	1.01E-03
2006	7	13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.86E-03	1.50E-01	1.08E-14	2.06E+00	1.83E-01	3.83E-01	4.21E-01	2.08E-04	0.00E+00
2006	7	14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-09	0.00E+00	3.96E-03	1.99E-01	8.62E-18	2.34E+00	1.79E-01	2.38E-01	5.82E-01	0.00E+00	0.00E+00
2006	7	15	7.50E-02	0.00E+00	2.99E-05	0.00E+00	0.00E+00	4.25E-05	1.79E-02	3.49E-01	4.79E-03	5.00E+00	1.45E-01	6.20E-01	6.64E-01	2.06E-03	1.44E-01
2006	7	16	1.05E-01	2.30E-01	5.22E-02	4.89E-02	5.64E-02	1.18E-01	1.30E-01	5.38E-01	5.70E-01	1.05E+01	4.25E-01	1.64E+00	1.58E+00	1.54E-01	2.15E-01
2006	7	17	2.30E-02	9.95E-02	3.56E-04	4.59E-02	1.09E-01	7.15E-04	6.00E-02	1.20E+00	3.79E-02	7.73E+00	1.49E+00	7.24E-01	1.27E+00	1.35E-01	6.52E-02
2006	7	18	1.11E-01	7.93E-02	6.83E-02	1.80E-02	3.09E-02	8.52E-02	2.49E-01	7.57E-01	1.41E+00	1.34E+01	7.15E-01	2.19E+00	3.41E+00	2.33E-01	1.35E-01
2006	7	19	4.14E-02	1.62E-02	1.15E-01	1.01E-04	1.10E-03	9.89E-02	6.15E-02	2.94E-01	3.57E+00	3.91E+00	4.85E-02	6.91E-01	8.26E-01	4.65E-02	5.05E-02
2006	7	20	1.76E-01	1.18E+00	1.35E-02	1.32E-01	1.63E-01	2.38E-02	9.45E-01	1.05E+00	3.47E-01	9.60E+00	2.74E+00	4.13E+00	4.50E+00	4.07E-01	2.28E-01
2006	7	21	2.54E-01	2.32E+00	3.54E-02	2.67E-01	3.60E-01	5.78E-02	4.02E-02	3.63E-01	2.48E+00	8.67E+00	9.20E+00	7.08E-01	1.45E+00	6.15E-02	4.84E-01
2006	7	22	1.73E-02	2.37E-01	1.08E-03	1.50E-01	3.72E-01	2.97E-03	5.73E-02	1.36E+00	3.81E-02	2.46E+01	2.91E+00	1.69E+00	3.19E+00	1.58E-01	4.60E-02
2006	7	23	6.76E-02	1.14E-02	1.36E-02	3.88E-03	4.47E-02	2.68E-02	1.25E-01	9.37E-01	1.87E+00	2.16E+01	1.53E+00	2.26E+00	4.51E+00	1.17E-01	1.30E-01
2006	7	24	9.70E-02	1.84E-01	4.80E-02	2.80E-02	5.64E-02	9.18E-02	9.22E-02	4.91E-01	1.60E+00	1.12E+01	8.08E-01	1.19E+00	1.55E+00	6.84E-02	1.97E-01
2006	7	25	2.01E-02	9.53E-01	9.88E-03	1.52E-01	2.98E-01	2.08E-02	3.57E-02	6.29E-01	3.22E-01	6.86E+00	6.06E+00	5.44E-01	6.75E-01	6.96E-02	3.80E-02
2006	7	26	2.17E-02	3.30E-05	7.73E-03	2.87E-06	1.49E-05	3.48E-02	5.73E-02	7.51E-01	6.99E-02	1.54E+01	3.68E-02	1.32E+00	1.74E+00	6.35E-02	6.80E-02
2006	7	27	1.02E-02	9.39E-02	5.57E-03	2.83E-02	1.29E-01	8.53E-03	8.19E-02	1.14E+00	9.99E-02	9.82E+00	1.99E+00	1.24E+00	1.22E+00	9.68E-02	1.49E-02
2006	7	28	3.87E-02	5.09E-03	4.24E-04	2.22E-01	2.56E-01	2.85E-03	6.97E-02	1.36E+00	2.95E-02	9.86E+00	1.97E+00	9.18E-01	1.57E+00	8.84E-02	9.80E-02
2006	7	29	1.88E-02	3.60E-02	6.60E-03	1.57E-02	6.71E-02	1.79E-02	5.13E-02	9.42E-01	3.22E-01	5.75E+00	1.72E+00	6.82E-01	1.30E+00	9.03E-02	3.35E-02
2006	7	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.34E-05	0.00E+00	1.88E-02	6.67E-01	1.18E-16	2.40E+00	2.04E-01	3.09E-01	6.07E-01	2.80E-02	0.00E+00
2006	7	31	8.57E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E-02	4.44E-01	3.80E-04	8.96E+00	3.85E-02	6.53E-01	9.48E-01	9.30E-02	2.36E-02
2006	8	1	2.65E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.19E-02	1.42E+00	0.00E+00	1.24E+01	6.75E-02	1.30E+00	1.27E+00	1.13E-01	3.12E-02
2006	8	2	1.88E-02	0.00E+00	3.75E-04	0.00E+00	0.00E+00	8.22E-03	7.71E-02	1.34E+00	1.77E-02	1.36E+01	8.21E-02	1.40E+00	1.16E+00	5.47E-02	7.28E-02
2006	8	3	3.87E-01	2.60E-02	1.04E-01	3.42E-02	8.30E-02	1.32E-01	6.77E-01	1.57E+00	6.26E-01	1.49E+01	5.52E-01	2.13E+00	2.41E+00	6.46E-01	5.46E-01
2006	8	4	3.61E-02	7.75E-01	2.51E-02	4.12E-01	8.25E-01	3.28E-02	3.06E-02	2.75E-01	1.11E+00	6.99E+00	8.54E+00	5.22E-01	9.62E-01	4.88E-02	6.96E-02
2006	8	5	1.88E-01	1.27E+00	1.57E-01	2.42E-01	3.62E-01	1.90E-01	1.51E-01	8.05E-01	1.07E+00	1.03E+01	5.28E+00	9.55E-01	2.02E+00	1.61E-01	2.56E-01
2006	8	6	7.42E-02	1.36E+00	2.14E-02	2.59E-01	3.12E-01	3.49E-02	1.36E-01	1.52E+00	3.98E-01	1.83E+01	8.58E+00	2.22E+00	3.21E+00	1.38E-01	1.45E-01
2006	8	7	1.83E-02	3.55E-02	5.10E-04	3.68E-01	6.59E-01	2.42E-03	5.95E-02	1.32E+00	4.45E-02	1.70E+01	7.48E+00	1.08E+00	1.37E+00	1.11E-01	3.85E-02
2006	8	8	4.38E-01	9.66E-01	1.22E-01	1.64E-01	2.49E-01	1.64E-01	4.06E-01	1.86E+00	8.08E-01	1.93E+01	2.84E+00	2.91E+00	3.38E+00	4.64E-01	5.98E-01
2006	8	9	1.05E-03	4.76E-03	1.94E-04	1.91E-06	5.44E-03	9.87E-04	3.57E-02	6.43E-01	6.35E-02	9.44E+00	9.79E-01	7.07E-01	1.51E+00	1.77E-02	1.84E-03
2006	8	10	3.39E-02	6.19E-01	4.71E-03	2.02E-01	3.94E-01	2.39E-02	1.51E-02	2.51E-01	4.83E-01	7.42E+00	7.66E+00	1.74E-01	7.03E-01	7.58E-02	5.19E-02
2006	8	11	2.53E-02	2.18E-02	5.09E-03	2.41E-02	8.36E-02	8.55E-03	2.11E-01	5.45E-01	1.48E-01	8.94E+00	2.62E+00	1.80E+00	1.65E+00	1.37E-01	3.85E-02
2006	8	12	1.11E+00	9.34E-02	1.33E-01	1.02E-01	1.89E-01	2.75E-01	6.74E-01	1.90E+00	1.68E+00	1.90E+01	1.60E+00	2.72E+00	3.13E+00	9.66E-01	1.36E+00
2006	8	13	9.17E-03	0.00E+00	3.74E-06	0.00E+00	0.00E+00	4.61E-05	7.60E-02	1.61E+00	1.19E-04	1.97E+01	4.72E-02	1.96E+00	3.86E+00	2.09E-01	3.02E-02
2006	8	14	1.51E-03	0.00E+00	0.00E+00	0.00E+00	1.38E-05	0.00E+00	8.65E-02	1.65E+00	1.01E-05	1.79E+01	1.27E-01	1.50E+00	2.32E+00	1.11E-01	8.34E-03
2006	8	15	1.22E-02	3.54E-01	3.01E-03	1.28E-01	1.02E-01	8.65E-03	6.19E-02	9.03E-01	4.95E-01	6.41E+00	9.04E-01	6.38E-01	1.02E+00	6.90E-02	2.90E-02
2006	8	16	1.54E-01	2.65E-04	2.12E-01	2.05E-07	2.28E-07	1.63E-01	9.61E-04	2.34E-01	5.60E+00	3.51E-03	4.22E-05	2.27E-03	9.30E-04	1.00E-01	2.05E-01
2006	8	17	2.05E+00	6.03E-01	8.95E-01	9.31E-02	1.53E-01	1.39E+00	8.86E-01	2.62E+00	4.87E+00	1.12E+01	3.75E+00	2.51E+00	2.47E+00	1.78E+00	2.23E+00
2006	8	18	3.22E-04	0.00E+00	9.98E-08	0.00E+00	6.12E-07	3.04E-07	8.70E-02	1.76E+00	2.12E-06	1.02E+01	4.77E-02	1.24E+00	2.05E+00	6.71E-02	2.96E-03
2006	8	19	7.08E-02	0.00E+00	4.18E-06	0.00E+00	8.58E-07	9.63E-05	9.50E-02	1.41E+00	3.92E-01	1.35E+01	1.32E-01	1.35E+00	1.26E+00	1.56E-01	1.48E-01
2006	8	20	2.86E-01	7.55E-01	1.80E-01	2.54E-02	3.44E-02	1.33E-01	6.52E-03	2.87E-01	5.02E+00	1.34E+00	1.71E+00	1.27E-01	2.31E-01	9.16E-02	5.74E-01
2006	8	21	1.14E-02	3.32E-01	3.30E-03	3.82E-01	4.02E-01	5.60E-03	7.10E-02	1.63E+00	6.17E-02	1.62E+01	1.06E+01	1.15E+00	2.31E+00	1.33E-01	2.29E-02
2006	8	22	7.96E-02	6.03E-02	1.27E-02	2.03E-01	2.48E-01	3.76E-02	7.72E-02	1.14E+00	1.42E-02	2.03E+01	2.57E+00	1.48E+00	1.31E+00	1.20E-01	1.99E-01
2006	8	23	3.87E-02	3.02E-04	5.10E-03	9.30E-05	5.89E-04	2.14E-02	5.61E-02	8.50E-01	5.29E-01	1.04E+01	2.80E-01	8.09E-01	1.37E+00	4.76E-02	1.09E-01
2006	8	24	3.47E-02	4.55E-02	8.41E-02	1.27E-02	3.26E-02	7.05E-02	1.02E-01	1.12E+00	2.04E+00	1.59E+01	7.61E-01	1.62E+00	2.56E+00	1.26E-01	7.77E-02
2006	8	25	2.33E-01	7.98E-01	3.34E-01	1.12E-01	3.93E-02	3.02E-01	1.07E-03	9.94E-02	3.28E+00	2.81E-01	6.47E+00	5.60E-03	4.94E-03	4.02E-02	3.71E-01
2006	8	26	6.33E-03	6.52E-04	4.80E-04	3.93E-02	7.12E-02	1.23E-03	9.48E-02	1.88E+00	4.03E-03	1.61E+01	3.05E-01	1.78E+00	1.32E+00	1.55E-01	2.06E-02
2006	8	27	6.61E-01	1.23E+00	2.51E-01	1.11E-01	1.38E-01	4.36E-01	7.80E-01	1.81E+00	2.21E+00	1.16E+01	3.34E+00	2.27E+00	2.65E+00	7.51E-01	7.83E-01
2006	8	28	7.23E-03	7.04E-01	8.38E-05	1.70E-01	1.49E-01	7.18E-04	5.58E-02	1.15E+00	2.16E-02	9.09E+00	7.39E+00	7.23E-01	1.72E+00	9.08E-02	2.35E-02
2006	8	29	5.28E-02	1.18E-04	1.82E-03	7.73E-02	5.13E-01	6.85E-03	2.08E-02	1.02E+00	5.67E-03	3.83E+00	4.25E+00	4.04E-02	5.59E-01	6.92E-02	1.36E-01
2006	8	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-02	0.00E+00	1.32E-02	3.69E-01	3.15E-18	2.74E+00	4.21E-01	3.44E-01	5.24E-01	1.44E-02	0.00E+00
2006	8	31	2.89E-02	2.81E-05	1.02E-02	7.82E-07	1.01E-04	3.33E-02	9.33E-02	8.68E-01	2.17E-01	2.59E+01	9.24E-02	2.40E+00	3.81E+00	5.98E-02	8.68E-02
2006	9	1	2.61E-02	6.64E-01	1.38E-03	3.58E-02	6.35E-02	4.84E-03	6.75E-02	1.20E+00	9.58E-02	1.91E+01	3.88E+00	1.41E+00	2.41E+00	1.40E-01	9.66E-02
2006	9	2	4.20E-02	9.66E-01	2.14E-03	3.06E-01	4.81E-01	5.93E-03	7.98E-02	1.53E+00	2.07E-01	1.95E+01	5.07E+00	1.50E+00	2.12E+00	1.15E-01	9.86E-02
2006	9	3	3.51E-01	3.86E-03	3.12E-01	1.07E-03	1.89E-03	3.67E-01	3.87E-01	2.04E+00	2.34E+00	8.70E+00	2.85E-02	1.79E+00	1.27E+00	6.45E-01	5.30E-01
2006	9	4	8.03E-01	9.25E-02	7.88E-01	5.20E-03	9.26E-03	8.02E-01	5.62E-01	1.96E+00	9.48E+00	8.03E-01	1.97E-01	1.66E+00	1.06E+00	7.76E-01	9.06E-01
2006	9	5	9.42E-01	5.92E-01	9.58E-01	1.28E-02	1.88E-02	1.13E+00	5.19E-01	1.82E+00	6.73E+00	3.26E+00	2.14E+00	1.60E+00	1.56E+00	7.26E-01	9.96E-01
2006	9	6	9.28E-01	9.50E-02	4.76E-01	6.56E-03	1.29E-02	5.74E-01	4.36E-01	1.60E+00	4.64E+00	2.91E+00	2.49E-01	9.93E-01	1.06E+00	7.66E-01	1.27E+00
2006	9	7	9.51E-01	2.12E-03	2.16E-01	7.35E-06	4.75E-05	3.67E-01	1.61E-01	1.08E+00	5.75E+00	1.98E+00	3.35E-02	6.24E-01	7.04E-01	6.04E-01	1.13E+00
2006	9	8	3.23E-01	5.07E-01	7.56E-02	2.57E-01	4.36E-01	7.90E-02	1.28E-01	9.53E-01	4.67E+00	1.14E+01	2.85E+00	1.40E+00	2.07E+00	1.53E-01	6.07E-01
2006	9	9	1.68E-02	3.47E-01	3.26E-03	6.89E-02	1.90E-01	1.64E-03	6.81E-02	1.39E+00	1.46E-01	9.39E+00	2.32E+00	8.29E-01	1.81E+00	1.09E-01	2.66E-02
2006	9	10	6.99E-03	1.09E-04	7.08E-03	3.31E-06	1.10E-05	2.62E-02	4.23E-02	8.41E-01	5.73E-02	1.41E+01	1.58E-02	1.41E+00	1.09E+00	1.27E-02	1.43E-02
2006	9	11	3.43E-02	9.73E-04	4.97E-03	8.76E-03	5.18E-02	1.97E-02	1.83E-01	1.64E+00	3.25E-02	2.57E+01	4.32E-01	3.11E+00	3.69E+00	1.55E-01	9.64E-02
2006	9	12	8.54E-01	1.37E+00	2.24E-01	2.81E-02	3.84E-02	3.37E-01	3.75E-01	1.75E+00	1.50E+00	7.70E+00	3.83E+00	1.17E+00	1.41E+00	7.24E-01	9.16E-01
2006	9	13	2.09E-01	4.79E-02	2.39E-01	9.59E-02	3.70E-01	3.02E-01	1.08E-01	5.61E-01	5.06E+00	8.89E+00	4.73E+00	1.07E+00	1.88E+00	1.76E-01	2.66E-01
2006	9	14	3.61E-01	1.05E-01	1.03E-01	2.68E-02	9.40E-02	9.01E-02	1.59E-02	3.79E-01	3.59E+00	1.02E+01	1.05E+00	3.99E-01	1.03E+00	5.24E-02	6.77E-01
2006	9	15	6.75E-01	2.11E-02	1.30E+00	1.52E-03	2.01E-02	8.15E-01	1.32E+00	1.01E+00	8.84E+00	1.08E+01	8.40E-01	3.85E+00	4.18E+00	7.67E-01	8.11E-01
2006	9	16	3.13E-01	1.46E+00	2.44E+00	1.33E-01	1.98E-01	1.83E+00	3.72E-01	4.16E-01	1.11E+01	1.09E+01	1.51E+00	2.30E+00	4.25E+00	3.09E-01	3.64E-01
2006	9	17	2.03E-01	2.30E+00	1.74E-01	4.39E-01	5.86E-01	2.44E-01	1.72E-01	4.30E-01	2.62E+00	1.55E+01	8.70E+00	1.83E+00	4.05E+00	1.84E-01	3.50E-01
2006	9	18	1.38E-01	1.52E+00	1.20E-02	4.78E-01	7.01E-01	2.62E-02	6.70E-02	1.29E+00	6.25E-01	1.42E+01	1.06E+01	1.34E+00	1.79E+00	5.94E-02	2.85E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application															Baseline															Project														
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	9	19	9.03E+00	1.05E+00	4.33E+00	1.79E-01	2.44E-01	1.78E+01	9.75E+00	2.04E+01	4.47E+00	1.69E+01	3.64E+00	3.59E+00	4.91E+00	2.50E+01	1.08E+01	8.87E+00	6.98E-02	3.90E+00	3.34E-02	4.49E-02	1.75E+01	9.58E+00	1.95E+01	4.30E-01	1.54E-01	9.74E-02	2.68E-01	1.95E-01	2.49E+01	1.05E+01	1.62E-01	9.76E-01	4.22E-01	1.46E-01	1.99E-01	3.29E-01	1.67E-01	9.23E-01	4.04E+00	1.68E+01	3.54E+00	3.32E+00	4.72E+00	8.97E-02	3.34E-01
2006	9	20	6.44E+00	8.38E-01	3.10E+00	1.46E-01	2.45E-01	1.18E+01	3.98E+00	1.44E+01	2.49E+00	3.50E+00	3.19E+00	3.78E-01	4.88E-01	1.54E+01	9.05E+00	6.31E+00	1.18E-02	3.07E+00	2.96E-03	4.69E-03	1.18E+01	3.96E+00	1.41E+01	1.71E-01	4.41E-02	2.12E-02	9.08E-02	6.17E-02	1.53E+01	8.80E+00	1.30E-01	8.26E-01	3.53E-02	1.43E-01	2.41E-01	4.47E-02	1.24E-02	3.10E-01	2.32E+00	3.45E+00	3.17E+00	2.87E-01	4.26E-01	3.01E-02	2.50E-01
2006	9	21	8.10E+00	1.04E-04	2.76E+00	9.31E-07	6.43E-06	1.05E+01	2.14E+00	1.05E+01	9.57E-01	4.89E+00	1.53E-02	1.52E+00	1.74E+00	1.02E+01	8.01E+00	6.84E+00	1.43E-05	2.74E+00	1.54E-08	3.47E-07	1.04E+01	1.86E+00	9.94E+00	1.16E-02	5.20E-04	9.22E-05	4.43E-03	1.38E-03	9.87E+00	6.49E+00	1.26E+00	8.99E-05	2.38E-02	9.15E-07	6.08E-06	6.16E-02	2.79E-01	5.87E-01	9.46E-01	4.89E+00	1.52E-02	1.52E+00	1.74E+00	2.97E-01	1.53E+00
2006	9	22	1.30E+01	4.91E-03	4.87E+00	9.17E-04	2.17E-03	2.39E+01	3.97E+00	2.68E+01	3.36E+00	3.13E+00	1.66E-02	8.43E-01	7.86E-01	2.19E+01	1.60E+01	1.07E+01	4.90E-03	4.64E+00	9.16E-04	2.16E-03	2.34E+01	3.79E+00	2.47E+01	2.11E-01	3.86E-02	1.59E-02	8.23E-02	5.44E-02	2.04E+01	1.32E+01	2.27E+00	9.39E-06	2.32E-01	4.18E-07	7.65E-06	4.73E-01	1.73E-01	2.05E+00	3.15E+00	3.09E+00	6.85E-04	7.61E-01	7.32E-01	1.46E+00	2.82E+00
2006	9	23	5.21E+00	2.70E-03	2.63E+00	9.73E-04	6.10E-03	2.35E+01	1.47E+01	2.53E+01	3.43E-01	3.39E+01	3.88E-02	2.99E+00	4.86E+00	3.42E+01	7.30E+00	5.17E+00	2.70E-03	2.62E+00	9.70E-04	2.64E-03	2.35E+01	1.46E+01	2.40E+01	2.51E-01	4.49E-02	1.27E-02	1.59E-01	8.95E-02	3.41E+01	7.20E+00	4.49E-02	8.17E-06	1.02E-02	3.25E-06	3.46E-03	3.31E-02	1.58E-01	1.30E+00	9.23E-02	3.38E+01	2.61E-02	2.83E+00	4.77E+00	1.66E-01	1.04E-01
2006	9	24	2.13E+00	8.74E-04	1.54E+00	5.04E-05	2.29E-04	1.91E+01	1.21E+01	3.04E+01	2.35E-01	2.13E+01	8.89E-03	3.37E+00	4.52E+00	2.27E+01	2.73E+00	2.10E+00	8.24E-04	1.53E+00	4.75E-05	2.15E-04	1.91E+01	1.19E+01	2.85E+01	2.29E-01	3.07E-02	5.14E-03	1.14E-01	6.14E-02	2.26E+01	2.65E+00	3.50E-02	4.99E-05	8.90E-03	2.92E-06	1.39E-05	2.50E-02	1.46E-01	1.83E+00	5.86E-03	2.13E+01	3.75E-03	3.26E+00	4.45E+00	1.01E-01	8.01E-02
2006	9	25	2.79E+00	3.82E-04	1.46E+00	3.76E-06	1.15E-04	1.68E+01	7.33E+00	2.19E+01	4.38E-01	1.29E+01	8.72E-02	1.69E+00	6.81E-01	1.98E+01	3.74E+00	2.76E+00	3.82E-04	1.46E+00	3.76E-06	1.15E-04	1.68E+01	7.25E+00	2.08E+01	4.38E-01	4.43E-02	5.81E-03	1.49E-01	9.40E-02	1.97E+01	3.63E+00	3.38E-02	0.00E+00	5.34E-04	0.00E+00	0.00E+00	5.07E-03	8.04E-02	1.13E+00	4.63E-04	1.29E+01	8.13E-02	1.54E+00	5.87E-01	5.93E-02	1.08E-01
2006	9	26	8.59E+00	4.83E-02	5.16E+00	9.35E-03	4.77E-02	1.52E+01	7.46E+00	2.28E+01	3.72E+00	1.73E+01	1.53E+00	1.40E+00	2.04E+00	2.41E+01	1.12E+01	8.53E+00	8.73E-03	4.93E+00	1.66E-03	3.49E-03	1.51E+01	7.39E+00	2.24E+01	4.77E-01	7.90E-02	2.61E-02	1.53E-01	1.14E-01	2.40E+01	1.11E+01	5.51E-02	3.96E-02	2.38E-01	7.69E-03	4.42E-02	1.53E-01	6.76E-02	3.67E-01	3.24E+00	1.72E+01	1.50E+00	1.25E+00	1.93E+00	7.18E-02	8.48E-02
2006	9	27	1.05E+01	4.53E-01	4.77E+00	1.58E-01	1.57E-01	1.76E+01	4.45E+00	2.20E+01	4.21E+00	4.48E+00	7.47E-01	5.62E-01	7.84E-01	2.75E+01	1.51E+01	1.03E+01	1.56E-02	4.74E+00	3.24E-03	4.68E-03	1.75E+01	4.43E+00	2.15E+01	4.05E-01	7.20E-02	2.69E-02	1.24E-01	9.54E-02	2.75E+01	1.47E+01	1.70E-01	4.37E-01	3.89E-02	1.55E-01	1.52E-01	8.66E-02	1.95E-02	4.84E-01	3.80E+00	4.41E+00	7.20E-01	4.38E-01	6.89E-01	2.15E-02	4.80E-01
2006	9	28	2.01E+00	0.00E+00	8.54E-01	0.00E+00	0.00E+00	6.85E+00	3.93E+00	1.05E+01	4.70E-03	1.20E+01	1.84E-03	9.46E-01	6.16E-01	1.02E+01	2.60E+00	1.96E+00	0.00E+00	8.53E-01	0.00E+00	0.00E+00	6.85E+00	3.85E+00	9.79E+00	4.48E-03	0.00E+00	0.00E+00	2.68E-03	4.92E-04	1.02E+01	2.47E+00	4.28E-02	0.00E+00	4.60E-04	0.00E+00	0.00E+00	4.34E-03	8.86E-02	7.42E-01	2.23E-04	1.20E+01	1.84E-03	9.43E-01	6.16E-01	1.27E-02	1.22E-01
2006	9	29	8.77E-01	0.00E+00	1.72E-01	0.00E+00	0.00E+00	5.82E+00	3.80E+00	1.03E+01	4.63E-02	1.09E+01	3.29E-02	1.35E+00	1.25E+00	6.74E+00	1.64E+00	8.48E-01	0.00E+00	1.72E-01	0.00E+00	0.00E+00	5.81E+00	3.75E+00	9.77E+00	4.45E-02	1.46E-03	7.02E-06	2.22E-02	7.24E-03	6.73E+00	1.60E+00	2.91E-02	0.00E+00	4.59E-04	0.00E+00	0.00E+00	6.18E-03	5.06E-02	5.01E-01	1.86E-03	1.09E+01	3.29E-02	1.33E+00	1.24E+00	1.19E-02	4.27E-02
2006	9	30	5.73E-01	1.71E-04	5.10E-01	9.09E-06	9.63E-05	9.75E+00	4.06E+00	1.46E+01	1.90E-01	5.17E+00	1.32E-01	9.42E-01	7.89E-01	1.23E+01	1.56E+00	5.59E-01	1.71E-04	5.10E-01	9.09E-06	9.63E-05	9.75E+00	4.01E+00	1.36E+01	1.90E-01	1.97E-02	2.07E-03	7.22E-02	5.38E-02	1.23E+01	1.44E+00	1.42E-02	0.00E+00	4.62E-08	0.00E+00	0.00E+00	1.10E-06	4.56E-02	9.57E-01	1.56E-06	5.15E+00	1.30E-01	8.70E-01	7.35E-01	2.37E-02	1.23E-01
2006	10	1	1.04E+00	4.04E-02	7.53E-01	3.62E-02	5.87E-02	4.27E+00	2.91E+00	7.47E+00	6.02E-01	1.19E+01	4.55E-01	1.40E+00	1.05E+00	6.05E+00	1.64E+00	8.77E-01	1.84E-03	7.11E-01	4.63E-04	8.71E-04	4.18E+00	2.76E+00	6.27E+00	1.21E-01	2.57E-02	6.53E-03	6.71E-02	4.50E-02	5.91E+00	1.31E+00	1.63E-01	3.86E-02	4.20E-02	3.57E-02	5.79E-02	8.92E-02	1.49E-01	1.20E+00	4.81E-01	1.19E+01	4.49E-01	1.33E+00	1.01E+00	1.41E-01	3.32E-01
2006	10	2	1.86E+00	3.72E-03	1.46E+00	2.76E-04	8.59E-04	3.72E+00	1.72E+00	5.90E+00	3.53E+00	1.40E+00	1.20E-02	5.99E-01	6.32E-01	5.50E+00	2.48E+00	1.56E+00	2.91E-03	1.14E+00	2.57E-04	7.90E-04	3.46E+00	1.64E+00	5.28E+00	9.81E-02	2.09E-02	7.75E-03	4.84E-02	3.11E-02	5.43E+00	1.93E+00	3.07E-01	8.14E-04	3.13E-01	1.92E-05	6.98E-05	2.67E-01	7.65E-02	6.25E-01	3.43E+00	1.38E+00	4.23E-03	5.51E-01	6.01E-01	7.65E-02	5.52E-01
2006	10	3	5.29E+00	2.89E-03	2.92E+00	1.50E-04	3.99E-04	5.14E+00	1.75E-01	5.73E+00	7.19E+00	1.79E-02	8.15E-03	2.60E-02	1.88E-02	7.01E+00	6.62E+00	4.82E+00	2.15E-03	2.68E+00	1.42E-04	3.67E-04	4.93E+00	1.69E-01	5.45E+00	7.78E-02	9.52E-03	3.79E-03	1.97E-02	1.35E-02	6.96E+00	5.72E+00	4.71E-01	7.36E-04	2.37E-01	7.73E-06	3.27E-05	2.14E-01	6.12E-03	2.81E-01	7.12E+00	8.39E-03	4.36E-03	6.21E-03	5.27E-03	5.50E-02	8.98E-01
2006	10	4	3.54E+00	9.87E-03	1.75E+00	1.51E-04	4.36E-04	3.90E+00	1.68E+00	7.15E+00	7.56E+00	5.20E-01	4.35E-02	8.91E-01	3.84E-01	6.56E+00	4.94E+00	2.61E+00	1.98E-03	1.10E+00	1.33E-04	3.27E-04	3.13E+00	9.61E-01	5.69E+00	1.04E-01	1.50E-02	4.95E-03	3.41E-02	2.21E-02	5.57E+00	3.82E+00	9.26E-01	7.89E-03	6.53E-01	1.82E-05	1.09E-04	7.71E-01	7.24E-01	1.46E+00	7.45E+00	5.05E-01	3.85E-02	8.56E-01	3.62E-01	9.84E-01	1.12E+00
2006	10	5	6.40E-01	3.28E-01	4.63E-01	7.04E-02	1.10E-01	3.85E+00	3.13E+00	9.21E+00	4.83E-01	8.88E+00	1.05E+00	1.73E+00	1.49E+00	5.01E+00	1.10E+00	6.19E-01	9.28E-03	4.50E-01	3.54E-03	6.30E-03	3.83E+00	3.00E+00	7.21E+00	2.26E-01	5.77E-02	2.30E-02	1.17E-01	8.64E-02	4.93E+00	1.04E+00	2.08E-02	3.19E-01	1.30E-02	6.68E-02	1.04E-01	1.77E-02	1.31E-01	1.99E+00	2.57E-01	8.82E+00	1.02E+00	1.61E+00	1.41E+00	7.31E-02	6.08E-02
2006	10	6	9.97E-01	9.58E-04	4.23E-01	1.07E-04	4.86E-04	3.30E+00	2.32E+00	7.02E+00	1.92E-01	8.28E+00	4.30E-02	1.52E+00	9.74E-01	5.27E+00	1.41E+00	9.33E-01	9.53E-04	4.20E-01	1.07E-04	4.86E-04	3.29E+00	2.17E+00	5.41E+00	8.35E-02	1.64E-02	5.22E-03	4.65E-02	2.79E-02	5.20E+00	1.25E+00	6.35E-02	5.11E-06	2.69E-03	6.39E-09	2.67E-07	1.16E-02	1.57E-01	1.60E+00	1.08E-01	8.26E+00	3.78E-02	1.48E+00	9.46E-01	6.92E-02	1.60E-01
2006	10	7	3.63E+00	2.59E-01	2.75E+00	4.48E-02	4.79E-02	4.86E+00	9.62E-01	6.47E+00	8.32E+00	6.73E-01	2.84E-01	3.28E-01	5.19E-01	6.90E+00	4.84E+00	3.31E+00	7.47E-03	2.17E+00	3.45E-03	4.06E-03	4.32E+00	9.04E-01	6.27E+00	1.06E-01	1.38E-02	8.19E-03	2.55E-02	1.73E-02	6.82E+00	4.34E+00	3.22E-01	2.52E-01	5.84E-01	4.14E-02	4.39E-02	5.45E-01	5.82E-02	1.99E-01	8.21E+00	6.59E-01	2.76E-01	3.03E-01	5.02E-01	8.61E-02	5.01E-01
2006	10	8	4.64E+00	1.91E-02	2.76E+00	1.80E-04	4.84E-04	4.95E+00	9.71E-01	6.36E+00	6.09E+00	1.15E-01	2.63E-02	9.81E-02	8.03E-02	6.84E+00	5.77E+00	4.10E+00	4.78E-03	2.53E+00	1.75E-04	4.59E-04	4.78E+00	9.60E-01	6.13E+00	1.54E-01	2.76E-02	9.45E-03	5.58E-02	3.86E-02	6.77E+00	4.90E+00	5.35E-01	1.43E-02	2.21E-01	5.08E-06	2.44E-05	1.64E-01	1.04E-02	2.30E-01	5.94E+00	8.78E-02	1.69E-02	4.23E-02	4.17E-02	6.32E-02	8.77E-01
2006	10	9	1.05E+00	4.23E-02	1.16E+00	4.84E-02	2.53E-01	5.47E+00	2.35E+00	8.95E+00	2.77E+00	9.40E+00	9.05E-01	1.48E+00	1.33E+00	7.32E+00	1.53E+00	6.56E-01	5.72E-03	7.60E-01	2.05E-03	4.02E-03	5.02E+00	2.16E+00	7.16E+00	1.68E-01	4.25E-02	1.64E-02	8.64E-02	6.16E-02	6.91E+00	1.01E+00	3.96E-01	3.66E-02	3.99E-01	4.64E-02	2.49E-01	4.47E-01	1.96E-01	1.79E+00	2.60E+00	9.36E+00	8.89E-01	1.40E+00	1.27E+00	4.09E-01	5.19E-01
2006	10	10	1.60E+00	1.57E-01	9.97E-01	2.89E-02	8.45E-02	5.45E+00	2.48E+00	9.79E+00	3.33E+00	1.36E+01	8.41E-01	2.00E+00	1.74E+00	6.78E+00	2.00E+00	1.44E+00	1.31E-03	8.73E-01	3.33E-04	1.18E-03	5.25E+00	2.22E+00	7.72E+00	1.52E-01	3.25E-02	8.59E-03	8.07E-02	5.40E-02	6.48E+00	1.79E+00	1.56E-01	1.56E-01	1.24E-01	2.85E-02	8.33E-02	1.98E-01	2.60E-01	2.07E+00	3.18E+00	1.36E+01	8.32E-01	1.92E+00	1.69E+00	3.04E-01	2.01E-01
2006	10	11	2.15E+00	1.17E+00	9.02E-01	2.05E-01	3.11E-01	6.59E+00	3.69E+00	1.01E+01	2.14E+00	9.26E+00	3.54E+00	2.43E+00	3.37E+00	8.03E+00	3.01E+00	1.83E+00	2.32E-02	7.96E-01	9.05E-03	1.27E-02	6.43E+00	3.26E+00	8.48E+00	2.18E-01	6.37E-02	3.37E-02	1.31E-01	8.93E-02	7.61E+00	2.45E+00	3.27E-01	1.15E+00	1.06E-01	1.96E-01	2.98E-01	1.56E-01	4.27E-01	1.62E+00	1.92E+00	9.19E+00	3.51E+00	2.30E+00	3.28E+00	4.19E-01	5.67E-01
2006	10	12	2.13E+00	4.10E-01	1.30E+00	9.41E-02	1.23E-01	4.51E+00	2.50E+00	8.44E+00	2.34E+00	1.12E+01	1.43E+00	1.90E+00	2.25E+00	5.95E+00	2.81E+00	1.98E+00	1.02E-02	1.26E+00	4.81E-03	7.32E-03	4.47E+00	2.33E+00	7.25E+00	1.63E-01	4.43E-02	2.08E-02	1.02E-01	6.78E-02	5.82E+00	2.49E+00	1.52E-01	4.00E-01	4.34E-02	8.93E-02	1.16E-01	4.49E-02	1.65E-01	1.19E+00	2.18E+00	1.12E+01	1.41E+00	1.80E+00	2.18E+00	1.35E-01	3.20E-01
2006	10	13	3.28E+00	1.45E+00	2.20E+00	2.54E-01	2.60E-01	5.63E+00	2.97E+00	8.69E+00	4.13E+00	6.61E+00	2.99E+00	1.34E+00	1.72E+00	7.46E+00	4.59E+00	2.78E+00	4.09E-02	1.87E+00	1.97E-02	2.71E-02	5.28E+00	2.78E+00	7.68E+00	3.26E-01	1.15E-01	6.62E-02	2.02E-01	1.50E-01	7.18E+00	3.60E+00	4.94E-01	1.41E+00	3.34E-01	2.34E-01	2.33E-01	3.42E-01	1.94E-01	1.02E+00	3.80E+00	6.50E+00	2.93E+00	1.14E+00	1.57E+00	2.85E-01	9.94E-01
2006	10	14	7.92E-01	2.88E-01	3.85E-01	4.89E-02	7.79E-02	3.68E+00	3.27E+00	9.42E+00	7.22E-01	1.27E+01	1.34E+00	2.13E+00	1.69E+00	6.74E+00	1.21E+00	7.01E-01	1.53E-02	3.05E-01	6.93E-03	1.12E-02	3.61E+00	3.13E+00	7.65E+00	1.41E-01	5.43E-02	2.87E-02	1.36E-01	8.66E-02	6.60E+00	1.04E+00	9.05E-02	2.73E-01	8.09E-02	4.20E-02	6.67E-02	7.14E-02	1.43E-01	1.77E+00	5.81E-01	1.26E+01	1.31E+00	2.00E+00	1.60E+00	1.46E-01	1.74E-01
2006	10	15	5.63E-01	3.83E-04	1.97E-01	8.68E-07	8.33E-05	1.90E+00	9.19E-01	3.46E+00	9.82E-02	4.44E+00	1.42E-01	8.51E-01	1.09E+00	2.44E+00	7.91E-01	5.47E-01	3.34E-04	1.94E-01	4.63E-07	7.13E-05	1.88E+00	9.03E-01	2.82E+00	6.84E-02	1.54E-02	3.43E-03	3.19E-02	2.33E-02	2.40E+00	7.56E-01	1.63E-02	4.90E-05	2.65E-03	4.05E-07	1.20E-05	1.98E-02	1.63E-02	6.35E-01	2.98E-02	4.43E+00	1.38E-01	8.19E-01	1.07E+00	3.77E-02	3.51E-02
2006	10	16	3.95E+00	1.39E-04	2.46E+00	1.19E-08	2.13E-06	3.55E+00	2.89E-01	3.52E+00	8.68E+00	9.53E-02	8.63E-04	1.51E-01	1.15E-01	4.56E+00	4.88E+00	3.89E+00	4.57E-05	2.25E+00	0.00E+00	1.52E-06	3.34E+00	2.50E-01	3.47E+00	3.68E-02	1.08E-03	2.26E-04	2.86E-03	1.88E-03	4.52E+00	4.77E+00	6.37E-02	9.30E-05	2.11E-01	1.19E-08	6.10E-07	2.11E-01	3.84E-02	5.13E-02	8.65E+00	9.42E-02	6.37E-04	1.48E-01	1.13E-01	3.51E-02	1.12E-01
2006	10	17	1.10E+00	2.06E-01	6.09E-01	8.07E-02	8.45E-02	2.79E+00	1.31E+00	3.94E+00	1.83E+00	3.14E+00	2.47E-01	5.77E-01	2.28E-01	3.15E+00	1.52E+00	1.08E+00	5.94E-03	6.01E-01	2.78E-03	4.11E-03	2.76E+00	1.29E+00	3.54E+00	5.89E-02	1.22E-02	7.93E-03	2.10E-02	1.67E-02	3.12E+00	1.47E+00	1.88E-02	2.00E-01	8.00E-03	7.79E-02	8.04E-02	2.44E-02	2.15E-02	4.01E-01	1.77E+00	3.13E+00	2.39E-01	5.56E-01	2.12E-01	2.83E-02	4.40E-02
2006	10	18	7.11E-02	0.00E+00	1.02E-03	0.00E+00	0.00E+00	4.48E-01	3.61E-01	1.40E+00	4.20E-16	2.04E+00	1.20E-02	6.00E-01	1.94E-01	6.69E-01	9.69E-02	7.11E-02	0.00E+00	1.02E-03	0.00E+00	0.00E+00	4.48E-01	3.30E-01	7.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-01	9.69E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E-02	6.69E-01	4.20E-16	2.04E+00	1.20E-02	6.00E-01	1.94E-01	9.59E-03	0.00E+00
2006	10	19	1.29E-01	0.00E+00	8.01E-03	0.00E+00	0.00E+00	6.96E-01	5.26E-01	1.99E+00	8.73E-06	4.18E+00	1.05E-02	7.82E-01	3.34E-01	1.05E+00	2.46E-01	1.29E-01	0.00E+00	8.01E-03	0.00E+00	0.00E+00	6.96E-01	4.64E-01	1.16E+00	8.73E-06	0.00E+00	0.00E+00	1.45E-04	0.00E+00	1.04E+00	2.46E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.24E-02	8.32E-01	2.38E-17	4.18E+00	1.05E-02	7.82E-01	3.34E-01	4.18E-03	0.00E+00
2006	10	20	3.29E+00	6.90E-02	1.18E+00	1.70E-02	3.88E-02	5.38E+00	2.80E+00	8.55E+00	2.79E+00	6.82E+00	4.85E-01	2.63E+00	2.97E+00	6.95E+00	4.37E+00	2.25E+00	9.44E-03	9.56E-01	2.54E-03	4.87E-03	4.98E+00	2.18E+00	7.04E+00	1.70E-01	4.80E-02	2.17E-02	1.01E-01	6.92E-02	6.05E+00	3.02E+00	1.04E+00	5.95E-02	2.21E-01	1.45E-02	3.39E-02	4.00E-01	6.19E-01	1.51E+00	2.62E+00	6.78E+00	4.63E-01	2.52E+00	2.90E+00	8.96E-01	1.36E+00
2006	10	21	4.59E+00	5.42E-01	3.18E+00	1.52E-01	2.67E-01	7.87E+00	3.57E+00	1.05E+01	6.85E+00	4.00E+00	2.53E+00	1.89E+00	1.65E+00	9.48E+00	5.66E+00	2.76E+00	3.68E-02	1.57E+00	1.14E-02	1.92E-02	5.98E+00	2.67E+00	7.70E+00	3.17E-01	1.16E-01	6.47E-02	1.92E-01	1.49E-01	7.66E+00	3.50E+00	1.83E+00	5.05E-01	1.61E+00	1.41E-01	2.48E-01	1.89E+00	9.01E-01	2.82E+00	6.53E+00	3.88E+00	2.47E+00	1.70E+00	1.50E+00	1.82E+00	2.17E+00
2006	10	22	8.44E-01	1.21E-03	3.24E-01	1.23E-04	4.01E-04	2.10E+00	1.46E+00	4.23E+00	6.10E-02	7.64E+00	9.06E-03	1.15E+00	2.58E-01	3.64E+00	1.15E+00	8.33E-01	1.19E-03	3.17E-01	1.22E-04	3.94E-04	2.05E+00	1.35E+00	3.34E+00	5.59E-02	1.24E-02	4.26E-03	2.89E-02	1.86E-02	3.61E+00	1.12E+00	1.11E-02	2.32E-05	7.45E-03	1.60E-06	7.08E-06	5.45E-02	1.07E-01	8.89E-01	5.11E-03	7.62E+00	4.80E-03	1.12E+00	2.39E-01	3.30E-02	3.14E-02
2006	10	23	1.10E+00	4.68E-04	4.76E-01	1.68E-05	1.57E-04	1.88E+00	1.11E+00	2.78E+00	7.07E-02	6.71E+00	1.61E-02	8.63E-01	8.20E-01	2.11E+00	1.54E+00	1.01E+00	4.41E-04	4.58E-01	1.58E-05	1.41E-04	1.82E+00	1.08E+00	2.39E+00	2.82E-02	6.19E-03	1.96E-03	1.22E-02	9.47E-03	2.10E+00	1.32E+00	9.53E-02	2.66E-05	1.76E-02	1.04E-06	1.54E-05	5.68E-02	3.34E-02	3.82E-01	4.25E-02	6.70E+00	1.42E-02	8.51E-01	8.10E-01	5.99E-03	2.21E-01
2006	10	24	5.79E-01	8.40E-04	3.39E-01	4.85E-05	3.25E-04	2.39E+00	9.04E-01	3.63E+00	8.07E-02	3.74E+00	6.66E-02	7.97E-01	6.81E-01	2.26E+00	9.59E-01	4.95E-01	7.42E-04	3.23E-01	4.16E-05	2.91E-04	2.34E+00	8.76E-01	2.65E+00	7.08E-02	1.55E-02	4.69E-03	3.15E-02	2.24E-02	2.24E+00	7.13E-01	8.40E-02	9.77E-05	1.67E-02	6.93E-06	3.39E-05	4.41E-02	2.81E-02	9.80E-01	9.88E-03	3.73E+00	6.19E-02	7.65E-01	6.58E-01	1.64E-02	2.46E-01
2006	10	25	7.88E-01	3.33E-04	6.41E-01	8.14E-06	8.03E-05	1.79E+00	1.02E+00	3.77E+00	4.57E-02	7.51E+00	2.07E-02	5.94E-01	8.52E-01	3.78E+00	1.18E+00	7.08E-01	2.12E-04	6.26E-01	2.36E-06	4.43E-05	1.76E+00	9.87E-01	3.33E+00	3.15E-02	5.48E-03	1.56E-03	1.64E-02	9.54E-03	3.76E+00	9.75E-01	8.07E-02	1.22E-04	1.52E-02	5.78E-06	3.60E-05	3.11E-02	3.50E-02	4.37E-01	1.42E-02	7.51E+00	1.91E-02	5.78E-01	8.42E-01	1.80E-02	2.00E-01
2006	10	26	3.03E-02	0.00E+00	5.93E-03	0.00E+00	0.00E+00	3.72E-01	2.34E-01	8.98E-01	2.14E-16	9.16E-01	2.57E-02	3.20E-01	1.62E-01	4.57E-01	4.53E-02	3.03E-02	0.00E+00	5.93E-03	0.00E+00	0.00E+00	3.72E-01	2.24E-01	5.43E-01	0.00E+00	0.00E+00	0.00E+00	5.73E-04	4.51E-05	4.55E-01	4.53E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-02	3.54E-01	2.14E-16	9.16E-01	2.57E-02	3.19E-01	1.61E-01	2.19E-03	0.00E+00
2006	10	27	5.12E-02	0.00E+00	3.21E-03	0.00E+00	0.00E+00	4.22E-01	3.12E-01	1.04E+00	3.31E-17	1.07E+00	5.17E-02	4.65E-01	2.11E-01	5.95E-01	8.16E-02	5.12E-02	0.00E+00	3.21E-03	0.00E+00	0.00E+00	4.22E-01	2.96E-01	7.21E-01	0.00E+00	0.00E+00	0.00E+00	3.07E-06	0.00E+00	5.95E-01	8.16E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-02	3.22E-01	3.31E-17	1.07E+00	5.17E-02	4.65E-01	2.11E-01	0.00E+00	0.00E+00
2006	10	28	3.82E-02	0.00E+00	4.20E-03	0.00E+00	0.00E+00	3.29E-01	2.58E-01	8.29E-01	2.42E-17	9.23E-01	3.99E-02	3.51E-01	1.95E-01	4.79E-01	5.36E-02	3.82E-02	0.00E+00	4.20E-03	0.00E+00	0.00E+00	3.29E-01	2.44E-01	5.11E-01	0.00E+00	0.00E+00	0.00E+00	6.32E-05	0.00E+00	4.77E-01	5.36E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-02	3.18E-01	2.42E-17	9.23E-01	3.99E-02	3.51E-01	1.95E-01	2.26E-03	0.00E+00
2006	10	29	1.01E+00	6.10E-04	9.20E-01	1.66E-05	1.30E-03	1.05E+00	2.12E-01	1.63E+00	2.07E+00	6.44E-01	2.23E-01	8.59E-02	5.83E-02	1.87E+00	1.30E+00	9.52E-01	3.76E-04	5.80E-01	1.66E-05	1.15E-03	9.20E-01	2.01E-01	1.46E+00	3.27E-03	2.04E-03	3.20E-03	3.14E-03	1.81E-03	1.86E+00	1.17E+00	5.84E-02	2.34E-04	3.40E-01	3.49E-10	1.49E-04	1.34E-01	1.14E-02	1.70E-01	2.07E+00	6.42E-01	2.20E-01	8.27E-02	5.65E-02	8.19E-03	1.28E-01
2006	10	30	1.79E+00	1.05E-03	1.09E+00	1.95E-04	7.39E-04	3.72E+00	1.49E+00	7.14E+00	2.02E+00	8.37E+00	9.23E-03	1.54E+00	1.74E+00	4.72E+00	2.21E+00	1.65E+00	1.03E-03	8.74E-01	1.90E-04	7.00E-04	3.63E+00	1.37E+00	6.07E+00	9.16E-02	1.56E-02	5.19E-03	4.81E-02	2.95E-02	4.54E+00	1.95E+00	1.37E-01	1.53E-05	2.15E-01	4.55E-06	3.90E-05	9.52E-02	1.15E-01	1.07E+00	1.93E+00	8.36E+00	4.04E-03	1.50E+00	1.71E+00	1.71E-01	2.64E-01
2006	10	31	1.66E+00	1.17E-03	1.06E+00	1.10E-04	4.44E-04	5.03E+00	2.50E+00	9.38E+00	1.94E-01	1.46E+01	1.71E-02	1.60E+00	1.03E+00	6.62E+00	2.22E+00	1.55E+00	1.05E-03	1.04E+00	1.04E-04	4.08E-04	4.96E+00	2.42E+00	8.05E+00	1.30E-01	2.55E-02	6.85E-03	5.55E-02	3.94E-02	6.43E+00	1.92E+00	1.09E-01	1.23E-04	2.43E-02	6.09E-06	3.54E-05	6.70E-02	7.96E-02	1.33E+00	6.32E-02	1.46E+01	1.03E-02	1.55E+00	9.89E-01	1.88E-01	2.92E-01
2006	11	1	1.12E+00	3.27E-02	8.66E-01	8.62E-03	2.14E-02	6.33E+00	3.41E+00	9.57E+00	4.26E-01	1.78E+01	2.51E-01	2.02E+00	1.46E+00	7.62E+00	1.91E+00	1.00E+00	8.14E-03	8.58E-01	2.53E-03	4.62E-03	6.32E+00	3.28E+00	7.54E+00	1.85E-01	4.66E-02	1.94E-02	1.07E-01	7.07E-02	7.39E+00	1.60E+00	1.16E-01	2.45E-02	7.94E-03	6.09E-03	1.68E-02	1.43E-02	1.27E-01	2.03E+00	2.41E-01	1.77E+01	2.32E-01	1.91E+00	1.39E+00	2.37E-01	3.17E-01
2006	11	2	3.45E+00	1.28E+00	2.18E+00	8.45E-01	1.09E+00	5.17E+00	1.76E+00	5.75E+00	3.48E+00	7.76E+00	1.04E+01	8.92E-01	1.59E+00	4.76E+00	4.45E+00	3.03E+00	4.49E-02	2.04E+00	2.07E-02	2.71E-02	5.00E+00	1.65E+00	5.15E+00	2.38E-01	9.29E-02	6.05E-02	1.41E-01	1.10E-01	4.61E+00	3.69E+00	4.22E-01	1.23E+00	1.37E-01	8.25E-01	1.06E+00	1.72E-01	1.09E-01	5.99E-01	3.24E+00	7.67E+00	1.03E+01	7.51E-01	1.48E+00	1.52E-01	7.53E-01
2006	11	3	1.31E-01	7.90E-05	2.61E-03	1.31E-03	2.00E-03	4.92E-01	6.68E-01	1.52E+00	4.35E-05	2.96E+00	6.05E-02	9.29E-01	3.21E-01	9.86E-01	1.84E-01	1.31E-01	6.21E-05	2.61E-03	2.65E-04	3.51E-04	4.92E-01	6.06E-01	1.17E+00	4.01E-05	1.26E-04	1.35E-04	1.60E-04	1.49E-04	9.67E-01	1.84E-01	1.22E-07	1.69E-05	0.00E+00	1.04E-03	1.65E-03	3.28E-08	6.20E-02	3.52E-01	3.40E-06	2.96E+00	6.04E-02	9.28E-01	3.21E-01	1.97E-02	1.49E-07
2006	11	4	6.99E-02	0.00E+00	4.90E-03	0.00E+00	6.17E-03	4.60E-01	3.87E-01	1.06E+00	1.00E-04	1.25E+00	1.13E-01	4.92E-01	2.82E-01	7.11E-01	1.29E-01	6.99E-02	0.00E+00	4.90E-03	0.00E+00	0.00E+00	4.60E-01	3.57E-01	6.62E-01	1.00E-04	9.74E-06	0.00E+00	3.88E-04	1.52E-04	7.11E-01	1.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.17E-03	0.00E+00	2.98E-02	4.02E-01	3.07E-17	1.25E+00	1.13E-01	4.92E-01	2.82E-01	0.00E+00	0.00E+00
2006	11	5	8.42E-02	0.00E+00	4.21E-02	2.21E-05	5.29E-02	5.00E-01	3.00E-01	9.14E-01	7.39E-04	1.25E+00	3.09E-01	1.89E-01	4.76E-01	5.75E-01	1.52E-01	8.42E-02	0.00E+00	4.21E-02	0.00E+00	0.00E+00	5.00E-01	2.97E-01	6.92E-01	7.39E-04	1.60E-04	3.93E-06	8.99E-04	3.01E-04	5.75E-01	1.52E-01	0.00E+00	0.00E+00	0.00E+00	2.21E-05	5.29E-02	0.00E+00	2.53E-03	2.22E-01	6.26E-18	1.25E+00	3.09E-01	1.88E-01	4.75E-01	0.00E+00	0.00E+00
2006	11	6	6.07E-01	0.00E+00	1.28E-01	2.15E-07	1.36E-03	1.56E+00	2.64E-01	2.25E+00	5.25E-02	1.42E+00	2.13E-01	3.01E-02	5.15E-01	1.44E+00	1.15E+00	6.02E-01	0.00E+00	1.26E-01	0.00E+00	1.88E-05	1.55E+00	2.64E-01	1.91E+00	5.16E-02	1.12E-02	6.52E-04	1.24E-02	1.22E-02	1.43E+00	1.11E+00	5.36E-03	0.00E+00	1.48E-03	2.15E-07	1.34E-03	4.45E-03	3.11E-04	3.36E-01	9.55E-04	1.41E+00	2.13E-01	1.77E-02	5.03E-01	2.23E-03	3.94E-02
2006	11	7	4.07E-01	0.00E+00	6.93E-02	5.92E-07	2.07E-04	9.85E-01	3.23E-01	1.37E+00	2.49E-02	1.77E+00	1.85E-01	1.24E-01	5.88E-01	1.00E+00	7.71E-01	4.07E-01	0.00E+00	6.93E-02	5.92E-07	2.36E-05	9.85E-01	3.22E-01	1.20E+00	2.46E-02	4.20E-03	3.44E-04	1.40E-02	8.23E-03	1.00E+00	7.71E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.84E-04	0.00E+00	9.85E-04	1.70E-01	2.70E-04	1.77E+00	1.85E-01	1.10E-01	5.79E-01	1.53E-04	1.07E-05
2006	11	8	8.22E-01	5.33E-04	5.21E-01	1.76E-05	1.50E-04	2.48E+00	1.08E+00	3.66E+00	5.18E-02	5.34E+00	4.73E-02	7.30E-01	6.90E-01	2.91E+00	1.26E+00	7.00E-01	3.81E-04	5.07E-01	3.79E-06	1.15E-04	2.45E+00	1.08E+00	3.26E+00	4.03E-02	9.96E-03	3.23E-03	2.45E-02	1.46E-02	2.90E+00	9.73E-01	1.22E-01	1.51E-04	1.42E-02	1.38E-05	3.49E-05	3.63E-02	8.63E-03	4.07E-01	1.15E-02	5.33E+00	4.41E-02	7.05E-01	6.75E-01	1.06E-02	2.88E-01
2006	11	9	1.54E+00	3.66E-01	8.69E-01	1.09E-02	2.73E-02	2.05E+00	1.04E+00	3.81E+00	2.72E+00	1.44E+00	1.48E+00	2.32E-01	2.26E-01	3.05E+00	1.97E+00	1.51E+00	1.76E-02	8.26E-01	4.45E-03	7.65E-03	1.96E+00	1.02E+00	3.62E+00	6.55E-02	3.12E-02	2.70E-02	3.51E-02	3.10E-02	3.03E+00	1.93E+00	2.60E-02	3.48E-01	4.34E-02	6.49E-03	1.97E-02	8.89E-02	1.99E-02	1.95E-01	2.66E+00	1.41E+00	1.45E+00	1.96E-01	1.95E-01	2.17E-02	4.42E-02
2006	11	10	5.04E-01	7.56E-02	1.56E-01	5.91E-02	2.45E-01	1.96E+00	6.57E-01	3.81E+00	1.29E-01	2.66E+00	1.05E+00	3.80E-01	1.00E+00	1.93E+00	8.94E-01	4.90E-01	3.63E-03	1.51E-01	1.47E-03	3.10E-03	1.94E+00	6.44E-01	2.83E+00	6.89E-02	2.05E-02	9.40E-03	2.97E-02	2.52E-02	1.83E+00	8.69E-01	1.39E-02	7.20E-02	4.58E-03	5.76E-02	2.42E-01	1.36E-02	1.31E-02	9.78E-01	6.01E-02	2.64E+00	1.04E+00	3.50E-01	9.80E-01	1.03E-01	2.60E-02
2006	11	11	3.12E-01	1.33E-06	3.11E-02	5.27E-07	3.27E-03	1.62E+00	4.46E-01	3.40E+00	4.60E-02	1.13E+00	1.62E-01	2.70E-01	4.96E-01	1.38E+00	5.30E-01	3.12E-01	1.33E-06	3.11E-02	5.27E-07	9.34E-05	1.62E+00	4.38E-01	2.28E+00	4.60E-02	6.72E-03	1.02E-03	1.81E-02	1.16E-02	1.36E+00	5.30E-01	5.67E-05	0.00E+00	0.00E+00	0.00E+00	3.18E-03	0.00E+00	8.74E-03	1.11E+00	1.66E-18	1.12E+00	1.61E-01	2.52E-01	4.85E-01	2.39E-02	2.51E-04
2006	11	12	1.73E+00	7.28E-04	3.30E-01	4.05E-04	1.12E-01	2.77E+00	7.09E-01	3.91E+00	1.07E-01	1.87E+00	1.02E+00	1.24E-01	4.36E-01	2.81E+00	2.27E+00	1.64E+00	5.55E-04	3.17E-01	2.55E-04	2.87E-03	2.72E+00	6.94E-01	3.20E+00	8.14E-02	2.37E-02	1.22E-02	4.37E-02	3.03E-02	2.79E+00	2.04E+00	8.28E-02	1.73E-04	1.36E-02	1.50E-04	1.09E-01	5.55E-02	1.52E-02	7.08E-01	2.54E-02	1.84E+00	1.01E+00	8.03E-02	4.06E-01	2.55E-02	2.27E-01
2006	11	13	1.01E+00	1.26E-01	1.81E-01	6.87E-02	1.22E-01	2.49E+00	6.49E-01	3.27E+00	1.46E-01	1.37E+00	2.05E+00	2.37E-01	2.92E-01	1.62E+00	1.51E+00	9.15E-01	9.84E-03	1.80E-01	6.99E-03	8.29E-03	2.49E+00	6.38E-01	2.53E+00	1.32E-01	4.42E-02	2.38E-02	6.96E-02	5.86E-02	1.57E+00	1.25E+00	9.20E-02	1.16E-01	1.24E-03	6.17E-02	1.14E-01	5.58E-03	1.17E-02	7.43E-01	1.38E-02	1.33E+00	2.03E+00	1.67E-01	2.33E-01	4.64E-02	2.60E-01
2006	11	14	1.25E+00	1.06E-02	5.27E-01	4.37E-04	2.05E-03	2.95E+00	1.80E+00	4.63E+00	4.58E-01	6.36E+00	1.44E-01	9.18E-01	8.88E-01	4.93E+00	1.73E+00	1.15E+00	5.07E-04	5.05E-01	5.16E-05	1.74E-04	2.89E+00	1.71E+00	3.95E+00	3.41E-02	5.34E-03	1.46E-03	2.25E-02	1.11E-02	4.84E+00	1.54E+00	9.34E-02	1.01E-02	2.19E-02	3.86E-04	1.87E-03	5.73E-02	9.67E-02	6.82E-01	4.24E-01	6.35E+00	1.43E-01	8.96E-01	8.77E-01	8.77E-02	1.83E-01
2006	11	15	3.63E-01	1.01E-04	1.11E-01	1.88E-02	1.29E-01	1.16E+00	4.34E-01	1.92E+00	2.65E-02	1.25E+00	9.20E-01	2.72E-01	2.64E-01	9.62E-01	6.13E-01	3.26E-01	1.01E-04	1.11E-01	2.39E-04	8.59E-04	1.16E+00	4.25E-01	1.46E+00	2.35E-02	4.77E-03	1.61E-03	9.90E-03	5.95E-03	9.55E-01	5.24E-01	3.71E-02	0.00E+00	2.91E-04	1.86E-02	1.28E-01	1.24E-03	9.02E-03	4.59E-01	3.02E-03	1.24E+00	9.18E-01	2.62E-01	2.58E-01	7.51E-03	8.88E-02
2006	11	16	1.31E-01	4.14E-08	2.81E-02	1.01E-05	6.14E-03	8.05E-01	4.84E-01	1.51E+00	1.35E-02	2.00E+00	1.49E-01	5.73E-01	3.79E-01	8.65E-01	2.13E-01	1.31E-01	4.14E-08	2.81E-02	1.00E-05	2.24E-04	8.05E-01	4.65E-01	1.10E+00	1.32E-02	3.29E-03	5.94E-04	4.39E-03	2.75E-03	8.65E-01	2.13E-01	0.00E+00	0.00E+00	0.00E+00	8.79E-08	5.92E-03	0.00E+00	1.84E-02	4.02E-01	3.12E-04	2.00E+00	1.48E-01	5.68E-01	3.76E-01	0.00E+00	2.58E-05
2006	11	17	7.08E-02	0.00E+00	1.03E-02	0.00E+00	0.00E+00	5.20E-01	5.55E-01	1.57E+00	2.20E-17	6.72E+00	2.07E-03	6.59E-01	2.95E-01	9.00E-01	1.09E-01	7.08E-02	0.00E+00	1.03E-02	0.00E+00	0.00E+00	5.20E-01	4.74E-01	1.02E+00	0.00E+00	0.00E+00	0.00E+00	6.01E-05	0.00E+00	8.99E-01	1.09E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.11E-02	5.48E-01	2.20E-17	6.72E+00	2.07E-03	6.59E-01	2.95E-01	1.23E-03	0.00E+00
2006	11	18	1.41E+00	3.87E-03	6.79E-01	6.39E-04	2.41E-03	2.35E+00	1.90E+00	4.06E+00	2.98E-01	1.16E+01	1.17E-01	1.02E+00	9.11E-01	3.45E+00	1.95E+00	1.28E+00	3.57E-03	6.64E-01	5.71E-04	1.13E-03	2.31E+00	1.81E+00	3.31E+00	6.29E-02	1.34E-02	6.33E-03	1.97E-02	1.58E-02	3.41E+00	1.67E+00	1.28E-01	3.00E-04	1.47E-02	6.79E-05	1.28E-03	4.29E-02	8.74E-02	7.50E-01	2.35E-01	1.16E+01	1.10E-01	9.98E-01	8.95E-01	4.12E-02	2.81E-01
2006	11	19	1.28E+00	1.92E-02	7.29E-01	1.15E-01	3.73E-01	2.91E+00	1.41E+00	3.79E+00	2.96E-01	3.97E+00	4.04E+00	2.56E-01	6.08E-01	2.89E+00	1.75E+00	1.13E+00	1.67E-02	7.14E-01	8.13E-03	1.32E-02	2.88E+00	1.40E+00	2.86E+00	1.82E-01	6.03E-02	3.46E-02	9.26E-02	7.54E-02	2.73E+00	1.44E+00	1.49E-01	2.51E-03	1.44E-02	1.07E-01	3.60E-01	3.00E-02	6.23E-03	9.34E-01	1.14E-01	3.91E+00	4.00E+00	1.63E-01	5.33E-01	1.68E-01	3.04E-01
2006	11	20	8.67E-01	2.50E-04	3.50E-01	2.35E-04	7.00E-03	2.73E+00	1.66E+00	5.44E+00	1.02E-01	3.13E+00	5.29E-01	5.26E-01	1.27E+00	3.13E+00	1.55E+00	8.01E-01	2.44E-04	3.48E-01	2.17E-04	1.40E-03	2.72E+00	1.61E+00	4.01E+00	8.78E-02	1.69E-02	5.11E-03	4.83E-02	3.25E-02	3.09E+00	1.39E+00	6.58E-02	5.70E-06	1.55E-03	1.86E-05	5.60E-03	8.93E-03	4.74E-02	1.43E+00	1.46E-02	3.12E+00	5.24E-01	4.78E-01	1.24E+00	3.51E-02	1.55E-01
2006	11	21	9.64E-01	3.58E-03	4.17E-01	3.36E-02	2.14E-01	3.07E+00	1.53E+00	4.96E+00	2.22E-01	2.54E+00	2.31E+00	2.67E-01	9.29E-01	3.13E+00	1.42E+00	9.47E-01	3.57E-03	4.17E-01	2.44E-03	7.70E-03	3.07E+00	1.49E+00	3.82E+00	2.08E-01	5.04E-02	2.27E-02	7.90E-02	6.55E-02	3.03E+00	1.37E+00	1.69E-02	1.49E-05	7.48E-05	3.12E-02	2.07E-01	6.40E-04	3.84E-02	1.14E+00	1.38E-02	2.49E+00	2.28E+00	1.88E-01	8.63E-01	9.09E-02	4.77E-02
2006	11	22	2.10E+00	3.02E-01	1.11E+00	3.39E-01	6.62E-01	2.48E+00	1.36E+00	3.96E+00	9.49E-01	1.78E+00	6.88E+00	2.51E-01	4.23E-01	3.27E+00	2.73E+00	2.00E+00	1.44E-02	1.07E+00	9.45E-03	1.20E-02	2.37E+00	1.32E+00	3.35E+00	3.88E-02	1.99E-02	1.87E-02	2.97E-02	2.05E-02	3.26E+00	2.51E+00	1.06E-01	2.88E-01	4.14E-02	3.30E-01	6.50E-01	1.16E-01	3.56E-02	6.17E-01	9.10E-01	1.76E+00	6.86E+00	2.22E-01	4.03E-01	1.39E-02	2.15E-01
2006	11	23	9.59E-01	1.08E-01	3.10E-01	2.49E-02	1.11E-01	2.76E+00	1.08E+00	3.73E+00	2.46E-01	3.14E+00	1.90E+00	3.50E-01	7.38E-01	2.40E+00	1.51E+00	9.32E-01	2.00E-03	3.10E-01	1.09E-03	1.79E-03	2.75E+00	1.05E+00	2.87E+00	8.16E-02	1.80E-02	5.16E-03	4.16E-02	3.34E-02	2.39E+00	1.46E+00	2.67E-02	1.06E-01	5.71E-04	2.38E-02	1.10E-01	7.83E-03	3.06E-02	8.54E-01	1.65E-01	3.12E+00	1.89E+00	3.08E-01	7.05E-01	1.71E-02	4.73E-02
2006	11	24	6.38E-01	6.65E-01	1.65E-01	1.28E-01	3.27E-01	9.48E-01	4.04E-01	1.71E+00	1.95E-01	9.24E-01	1.82E+00	1.86E-02	7.66E-02	1.52E+00	9.07E-01	6.38E-01	5.61E-03	1.65E-01	6.67E-03	1.59E-02	9.42E-01	4.03E-01	1.69E+00	5.15E-02	1.92E-02	2.04E-02	1.46E-02	1.98E-02	1.52E+00	9.07E-01	3.13E-05	6.60E-01	7.49E-05	1.21E-01	3.11E-01	6.32E-03	1.86E-04	1.58E-02	1.43E-01	9.04E-01	1.80E+00	3.98E-03	5.69E-02	3.63E-05	3.46E-05
2006	11	25	9.82E-01	6.36E-01	4.29E-01	7.69E-02	1.55E-01	1.27E+00	6.74E-01	2.51E+00	5.82E-01	8.54E-01	2.46E+00	4.84E-02	9.40E-02	2.21E+00	1.38E+00	9.82E-01	6.65E-03	4.22E-01	3.09E-03	5.03E-03	1.22E+00	6.74E-01	2.51E+00	5.27E-02	3.43E-02	1.80E-02	4.23E-02	4.16E-02	2.21E+00	1.38E+00	1.38E-11	6.30E-01	7.01E-03	7.38E-02	1.50E-01	4.47E-02	1.07E-07	4.05E-11	5.30E-01	8.20E-01	2.45E+00	6.12E-03	5.24E-02	0.00E+00	2.08E-11
2006	11	26	7.71E-01	3.64E-01	4.28E-01	1.33E-01	1.74E-01	1.00E+00	2.20E-01	1.75E+00	1.89E+00	7.09E-02	3.01E-01	1.15E-02	2.12E-02	1.98E+00	1.02E+00	7.71E-01	1.08E-02	4.01E-01	4.76E-03	6.27E-03	9.54E-01	2.20E-01	1.75E+00	1.63E-02	9.83E-03	1.06E-02	8.21E-03	8.00E-03	1.98E+00	1.02E+00	3.48E-04	3.53E-01	2.60E-02	1.28E-01	1.68E-01	4.69E-02	8.10E-05	2.58E-04	1.88E+00	6.11E-02	2.90E-01	3.32E-03	1.32E-02	2.22E-04	3.47E-04
2006	11	27	1.11E+00	0.00E+00	7.44E-01	0.00E+00	0.00E+00	1.25E+00	2.30E-01	1.73E+00	3.77E+00	3.99E-10	0.00E+00	0.00E+00	0.00E+00	2.36E+00	1.39E+00	1.11E+00	0.00E+00	6.61E-01	0.00E+00	0.00E+00	1.15E+00	2.30E-01	1.73E+00	6.12E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E+00	1.39E+00	0.00E+00	0.00E+00	8.31E-02	0.00E+00	0.00E+00	9.87E-02	0.00E+00	0.00E+00	3.77E+00	3.99E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2006	11	28	3.85E+00	2.70E-01	2.40E+00	6.93E-02	1.37E-01	5.70E+00	2.13E+00	4.99E+00	1.04E+01	2.54E+00	2.77E+00	4.24E-01	8.11E-01	5.36E+00	4.93E+00	3.75E+00	9.09E-03	2.04E+00	2.86E-03	5.36E-03	5.28E+00	2.08E+00	4.46E+00	1.23E-01	3.63E-02	1.87E-02	6.32E-02	4.73E-02	5.26E+00	4.74E+00	1.01E-01	2.61E-01	3.60E-01	6.65E-02	1.32E-01	4.18E-01	4.43E-02	5.27E-01	1.02E+01	2.50E+00	2.75E+00	3.61E-01	7.64E-01	9.93E-02	1.85E-01
2006	11	29	4.82E-01	6.91E-03	4.23E-01	1.68E-03	3.43E-03	2.97E+00	2.37E+00	6.09E+00	1.64E-01	1.08E+01	3.78E-02	1.37E+00	6.25E-01	4.42E+00	7.27E-01	4.58E-01	5.90E-03	4.22E-01	1.41E-03	3.06E-03	2.97E+00	2.28E+00	4.72E+00	1.34E-01	3.56E-02	1.59E-02	6.34E-02	4.60E-02	4.36E+00	6.57E-01	2.45E-02	1.01E-03	1.03E-03	2.68E-04	3.66E-04	6.28E-03	8.27E-02	1.36E+00	3.00E-02	1.08E+01	2.19E-02	1.31E+00	5.79E-01	5.71E-02	7.01E-02
2006	11	30	8.03E-02	0.00E+00	6.96E-04	0.00E+00	0.00E+00	3.54E-01	3.26E-01	9.85E-01	2.25E-16	2.80E+00	1.04E-02	4.18E-01	1.97E-01	6.12E-01	1.07E-01	8.03E-02	0.00E+00	6.96E-04	0.00E+00	0.00E+00	3.54E-01	2.80E-01	7.93E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E-01	1.07E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.58E-02	1.92E-01	2.25E-16	2.80E+00	1.04E-02	4.18E-01	1.97E-01	1.83E-02	0.00E+00
2006	12	1	1.88E+00	4.14E-01	9.54E-01	2.05E-02	2.94E-02	2.67E+00	1.66E+00	3.79E+00	1.33E+00	7.36E+00	1.13E+00	9.13E-01	1.41E+00	3.07E+00	2.59E+00	1.72E+00	6.39E-03	8.24E-01	1.10E-03	2.02E-03	2.47E+00	1.47E+00	3.31E+00	1.24E-01	3.49E-02	1.40E-02	6.62E-02	4.80E-02	2.93E+00	2.38E+00	1.59E-01	4.07E-01	1.30E-01	1.94E-02	2.74E-02	1.97E-01	1.94E-01	4.70E-01	1.21E+00	7.32E+00	1.12E+00	8.47E-01	1.36E+00	1.41E-01	2.09E-01
2006	12	2	3.03E+00	1.63E+00	1.68E+00	4.29E-01	5.71E-01	3.82E+00	1.67E+00	5.11E+00	2.93E+00	5.00E+00	9.43E+00	5.95E-01	6.28E-01	4.44E+00	4.14E+00	2.88E+00	4.71E-02	1.62E+00	1.60E-02	2.28E-02	3.73E+00	1.63E+00	4.71E+00	2.87E-01	1.14E-01	6.96E-02	1.69E-01	1.37E-01	4.40E+00	3.83E+00	1.48E-01	1.58E+00	6.49E-02	4.13E-01	5.48E-01	8.97E-02	4.09E-02	4.01E-01	2.65E+00	4.89E+00	9.36E+00	4.25E-01	4.91E-01	4.11E-02	3.14E-01
2006	12	3	4.18E-02	0.00E+00	6.54E-04	0.00E+00	0.00E+00	2.99E-01	3.36E-01	9.28E-01	5.39E-16	4.17E+00	1.33E-03	4.12E-01	2.08E-01	5.71E-01	7.42E-02	4.18E-02	0.00E+00	6.54E-04	0.00E+00	0.00E+00	2.99E-01	2.87E-01	5.84E-01	0.00E+00	0.00E+00	0.00E+00	1.17E-07	0.00E+00	5.71E-01	7.42E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-02	3.44E-01	5.39E-16	4.17E+00	1.33E-03	4.12E-01	2.08E-01	0.00E+00	0.00E+00
2006	12	4	4.33E-02	0.00E+00	2.97E-03	0.00E+00	0.00E+00	3.16E-01	2.77E-01	8.68E-01	5.53E-16	2.39E+00	1.74E-02	3.78E-01	1.98E-01	5.16E-01	7.00E-02	4.33E-02	0.00E+00	2.97E-03	0.00E+00	0.00E+00	3.16E-01	2.48E-01	5.93E-01	0.00E+00	0.00E+00	0.00E+00	1.04E-05	0.00E+00	5.02E-01	7.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E-02	2.75E-01	5.53E-16	2.39E+00	1.74E-02	3.78E-01	1.98E-01	1.34E-02	0.00E+00
2006	12	5	1.19E-01	0.00E+00	2.81E-04	0.00E+00	0.00E+00	4.75E-01	3.94E-01	1.34E+00	1.90E-17	6.45E+00	1.23E-04	4.17E-01	4.45E-01	9.04E-01	1.48E-01	1.19E-01	0.00E+00	2.81E-04	0.00E+00	0.00E+00	4.75E-01	3.26E-01	8.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.35E-01	1.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.74E-02	5.41E-01	1.90E-17	6.45E+00	1.23E-04	4.17E-01	4.45E-01	6.90E-02	0.00E+00
2006	12	6	9.98E-02	0.00E+00	7.04E-04	0.00E+00	0.00E+00	5.06E-01	7.52E-01	1.89E+00	6.64E-17	7.23E+00	7.54E-04	9.92E-01	2.87E-01	1.11E+00	1.57E-01	9.98E-02	0.00E+00	7.04E-04	0.00E+00	0.00E+00	5.06E-01	6.51E-01	9.43E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E+00	1.57E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-01	9.51E-01	6.64E-17	7.23E+00	7.54E-04	9.92E-01	2.87E-01	0.00E+00	0.00E+00
2006	12	7	1.45E-01	0.00E+00	7.40E-02	0.00E+00	0.00E+00	9.58E-01	7.09E-01	2.35E+00	1.57E-03	6.03E+00	4.90E-03	8.43E-01	3.65E-01	1.60E+00	3.11E-01	1.03E-01	0.00E+00	7.40E-02	0.00E+00	0.00E+00	9.58E-01	6.55E-01	1.86E+00	1.57E-03	1.56E-04	4.46E-07	6.31E-03	1.25E-03	1.57E+00	2.61E-01	4.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.41E-02	4.96E-01	1.04E-16	6.03E+00	4.90E-03	8.37E-01	3.64E-01	3.13E-02	5.08E-02
2006	12	8	9.40E-01	5.64E-04	2.80E-01	1.01E-04	1.05E-03	1.33E+00	9.12E-01	2.63E+00	9.09E-02	4.41E+00	3.73E-02	5.80E-01	4.34E-01	1.89E+00	1.27E+00	9.17E-01	5.15E-04	2.69E-01	9.32E-05	9.35E-04	1.29E+00	8.46E-01	2.32E+00	5.32E-02	1.51E-02	6.43E-03	1.44E-02	1.72E-02	1.85E+00	1.18E+00	2.25E-02	4.86E-05	1.09E-02	8.03E-06	1.18E-04	4.28E-02	6.58E-02	3.06E-01	3.76E-02	4.39E+00	3.08E-02	5.66E-01	4.17E-01	3.56E-02	8.74E-02
2006	12	9	5.23E-01	4.65E-04	3.45E-01	3.06E-04	4.31E-03	2.87E+00	2.16E+00	5.86E+00	8.09E-02	8.42E+00	2.36E-01	1.32E+00	1.29E+00	5.10E+00	8.23E-01	5.05E-01	4.63E-04	3.45E-01	2.92E-04	1.30E-03	2.87E+00	2.08E+00	4.51E+00	7.37E-02	1.75E-02	4.74E-03	4.22E-02	2.98E-02	4.94E+00	6.99E-01	1.84E-02	2.01E-06	3.79E-04	1.42E-05	3.01E-03	2.78E-03	7.42E-02	1.35E+00	7.20E-03	8.40E+00	2.31E-01	1.28E+00	1.26E+00	1.54E-01	1.24E-01

Table C.5 - Timeseries Data for PM10

Year	Month	Day	Application														Baseline														Project													
			R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
2006	12	10	6.10E-02	0.00E+00	1.49E-03	0.00E+00	0.00E+00	4.62E-01	7.15E-01	1.70E+00	4.38E-07	7.62E+00	7.17E-03	1.10E+00	4.06E-01	9.61E-01	9.89E-02	6.10E-02	0.00E+00	1.49E-03	0.00E+00	0.00E+00	4.62E-01	6.36E-01	8.91E-01	4.38E-07	1.74E-06	0.00E+00	1.83E-04	4.32E-05	9.59E-01	9.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.95E-02	8.12E-01	5.29E-18	7.62E+00	7.17E-03	1.10E+00	4.06E-01	2.24E-03	0.00E+00
2006	12	11	3.71E-02	0.00E+00	9.17E-03	0.00E+00	5.55E-04	3.16E-01	2.98E-01	7.62E-01	1.47E-17	9.51E-01	8.97E-02	3.07E-01	2.49E-01	5.24E-01	5.06E-02	3.71E-02	0.00E+00	9.17E-03	0.00E+00	0.00E+00	3.16E-01	2.94E-01	6.17E-01	0.00E+00	0.00E+00	0.00E+00	1.60E-04	9.47E-07	4.96E-01	5.06E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E-04	0.00E+00	3.91E-03	1.45E-01	1.47E-17	9.51E-01	8.97E-02	3.07E-01	2.49E-01	2.84E-02	0.00E+00
2006	12	12	1.10E-01	0.00E+00	2.42E-02	0.00E+00	4.26E-03	7.92E-01	3.19E-01	1.26E+00	1.55E-02	1.19E+00	1.89E-01	1.99E-01	4.29E-01	7.13E-01	2.86E-01	1.10E-01	0.00E+00	2.42E-02	0.00E+00	2.39E-05	7.92E-01	3.16E-01	9.57E-01	1.55E-02	2.82E-03	1.38E-04	7.39E-03	7.04E-03	7.13E-01	2.86E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.24E-03	0.00E+00	3.51E-03	3.07E-01	1.67E-20	1.18E+00	1.89E-01	1.91E-01	4.22E-01	6.75E-05	0.00E+00
2006	12	13	1.47E-01	0.00E+00	6.12E-02	1.66E-07	1.25E-02	6.80E-01	2.62E-01	1.20E+00	2.84E-03	1.16E+00	1.65E-01	1.90E-01	3.32E-01	6.15E-01	2.23E-01	1.35E-01	0.00E+00	6.12E-02	1.65E-07	6.28E-05	6.80E-01	2.57E-01	9.08E-01	2.84E-03	9.25E-04	2.22E-04	4.49E-03	3.56E-03	6.15E-01	2.03E-01	1.20E-02	0.00E+00	0.00E+00	1.55E-09	1.24E-02	1.18E-04	5.76E-03	2.94E-01	2.27E-19	1.16E+00	1.65E-01	1.85E-01	3.28E-01	6.78E-04	2.01E-02
2006	12	14	1.45E+00	3.85E-01	5.30E-01	8.70E-02	7.95E-02	1.65E+00	1.06E+00	3.30E+00	7.33E-01	2.74E+00	3.27E+00	5.76E-01	4.33E-01	2.46E+00	1.94E+00	1.19E+00	3.66E-03	5.27E-01	1.69E-03	2.88E-03	1.65E+00	1.03E+00	2.64E+00	2.72E-02	1.38E-02	7.32E-03	2.93E-02	2.05E-02	2.40E+00	1.47E+00	2.59E-01	3.81E-01	3.44E-03	8.53E-02	7.67E-02	6.41E-03	3.01E-02	6.62E-01	7.06E-01	2.73E+00	3.26E+00	5.46E-01	4.12E-01	6.43E-02	4.71E-01
2006	12	15	2.82E-01	4.05E-04	1.95E-02	8.83E-02	1.57E-01	7.77E-01	2.83E-01	1.73E+00	1.13E-02	1.02E+00	8.49E-01	2.55E-01	1.78E-01	7.10E-01	4.05E-01	2.82E-01	3.60E-04	1.95E-02	1.62E-03	3.01E-03	7.77E-01	2.73E-01	1.04E+00	1.06E-02	5.36E-03	2.73E-03	1.37E-02	9.76E-03	7.09E-01	4.04E-01	1.28E-04	4.49E-05	1.03E-06	8.67E-02	1.54E-01	2.03E-06	1.05E-02	6.93E-01	7.62E-04	1.01E+00	8.46E-01	2.42E-01	1.69E-01	1.33E-03	1.71E-04
2006	12	16	3.81E-01	7.10E-04	2.50E-01	1.85E-04	8.78E-04	2.99E+00	1.68E+00	5.82E+00	8.69E-02	5.84E+00	1.43E-02	8.21E-01	8.27E-01	3.53E+00	5.59E-01	3.62E-01	6.44E-04	2.48E-01	1.63E-04	8.29E-04	2.98E+00	1.59E+00	4.22E+00	8.52E-02	2.06E-02	6.26E-03	3.45E-02	2.83E-02	3.45E+00	5.20E-01	1.89E-02	6.54E-05	2.14E-03	2.19E-05	4.87E-05	6.32E-03	8.74E-02	1.59E+00	1.73E-03	5.82E+00	8.03E-03	7.86E-01	7.99E-01	8.16E-02	3.86E-02
2006	12	17	7.18E-01	3.08E-04	2.83E-01	1.78E-05	1.48E-04	2.46E+00	1.60E+00	5.34E+00	8.69E-02	7.02E+00	2.58E-02	1.28E+00	8.12E-01	3.30E+00	1.34E+00	5.99E-01	3.08E-04	2.80E-01	1.78E-05	1.47E-04	2.45E+00	1.49E+00	4.12E+00	8.11E-02	1.46E-02	3.32E-03	3.60E-02	2.51E-02	3.21E+00	9.22E-01	1.20E-01	1.87E-07	3.30E-03	0.00E+00	4.09E-07	1.02E-02	1.05E-01	1.22E+00	5.75E-03	7.00E+00	2.25E-02	1.25E+00	7.87E-01	8.70E-02	4.13E-01
2006	12	18	4.83E-02	0.00E+00	4.77E-04	0.00E+00	0.00E+00	2.85E-01	2.98E-01	7.73E-01	3.58E-15	3.10E+00	1.61E-03	4.36E-01	1.81E-01	5.29E-01	6.63E-02	4.83E-02	0.00E+00	4.77E-04	0.00E+00	0.00E+00	2.85E-01	2.66E-01	3.75E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-01	6.63E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-02	3.98E-01	3.58E-15	3.10E+00	1.61E-03	4.36E-01	1.81E-01	5.86E-04	0.00E+00
2006	12	19	6.22E-02	0.00E+00	1.03E-03	0.00E+00	0.00E+00	3.89E-01	4.78E-01	1.39E+00	1.40E-16	4.99E+00	1.00E-02	6.38E-01	3.84E-01	7.48E-01	8.85E-02	6.22E-02	0.00E+00	1.03E-03	0.00E+00	0.00E+00	3.89E-01	4.26E-01	9.58E-01	0.00E+00	0.00E+00	0.00E+00	5.60E-05	0.00E+00	7.38E-01	8.85E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.20E-02	4.32E-01	1.40E-16	4.99E+00	1.00E-02	6.38E-01	3.84E-01	9.56E-03	0.00E+00
2006	12	20	3.12E-01	0.00E+00	1.73E-01	0.00E+00	0.00E+00	7.49E-01	8.05E-01	1.70E+00	8.59E-03	5.37E+00	2.82E-03	9.90E-01	2.49E-01	1.04E+00	3.86E-01	2.88E-01	0.00E+00	1.73E-01	0.00E+00	0.00E+00	7.48E-01	7.50E-01	1.25E+00	3.63E-04	7.13E-06	0.00E+00	6.51E-04	1.52E-04	1.02E+00	3.22E-01	2.38E-02	0.00E+00	2.07E-04	0.00E+00	0.00E+00	8.96E-04	5.57E-02	4.51E-01	8.23E-03	5.37E+00	2.82E-03	9.90E-01	2.49E-01	1.22E-02	6.39E-02
2006	12	21	1.20E-01	0.00E+00	4.39E-03	0.00E+00	0.00E+00	5.19E-01	5.14E-01	1.47E+00	5.26E-17	2.11E+00	3.28E-02	7.53E-01	2.24E-01	8.81E-01	1.70E-01	1.20E-01	0.00E+00	4.39E-03	0.00E+00	0.00E+00	5.19E-01	4.73E-01	9.34E-01	0.00E+00	0.00E+00	0.00E+00	9.03E-05	0.00E+00	8.61E-01	1.70E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-02	5.32E-01	5.26E-17	2.11E+00	3.28E-02	7.52E-01	2.24E-01	1.98E-02	0.00E+00
2006	12	22	1.95E-01	0.00E+00	9.70E-02	0.00E+00	0.00E+00	1.20E+00	6.89E-01	2.17E+00	5.66E-03	5.59E+00	6.81E-03	8.18E-01	2.85E-01	1.54E+00	2.98E-01	1.55E-01	0.00E+00	9.69E-02	0.00E+00	0.00E+00	1.20E+00	5.95E-01	1.53E+00	4.17E-03	2.23E-04	7.11E-07	1.09E-03	5.26E-04	1.48E+00	2.05E-01	4.01E-02	0.00E+00	1.42E-04	0.00E+00	0.00E+00	1.53E-03	9.45E-02	6.44E-01	1.49E-03	5.59E+00	6.81E-03	8.16E-01	2.85E-01	6.53E-02	9.28E-02
2006	12	23	1.05E-01	0.00E+00	3.06E-03	0.00E+00	2.65E-11	4.54E-01	4.70E-01	1.57E+00	2.57E-17	3.79E+00	2.95E-02	7.56E-01	2.86E-01	8.57E-01	1.36E-01	1.05E-01	0.00E+00	3.06E-03	0.00E+00	0.00E+00	4.54E-01	4.38E-01	9.46E-01	0.00E+00	0.00E+00	0.00E+00	2.12E-05	0.00E+00	8.35E-01	1.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-11	0.00E+00	3.21E-02	6.25E-01	2.57E-17	3.79E+00	2.95E-02	7.56E-01	2.86E-01	2.21E-02	0.00E+00
2006	12	24	6.39E-01	6.10E-04	2.45E-01	1.33E-05	1.00E-01	1.58E+00	1.24E+00	3.38E+00	4.77E-02	8.07E+00	1.57E-01	1.23E+00	3.96E-01	2.54E+00	9.46E-01	6.21E-01	5.89E-04	2.40E-01	4.22E-06	1.59E-04	1.56E+00	1.17E+00	2.49E+00	4.07E-02	7.67E-03	2.59E-03	1.61E-02	1.12E-02	2.50E+00	8.72E-01	1.85E-02	2.02E-05	4.67E-03	9.08E-06	1.00E-01	2.41E-02	7.23E-02	8.90E-01	7.00E-03	8.06E+00	1.54E-01	1.22E+00	3.85E-01	3.69E-02	7.42E-02
2006	12	25	4.02E-01	7.16E-04	1.99E-01	1.28E-04	8.07E-04	3.39E+00	9.60E-01	4.93E+00	1.09E-01	2.88E+00	1.93E-01	5.17E-01	4.84E-01	2.71E+00	6.18E-01	3.93E-01	7.16E-04	1.98E-01	1.28E-04	6.04E-04	3.39E+00	9.13E-01	3.31E+00	1.06E-01	1.79E-02	4.71E-03	3.31E-02	2.49E-02	2.60E+00	5.79E-01	9.07E-03	0.00E+00	4.52E-04	0.00E+00	2.03E-04	2.88E-03	4.75E-02	1.62E+00	2.88E-03	8.26E+00	1.88E-01	4.84E-01	4.59E-01	1.14E-01	3.86E-02
2006	12	26	2.25E+00	7.94E-05	8.90E-01	8.51E-08	6.44E-06	2.22E+00	8.64E-01	3.50E+00	1.64E+00	7.99E+00	4.86E-03	1.40E+00	1.34E+00	3.01E+00	2.31E+00	1.98E+00	7.86E-05	5.90E-01	8.50E-08	6.43E-06	2.00E+00	7.05E-01	2.72E+00	2.78E-02	5.65E-03	1.03E-03	1.47E-02	9.90E-03	2.85E+00	2.05E+00	2.74E-01	7.97E-07	3.00E-01	1.25E-10	1.38E-08	2.24E-01	1.59E-01	7.82E-01	1.61E+00	7.98E+00	3.83E-03	1.38E+00	1.33E+00	1.61E-01	2.58E-01
2006	12	27	2.24E+00	3.13E-05	1.51E+00	6.49E-07	2.54E-06	2.25E+00	6.86E-02	2.72E+00	6.65E+00	1.31E-03	1.19E-04	2.48E-03	1.40E-03	3.41E+00	3.07E+00	2.13E+00	3.13E-05	9.61E-01	6.49E-07	2.54E-06	1.93E+00	6.80E-02	2.62E+00	8.33E-03	6.92E-04	1.04E-04	2.26E-03	1.26E-03	3.34E+00	2.93E+00	1.12E-01	0.00E+00	5.45E-01	0.00E+00	0.00E+00	3.16E-01	5.84E-04	1.00E-01	6.64E+00	6.16E-04	1.50E-05	2.25E-04	1.40E-04	7.04E-02	1.37E-01
2006	12	28	4.56E+00	1.05E+00	3.28E+00	1.51E-01	1.94E-01	6.92E+00	1.85E+00	8.06E+00	6.04E+00	5.53E+00	2.48E+00	9.20E-01	9.31E-01	6.19E+00	5.47E+00	3.95E+00	1.54E-02	1.88E+00	6.85E-03	1.03E-02	5.67E+00	1.78E+00	6.85E+00	1.35E-01	5.04E-02	2.79E-02	1.02E-01	7.19E-02	5.94E+00	4.48E+00	6.11E-01	1.03E+00	1.40E+00	1.44E-01	1.84E-01	1.25E+00	6.98E-02	1.21E+00	5.90E+00	5.48E+00	2.45E+00	8.18E-01	8.59E-01	2.47E-01	9.93E-01
2006	12	29	9.98E-01	6.40E-03	4.89E-01	3.99E-03	4.88E-03	1.89E+00	1.56E+00	3.92E+00	1.16E-01	9.03E+00	2.77E-02	1.23E+00	4.18E-01	2.58E+00	1.37E+00	9.66E-01	2.93E-03	4.84E-01	6.16E-04	1.30E-03	1.85E+00	1.50E+00	3.12E+00	6.75E-02	1.81E-02	7.89E-03	3.47E-02	2.60E-02	2.48E+00	1.28E+00	3.16E-02	3.47E-03	4.61E-03	3.38E-03	3.58E-03	4.10E-02	6.59E-02	7.99E-01	4.84E-02	9.02E+00	1.98E-02	1.20E+00	3.92E-01	9.54E-02	9.70E-02
2006	12	30	6.64E-01	1.34E-05	1.86E-01	0.00E+00	0.00E+00	1.66E+00	1.11E+00	3.31E+00	1.92E-02	1.10E+01	8.31E-03	1.18E+00	9.12E-01	2.37E+00	9.84E-01	6.63E-01	1.01E-05	1.82E-01	0.00E+00	0.00E+00	1.63E+00	1.03E+00	2.98E+00	1.60E-02	2.17E-03	3.38E-04	5.26E-03	3.36E-03	2.28E+00	9.78E-01	1.58E-03	3.31E-06	4.46E-03	0.00E+00	0.00E+00	2.57E-02	8.30E-02	3.32E-01	3.16E-03	1.10E+01	7.97E-03	1.18E+00	9.09E-01	8.95E-02	6.02E-03
2006	12	31	3.51E-01	6.41E-05	3.83E-01	8.23E-06	3.19E-05	2.39E+00	1.59E+00	3.44E+00	1.54E-02	9.90E+00	7.28E-04	1.06E+00	3.66E-01	3.50E+00	5.44E-01	2.89E-01	6.41E-05	3.83E-01	8.23E-06	3.19E-05	2.39E+00	1.50E+00	2.75E+00	1.46E-02	2.36E-03	5.76E-04	6.66E-03	4.03E-03	3.41E+00	4.05E-01	6.17E-02	0.00E+00	2.03E-06	0.00E+00	0.00E+00	3.80E-04	9.18E-02	6.86E-01	7.05E-04	9.90E+00	1.51E-04	1.05E+00	3.62E-01	8.62E-02	1.39E-01



Note: Benthic invertebrate habitat results are only calculated during July-September each year, although year-round flows are shown for reference. For clarity, closure phase results are abbreviated to 2058 but results are virtually identical between 2046-2058 (shown) and 2058-2100 (not shown). A median year was selected for displaying maximum AWS changes to baseline, during late operations and closure when the same value occurred in multiple years.

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT THE RSA-MPOI FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\Health Canada\Fig C-3-1 NO2 RSA-MPOI 14-00201.mxd

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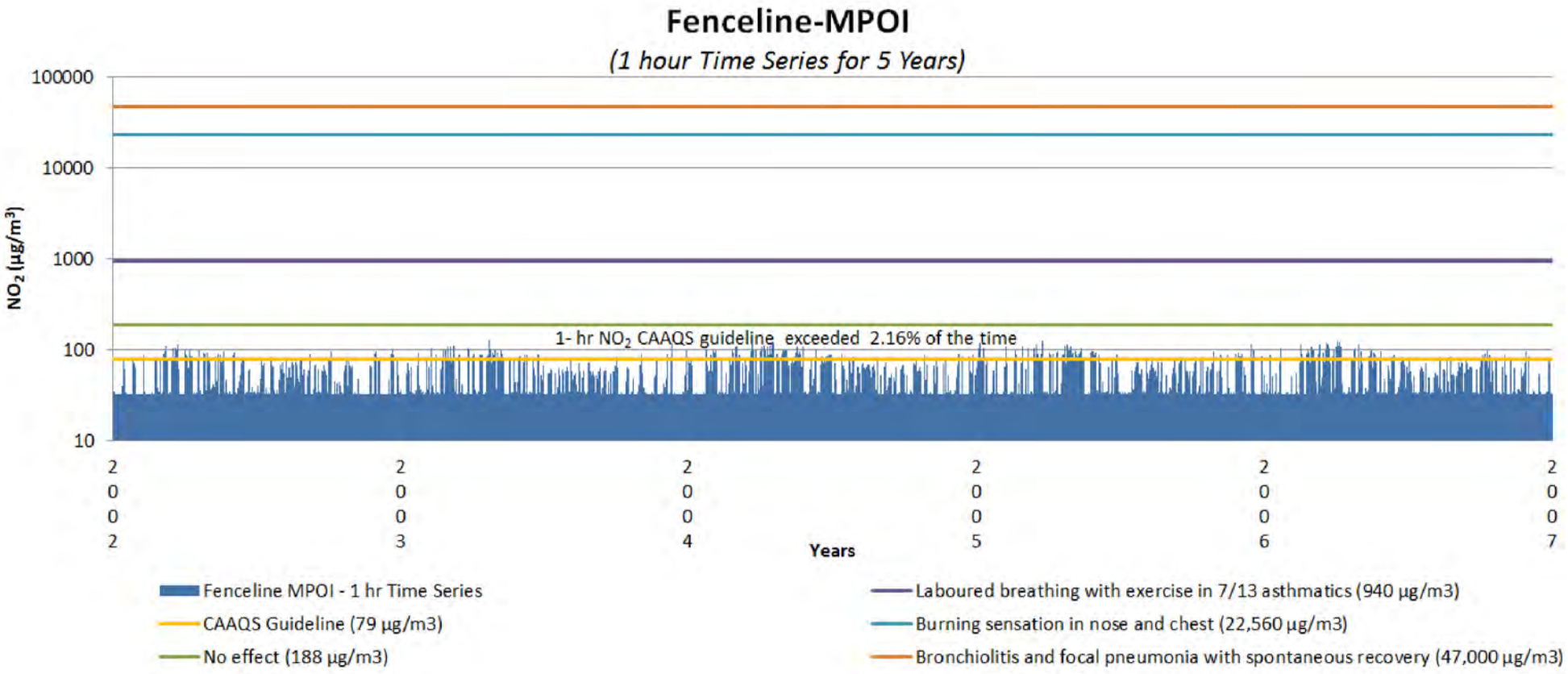

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT THE FENCELINE-MPOI FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.2

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SHealth Canada\Fig C-3-2 NO2 Fenceline-MPOI 14-00201.mxd

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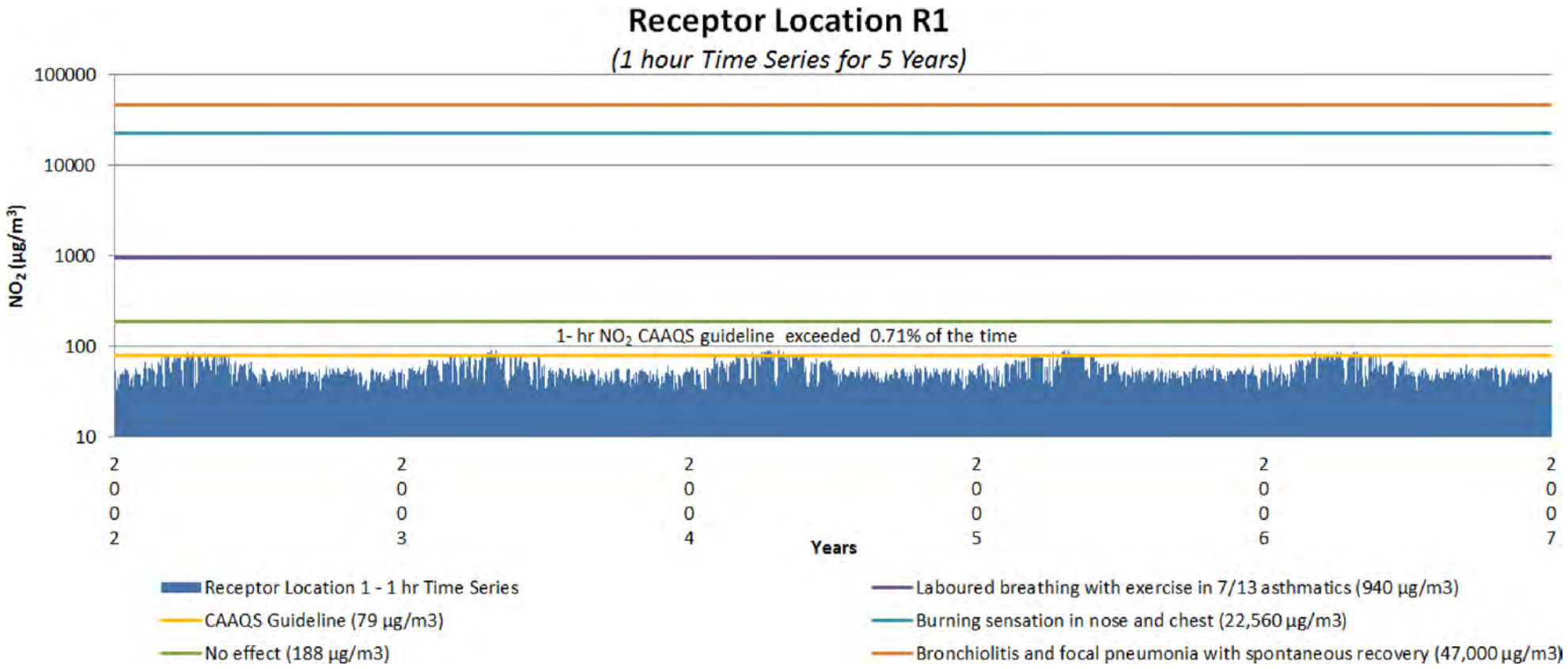

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R1 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.3

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SIHealth Canada\Fig C-3 NO2 Receptor Location 1 14-00201.mxd

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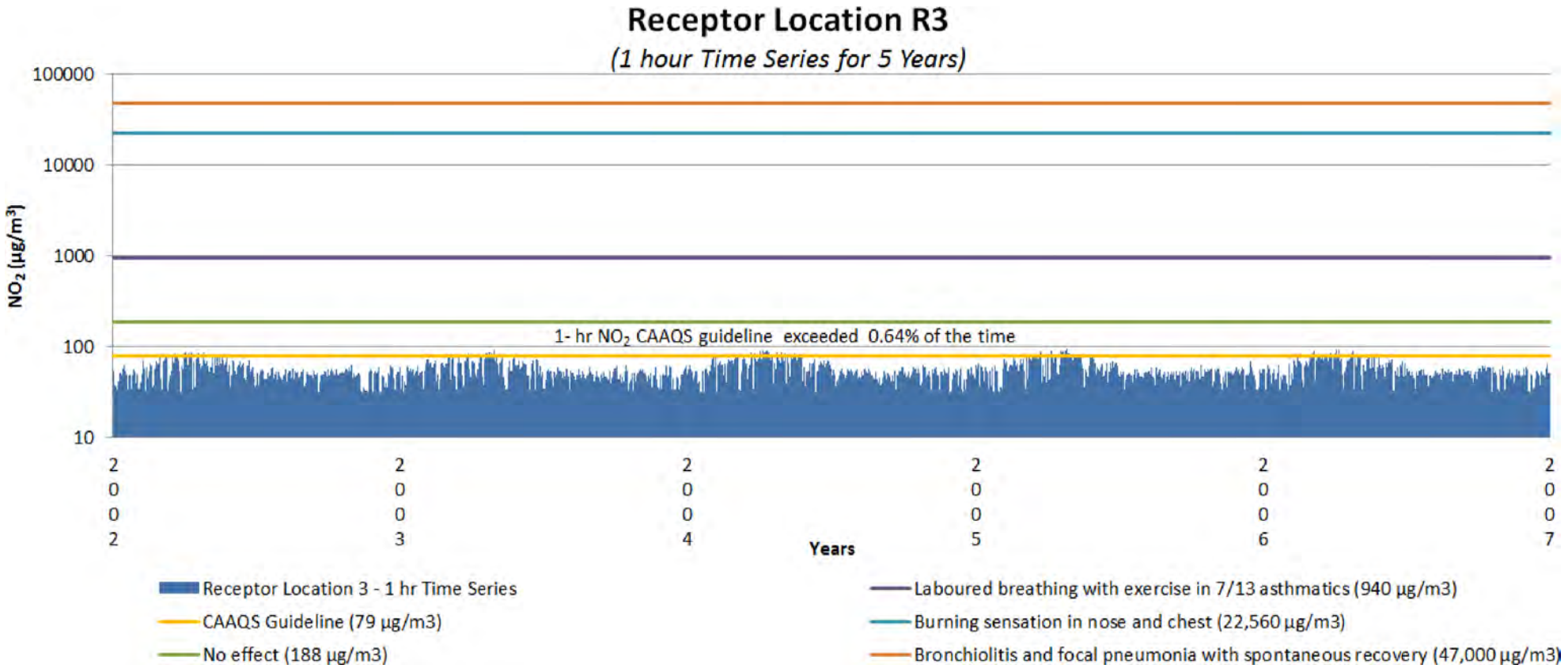

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R3 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.4

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SHealth Canada\Fig C-4 NO2 Receptor Location 3 14-00201.mxd

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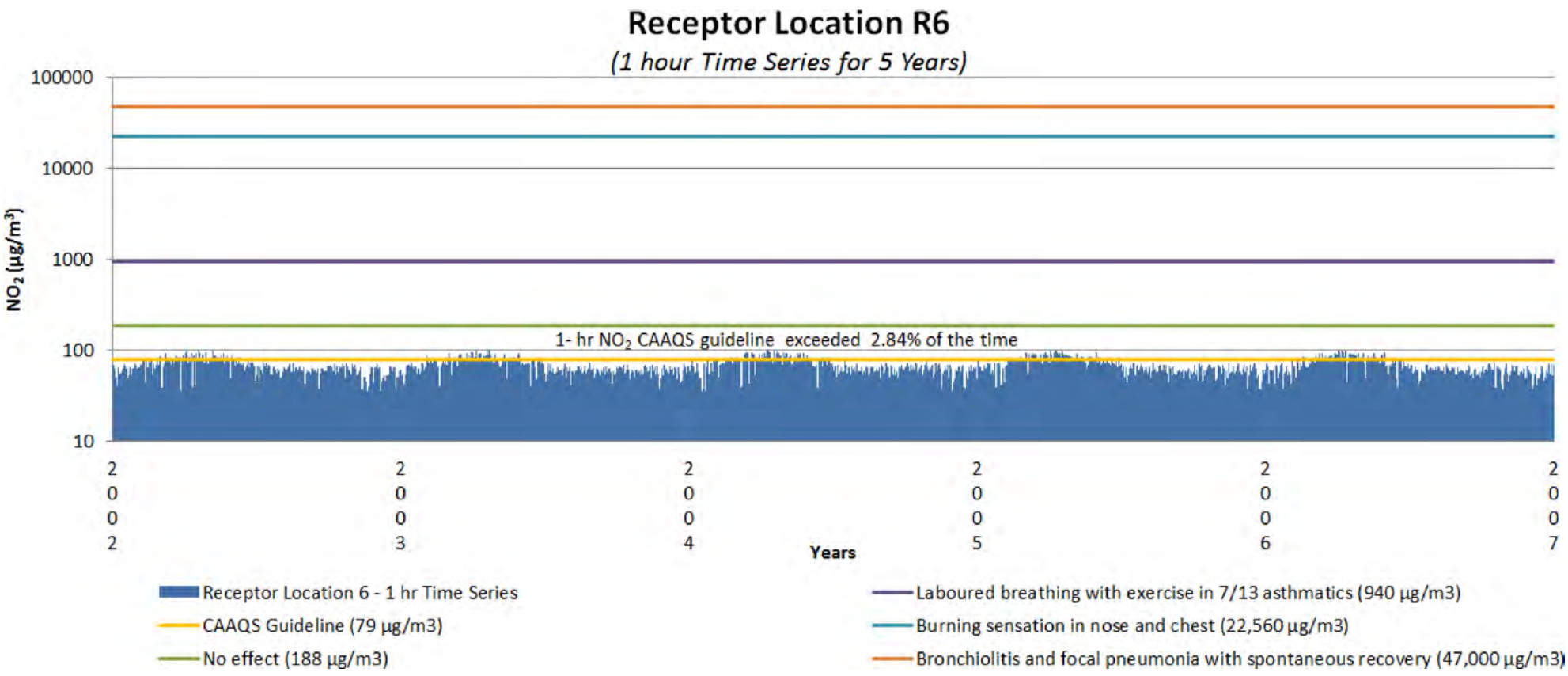

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R6 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.5

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SIHealth Canada\Fig C-5 NO2 Receptor Location 6 14-00201.mxd

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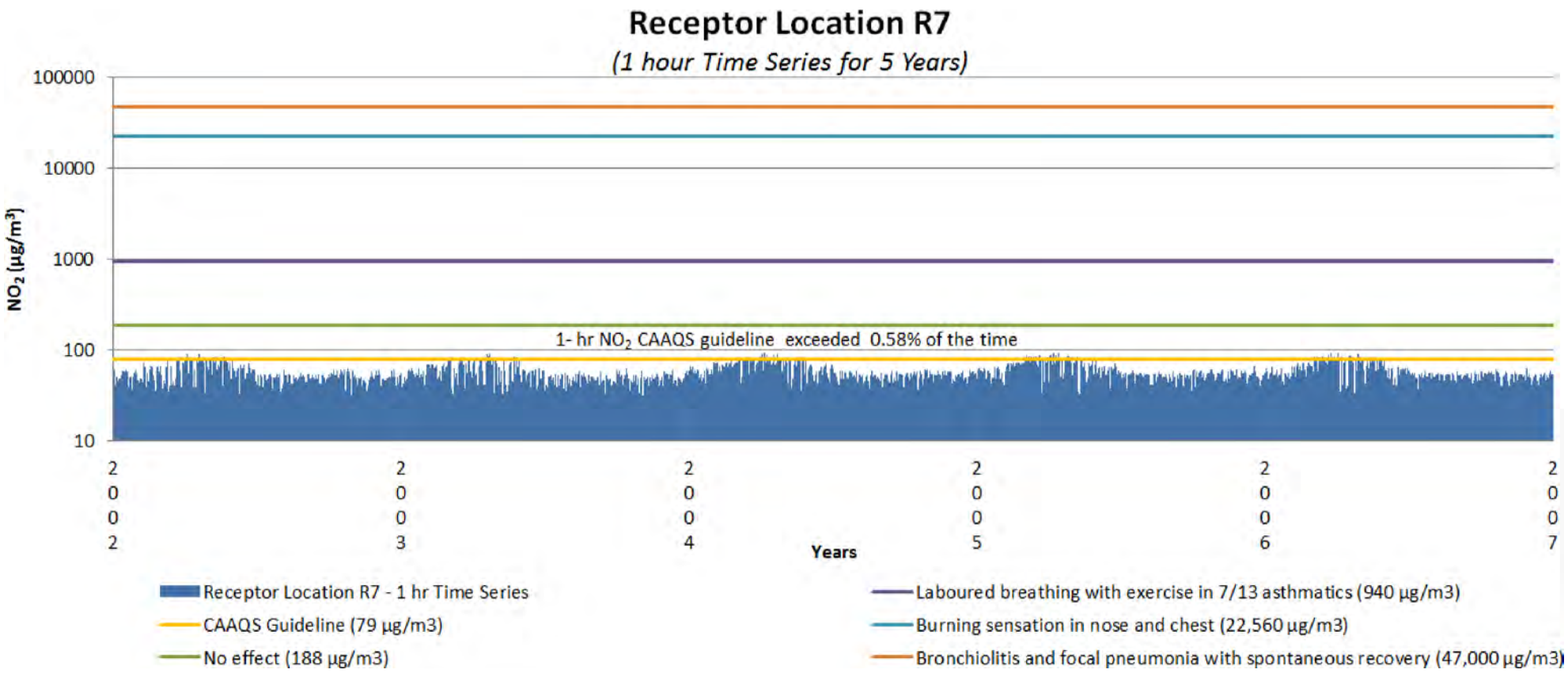

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R7 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.6

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SHealth Canada\Fig C-6 NO2 Receptor Location 7 14-00201.mxd

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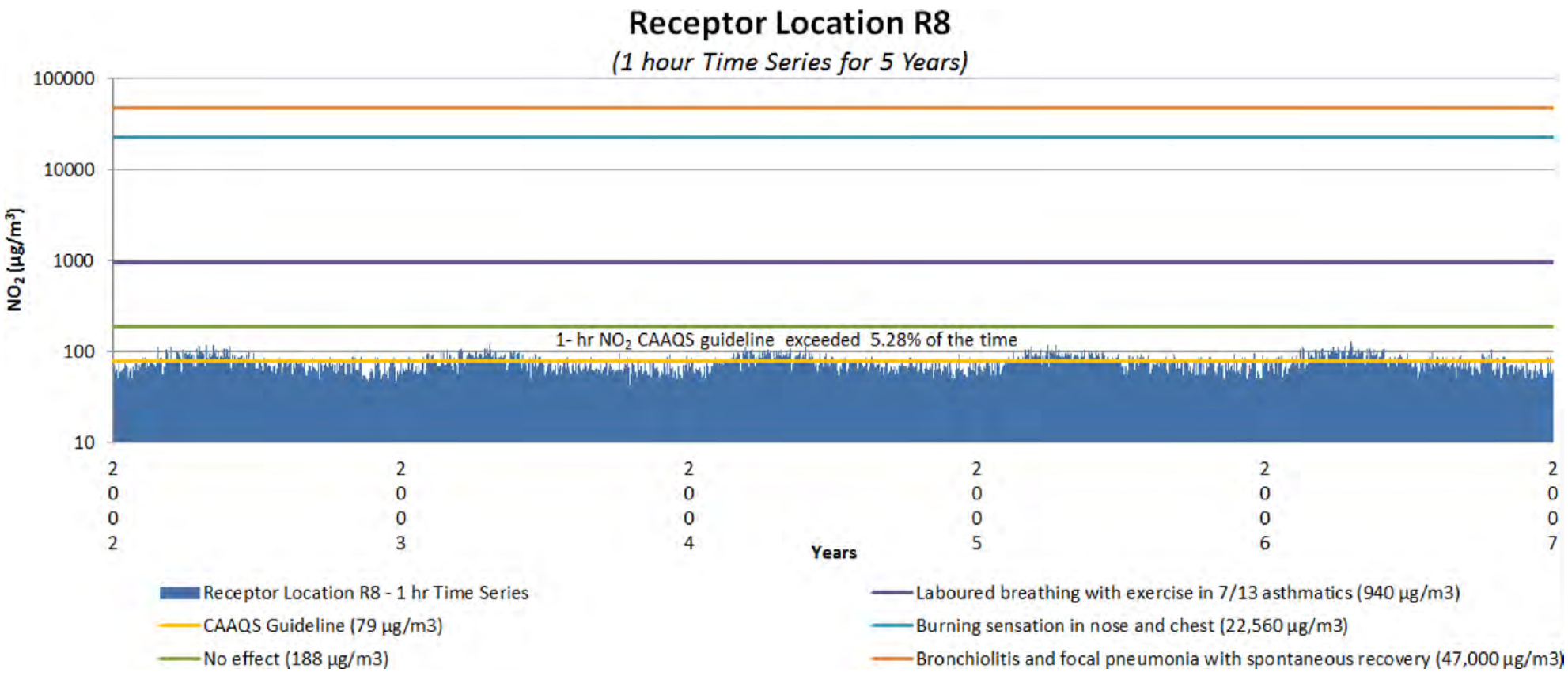

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R8 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.7

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SHealth Canada\Fig C-7 NO2 Receptor Location 8 14-00201.mxd

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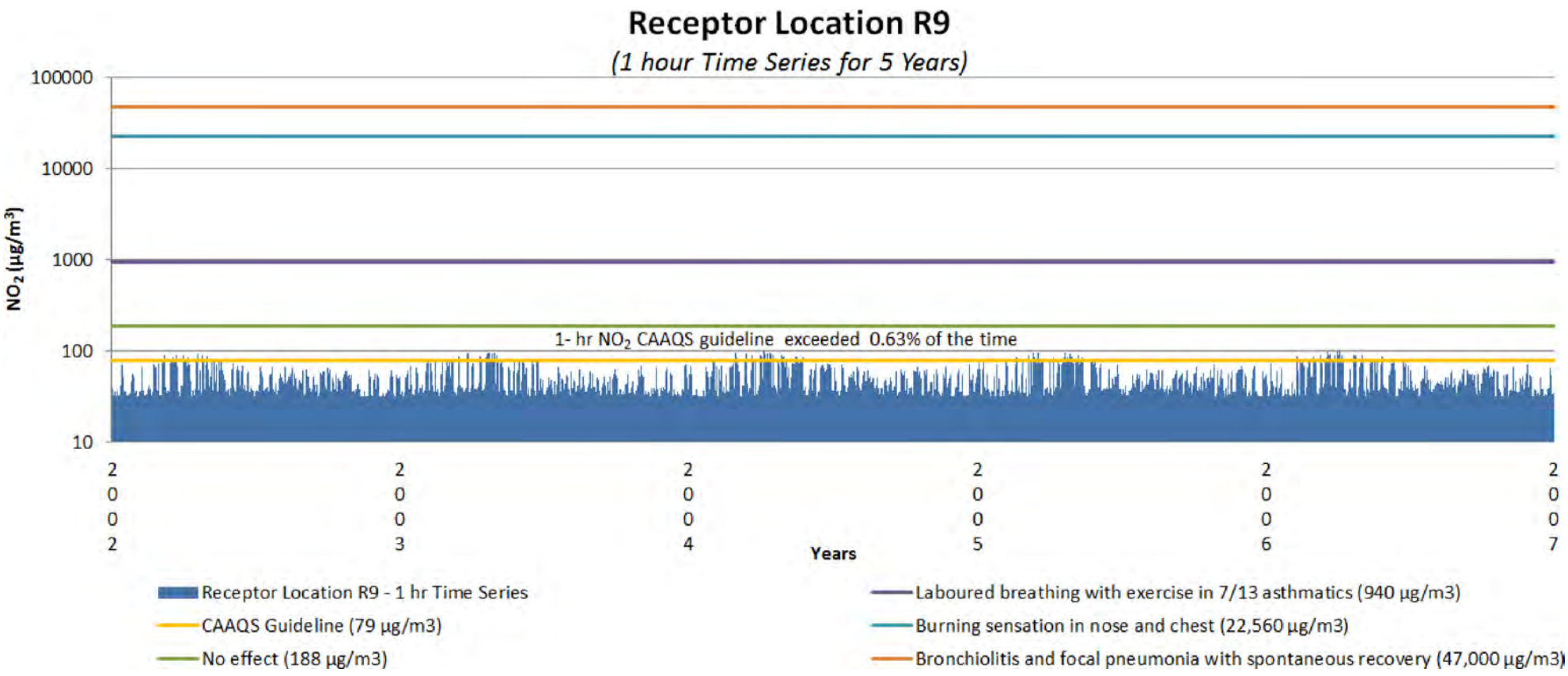

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R9 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.8

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SIHealth Canada\Fig C-8 NO2 Receptor Location 9 14-00201.mxd

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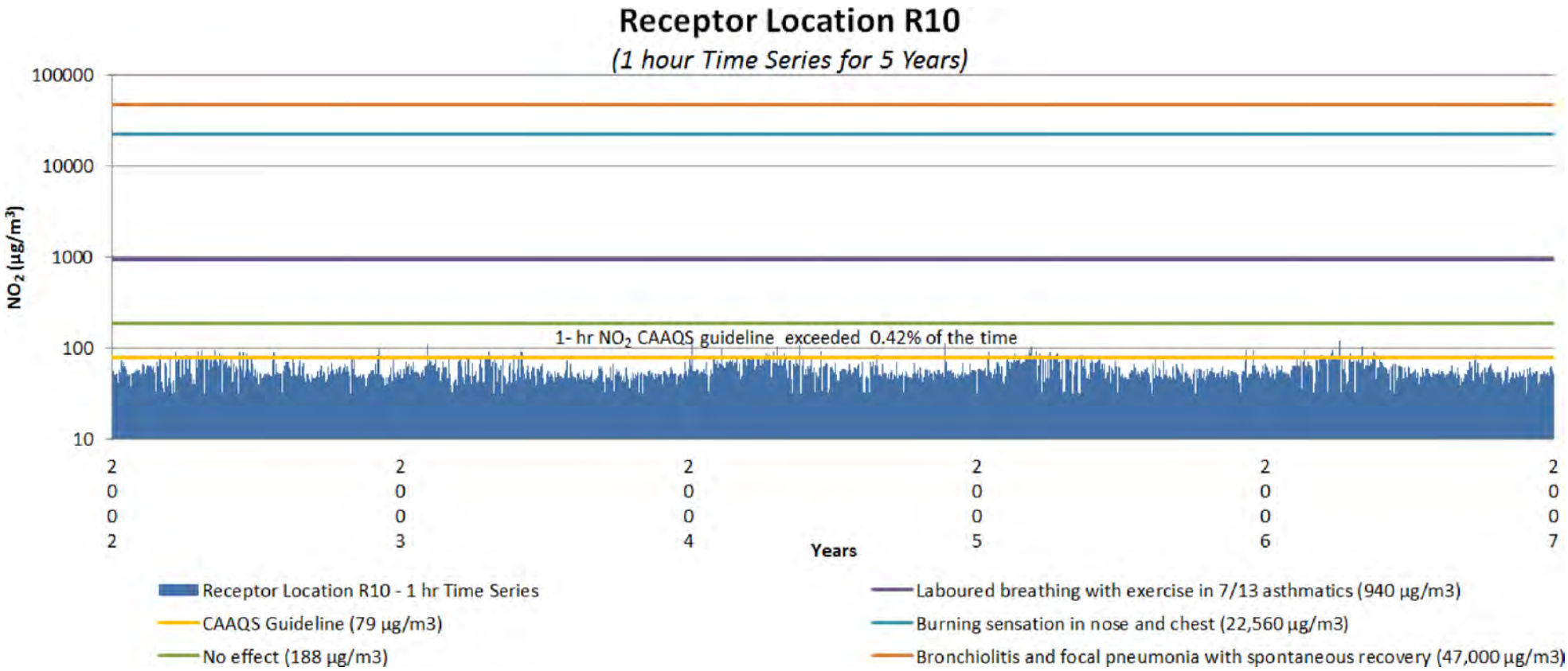

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R10 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.9

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SIHealth Canada\Fig C-9 NO2 Receptor Location 10 14-00201.mxd

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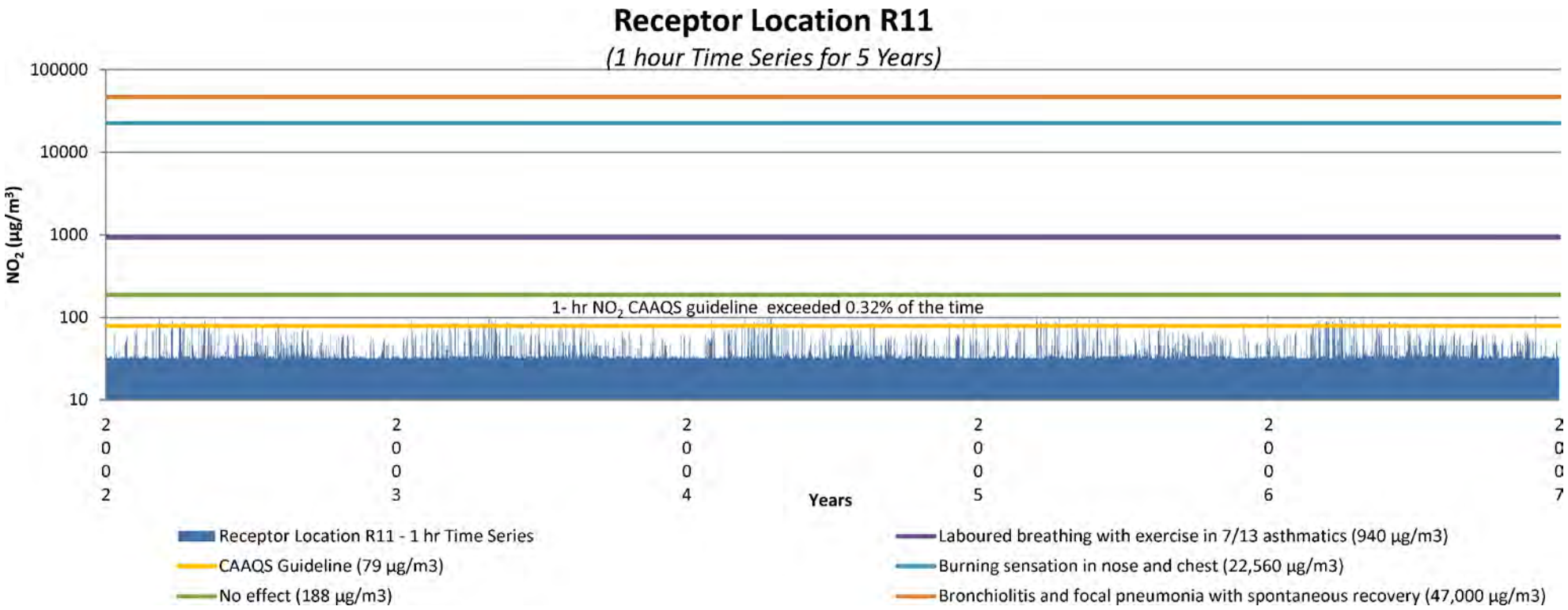

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R11 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: BS
DATE: JUNE 21, 2019

FIGURE
C.10

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\Landuse\Resubmission\Information Request 3\Fig C-10 NO2 Receptor Location 11 14-00201.mxd

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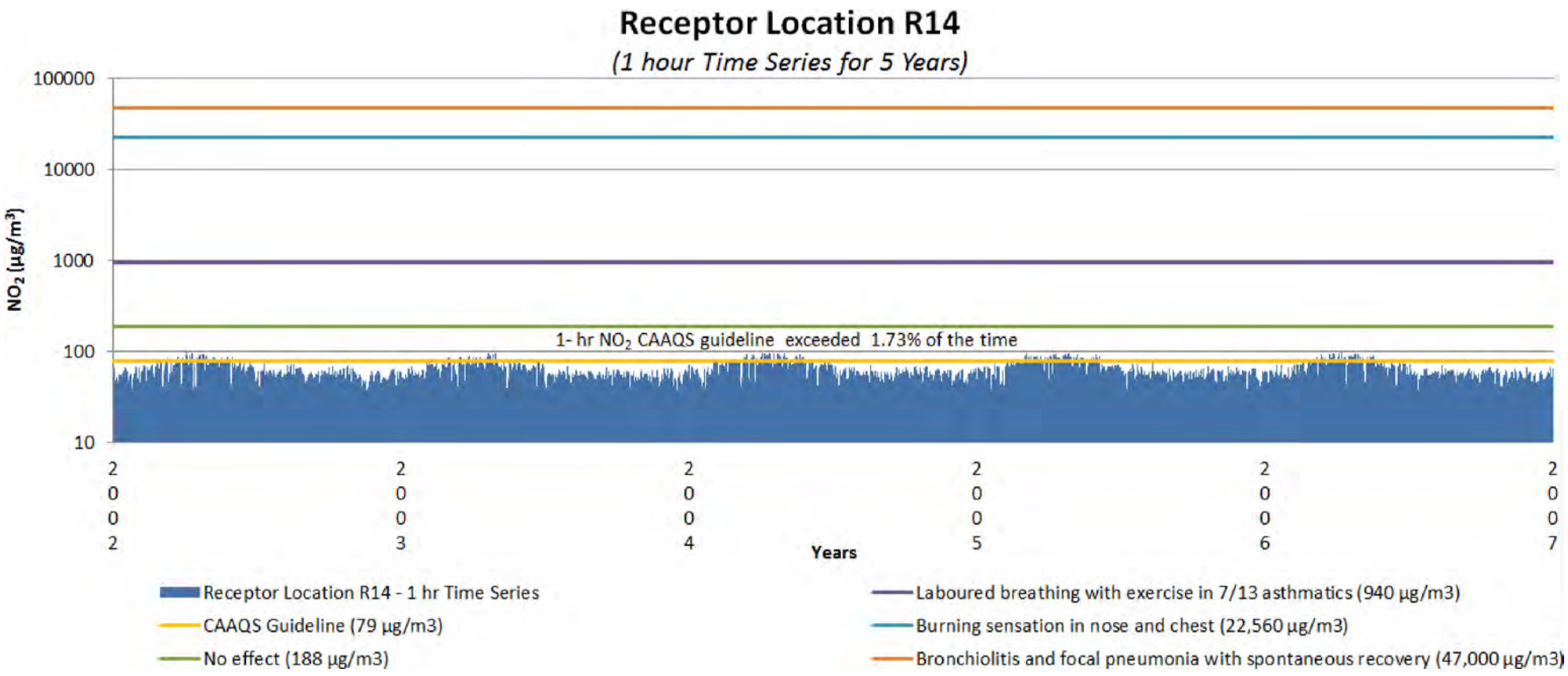

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

1-HOUR NO_2 (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R14 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.11

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\SHealth Canada\Fig C-11 NO2 Receptor Location 14 14-00201.mxd

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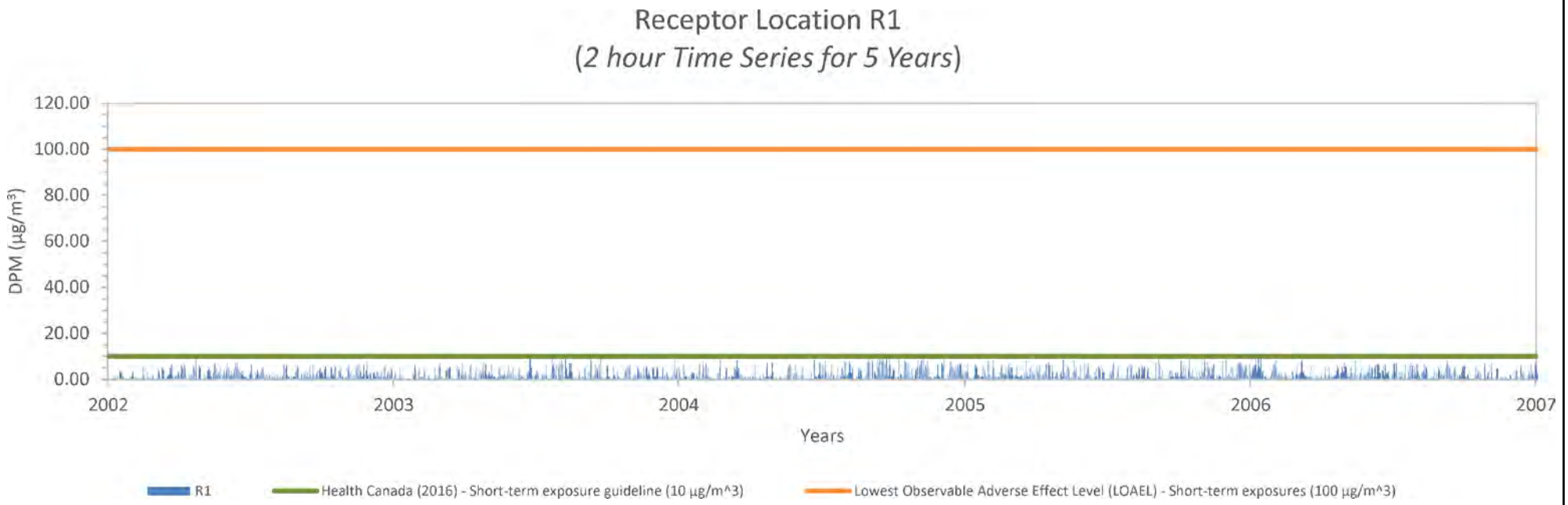

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

2-HOUR DIESEL PARTICULATE MATTER (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R1 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.12

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\Health Canada\Fig C-12 2-Hour Diesel Particulate Location 1 14-00201.mxd

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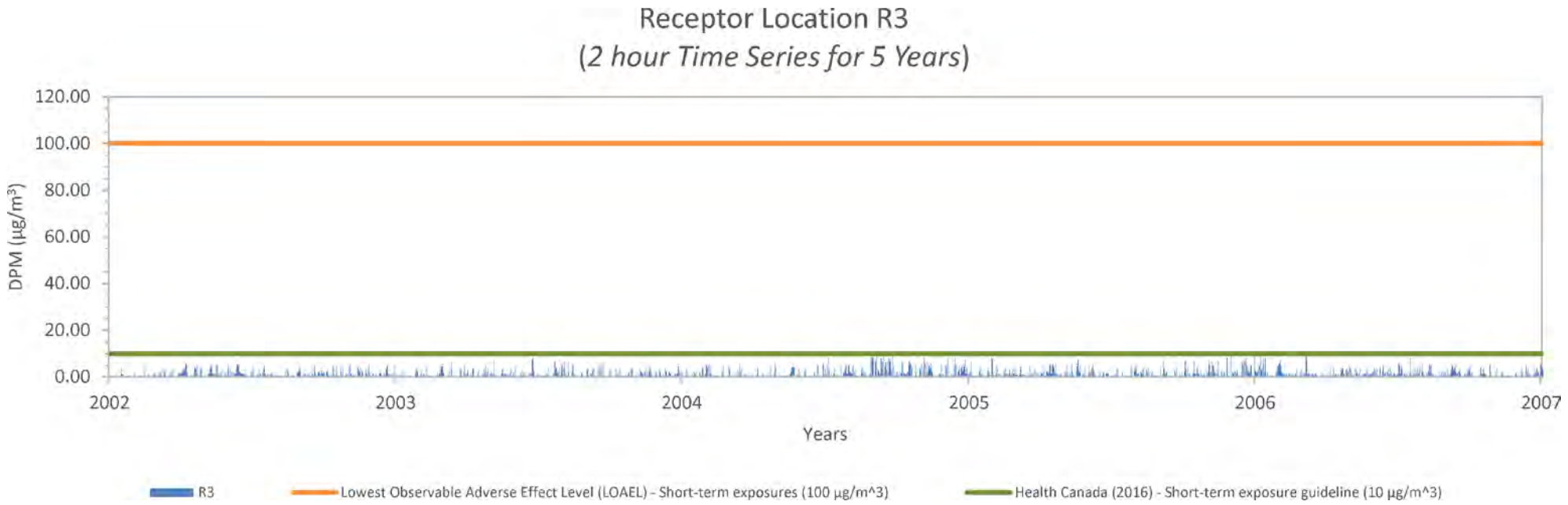

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

2-HOUR DIESEL PARTICULATE MATTER (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R3 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.13

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\Health Canada\Fig C-13 2-Hour Diesel Particulate Location 3 14-00201.mxd

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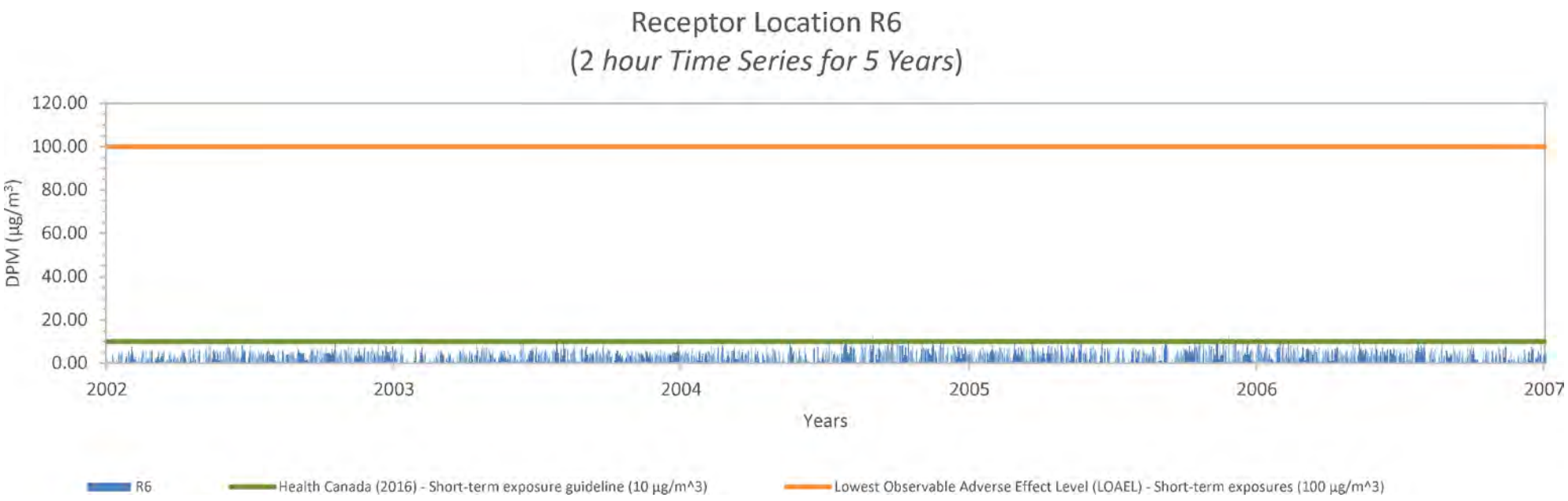

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

2-HOUR DIESEL PARTICULATE MATTER (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R6 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.14

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\Health Canada\Fig C-14 2-Hour Diesel Particulate Location 6 14-00201.mxd

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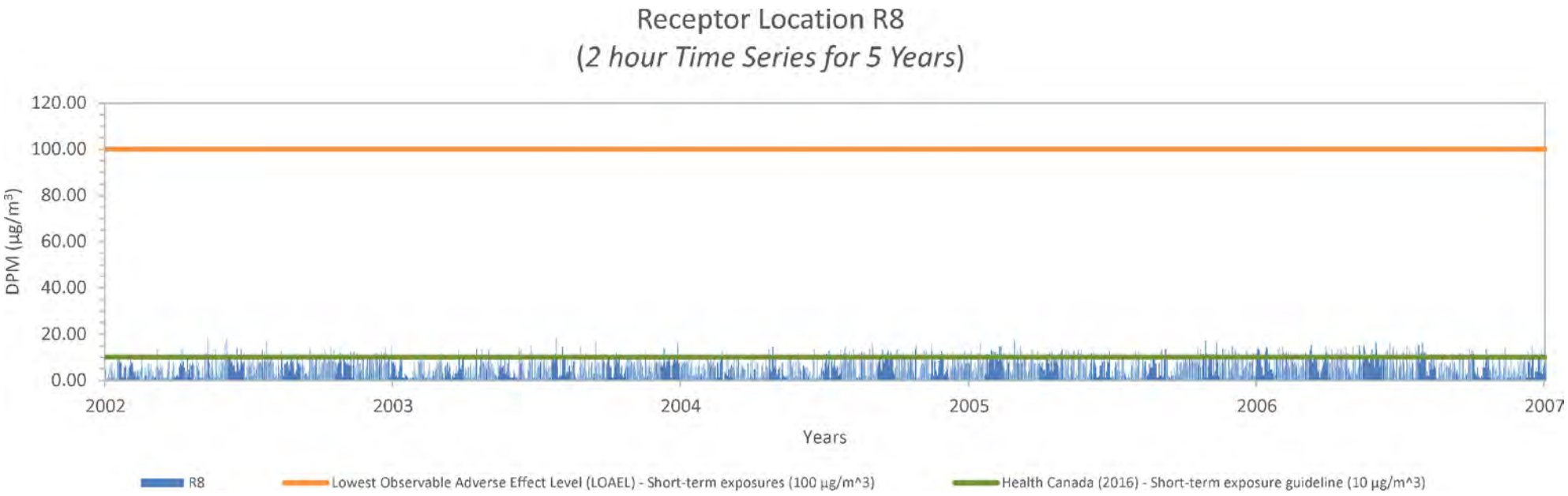

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

2-HOUR DIESEL PARTICULATE MATTER (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R8 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.15

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\Health Canada\Fig C-15 2-Hour Diesel Particulate Location 8 14-00201.mxd

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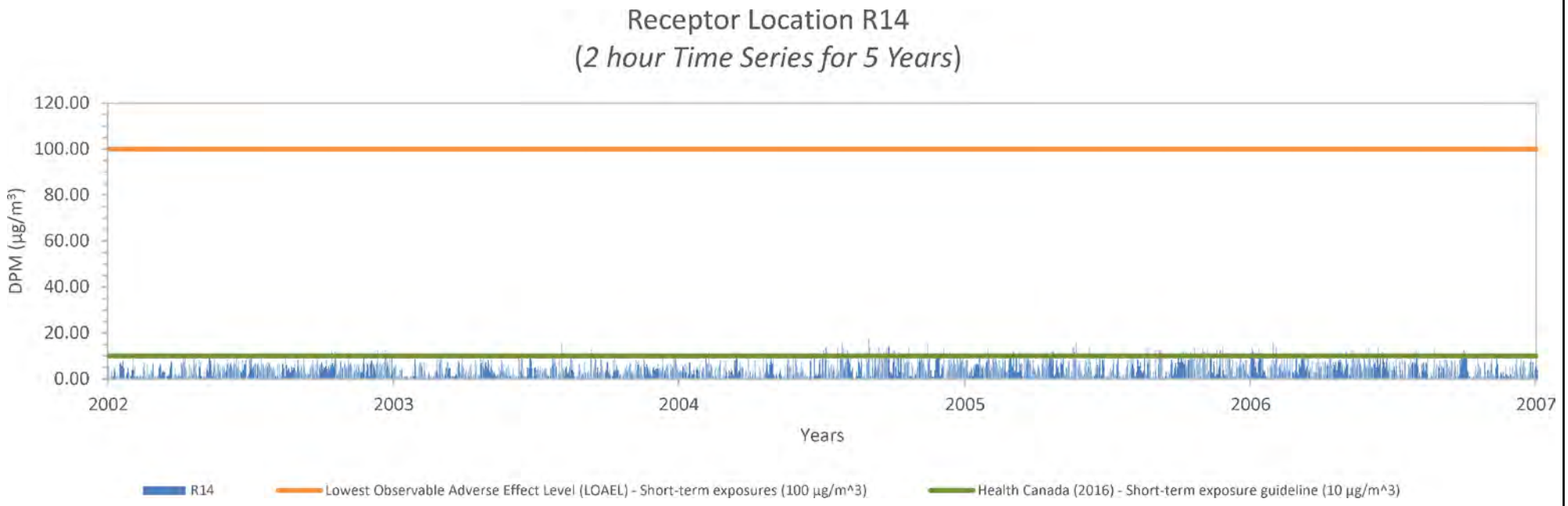

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

2-HOUR DIESEL PARTICULATE MATTER (µG/M^3) TIME SERIES DATA AT RECEPTOR LOCATION R14 FOR 5 YEARS

MEMS, 2019

PROJECT: 14-00201
DRAWN BY: JLAMBERTS
CHECKED BY: SF
DATE: JUNE 21, 2019

FIGURE
C.16

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR\Health Canada\Fig C-16 2-Hour Diesel Particulate Location 14 14-00201.mxd

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APPENDIX D: CHRONIC INHALATION RESULTS

TABLE D.1: Predicted Hazard Quotients from Inhalation of Criteria Air Contaminants

Criteria Air Contaminant	NO2						PM2.5			PM10		
Averaging Time	Annual (WHO TRV)			Annual (CCME CAAQSs)			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	8.6E-01	1.3E+00	1.6E+00	1.5E+00	2.2E+00	2.8E+00	1.8E+00	5.8E-01	1.8E+00	2.7E+00	6.5E-01	3.3E+00
FL-MPOI	3.0E-01	5.2E-01	6.9E-01	5.2E-01	9.1E-01	1.2E+00	2.1E-01	3.5E-02	2.1E-01	3.2E-01	6.8E-01	9.8E-01
R1	7.8E-02	6.5E-01	6.8E-01	1.4E-01	1.1E+00	1.2E+00	1.3E-02	1.4E-01	1.5E-01	8.9E-03	8.0E-01	8.1E-01
R2	1.6E-02	4.1E-01	4.3E-01	2.7E-02	7.1E-01	7.4E-01	1.1E-02	7.8E-04	1.2E-02	1.3E-02	6.5E-01	6.6E-01
R3	1.3E-02	6.7E-01	6.8E-01	2.3E-02	1.2E+00	1.2E+00	5.6E-03	8.2E-02	8.7E-02	6.4E-03	7.3E-01	7.3E-01
R4	4.5E-03	4.1E-01	4.1E-01	7.8E-03	7.1E-01	7.2E-01	3.0E-03	3.1E-04	3.3E-03	3.4E-03	6.5E-01	6.5E-01
R5	7.6E-03	4.1E-01	4.2E-01	1.3E-02	7.1E-01	7.3E-01	4.8E-03	5.0E-04	5.3E-03	5.7E-03	6.5E-01	6.6E-01
R6	2.0E-02	9.5E-01	9.6E-01	3.5E-02	1.7E+00	1.7E+00	6.5E-03	3.9E-01	3.9E-01	6.5E-03	1.1E+00	1.1E+00
R7	3.6E-02	7.7E-01	7.8E-01	6.3E-02	1.3E+00	1.4E+00	7.4E-03	1.6E-01	1.7E-01	6.1E-03	8.2E-01	8.3E-01
R8	3.9E-01	1.2E+00	1.3E+00	6.7E-01	2.0E+00	2.2E+00	6.5E-02	4.9E-01	5.5E-01	4.4E-02	1.2E+00	1.2E+00
R9	1.2E-01	4.5E-01	5.4E-01	2.0E-01	7.7E-01	9.4E-01	4.3E-02	1.2E-02	5.5E-02	7.4E-02	6.6E-01	7.3E-01
R10	3.3E-01	4.2E-01	7.1E-01	5.7E-01	7.3E-01	1.2E+00	2.7E-01	3.3E-03	2.7E-01	3.7E-01	6.5E-01	1.0E+00
R11	7.0E-02	4.1E-01	4.8E-01	1.2E-01	7.2E-01	8.3E-01	5.4E-02	1.6E-03	5.5E-02	7.0E-02	6.5E-01	7.2E-01
R12	1.0E-01	4.3E-01	5.2E-01	1.7E-01	7.4E-01	9.1E-01	3.0E-02	6.3E-03	3.6E-02	5.2E-02	6.6E-01	7.1E-01
R13	8.6E-02	4.2E-01	5.0E-01	1.5E-01	7.3E-01	8.8E-01	4.3E-02	4.6E-03	4.8E-02	5.7E-02	6.5E-01	7.1E-01
R14	6.3E-02	9.0E-01	9.2E-01	1.1E-01	1.6E+00	1.6E+00	1.0E-02	4.7E-01	4.8E-01	7.0E-03	1.2E+00	1.2E+00

TABLE D.2: Predicted Hazard Quotients from Inhalation of Metals

COPC	Aluminum			Antimony			Arsenic		
Averaging Time	Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	1.1E-04	2.1E-04	2.5E-04	3.1E-05	1.5E-05	3.1E-05	4.6E-06	-	-
FL-MPOI	8.7E-06	1.1E-05	1.2E-05	3.7E-06	8.8E-07	3.8E-06	3.9E-07	-	-
R1	5.9E-06	4.7E-05	5.3E-05	1.4E-07	3.6E-06	3.7E-06	2.5E-07	-	-
R2	5.1E-07	2.4E-07	7.6E-07	2.0E-07	1.7E-08	2.1E-07	2.3E-08	-	-
R3	7.7E-07	3.0E-05	3.0E-05	8.6E-08	1.9E-06	2.0E-06	3.3E-08	-	-
R4	1.6E-07	1.0E-07	2.6E-07	5.6E-08	6.3E-09	6.2E-08	7.0E-09	-	-
R5	2.5E-07	1.6E-07	4.1E-07	9.0E-08	1.0E-08	1.0E-07	1.1E-08	-	-
R6	1.3E-06	1.2E-04	1.3E-04	9.1E-08	1.1E-05	1.1E-05	5.7E-08	-	-
R7	2.6E-06	6.0E-05	6.2E-05	1.0E-07	4.3E-06	4.4E-06	1.1E-07	-	-
R8	3.9E-05	1.8E-04	2.2E-04	6.4E-07	1.2E-05	1.3E-05	1.6E-06	-	-
R9	4.1E-06	3.8E-06	7.9E-06	6.9E-07	3.1E-07	9.6E-07	1.8E-07	-	-
R10	9.8E-06	1.0E-06	1.1E-05	4.8E-06	8.0E-08	4.9E-06	4.5E-07	-	-
R11	2.3E-06	4.8E-07	2.7E-06	9.8E-07	3.6E-08	1.0E-06	1.0E-07	-	-
R12	2.9E-06	1.9E-06	4.8E-06	5.4E-07	1.5E-07	6.8E-07	1.3E-07	-	-
R13	2.5E-06	1.4E-06	3.9E-06	7.4E-07	1.1E-07	8.4E-07	1.1E-07	-	-
R14	4.5E-06	1.7E-04	1.7E-04	1.2E-07	1.2E-05	1.2E-05	1.9E-07	-	-

TABLE D.2: Predicted Hazard Quotients from Inhalation of Metals

COPC	Barium			Beryllium			Cadmium			Chromium		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	1.7E-03	7.2E-04	1.7E-03	3.3E-04	1.3E-04	3.3E-04	2.0E-02	4.2E-02	5.0E-02	6.2E-07	-	-
FL-MPOI	2.0E-04	4.3E-05	2.0E-04	3.8E-05	8.0E-06	3.9E-05	2.6E-03	2.2E-03	2.8E-03	6.7E-08	-	-
R1	4.5E-06	1.7E-04	1.8E-04	8.0E-07	3.2E-05	3.3E-05	1.1E-03	9.5E-03	1.1E-02	3.4E-08	-	-
R2	1.1E-05	8.2E-07	1.1E-05	2.0E-06	1.5E-07	2.2E-06	1.5E-04	4.9E-05	2.0E-04	3.8E-09	-	-
R3	4.4E-06	8.8E-05	9.2E-05	8.3E-07	1.6E-05	1.7E-05	1.6E-04	5.9E-03	6.1E-03	4.7E-09	-	-
R4	3.0E-06	3.0E-07	3.3E-06	5.7E-07	5.6E-08	6.3E-07	4.4E-05	2.0E-05	6.3E-05	1.1E-09	-	-
R5	4.9E-06	5.0E-07	5.3E-06	9.3E-07	9.3E-08	1.0E-06	7.0E-05	3.2E-05	1.0E-04	1.8E-09	-	-
R6	4.4E-06	5.3E-04	5.3E-04	8.2E-07	1.0E-04	1.0E-04	2.7E-04	2.5E-02	2.6E-02	7.9E-09	-	-
R7	4.1E-06	2.1E-04	2.1E-04	7.4E-07	3.9E-05	3.9E-05	5.0E-04	1.2E-02	1.2E-02	1.5E-08	-	-
R8	1.4E-05	5.9E-04	6.0E-04	2.2E-06	1.1E-04	1.1E-04	7.2E-03	3.7E-02	4.4E-02	2.2E-07	-	-
R9	3.6E-05	1.5E-05	4.8E-05	6.8E-06	2.8E-06	9.2E-06	9.3E-04	7.7E-04	1.7E-03	2.6E-08	-	-
R10	2.6E-04	3.8E-06	2.6E-04	5.0E-05	7.2E-07	5.0E-05	3.1E-03	2.1E-04	3.3E-03	7.8E-08	-	-
R11	5.3E-05	1.7E-06	5.5E-05	1.0E-05	3.3E-07	1.0E-05	6.8E-04	9.8E-05	7.8E-04	1.7E-08	-	-
R12	2.8E-05	7.4E-06	3.5E-05	5.4E-06	1.4E-06	6.6E-06	6.8E-04	3.9E-04	1.1E-03	1.9E-08	-	-
R13	4.0E-05	5.4E-06	4.4E-05	7.6E-06	1.0E-06	8.4E-06	6.6E-04	2.9E-04	9.4E-04	1.8E-08	-	-
R14	3.9E-06	5.9E-04	5.9E-04	6.9E-07	1.1E-04	1.1E-04	8.5E-04	3.4E-02	3.4E-02	2.6E-08	-	-

TABLE D.2: Predicted Hazard Quotients from Inhalation of Metals

COPC	Cobalt			Copper			Lead			Manganese		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	7.7E-03	3.2E-03	7.7E-03	4.2E-04	8.7E-04	1.0E-03	1.2E-03	2.5E-03	2.9E-03	1.1E-03	2.1E-03	2.5E-03
FL-MPOI	9.0E-04	1.9E-04	9.2E-04	5.3E-05	4.6E-05	5.7E-05	1.5E-04	1.3E-04	1.6E-04	8.6E-05	1.1E-04	1.2E-04
R1	1.9E-05	7.6E-04	7.8E-04	2.3E-05	2.0E-04	2.2E-04	6.6E-05	5.6E-04	6.2E-04	5.8E-05	4.6E-04	5.2E-04
R2	4.8E-05	3.6E-06	5.1E-05	3.0E-06	1.0E-06	4.0E-06	8.6E-06	2.9E-06	1.1E-05	5.1E-06	2.4E-06	7.5E-06
R3	2.0E-05	3.9E-04	4.0E-04	3.3E-06	1.2E-04	1.3E-04	9.5E-06	3.5E-04	3.6E-04	7.7E-06	2.9E-04	3.0E-04
R4	1.4E-05	1.3E-06	1.5E-05	8.9E-07	4.1E-07	1.3E-06	2.5E-06	1.2E-06	3.7E-06	1.5E-06	9.9E-07	2.5E-06
R5	2.2E-05	2.2E-06	2.4E-05	1.4E-06	6.7E-07	2.1E-06	4.1E-06	1.9E-06	6.0E-06	2.5E-06	1.6E-06	4.1E-06
R6	1.9E-05	2.4E-03	2.4E-03	5.5E-06	5.3E-04	5.3E-04	1.6E-05	1.5E-03	1.5E-03	1.3E-05	1.2E-03	1.2E-03
R7	1.8E-05	9.1E-04	9.3E-04	1.0E-05	2.5E-04	2.6E-04	2.9E-05	7.1E-04	7.4E-04	2.6E-05	5.9E-04	6.2E-04
R8	5.1E-05	2.6E-03	2.6E-03	1.5E-04	7.6E-04	9.1E-04	4.3E-04	2.2E-03	2.6E-03	3.8E-04	1.8E-03	2.2E-03
R9	1.6E-04	6.7E-05	2.2E-04	1.9E-05	1.6E-05	3.5E-05	5.5E-05	4.5E-05	1.0E-04	4.1E-05	3.7E-05	7.8E-05
R10	1.2E-03	1.7E-05	1.2E-03	6.3E-05	4.3E-06	6.6E-05	1.8E-04	1.2E-05	1.9E-04	9.7E-05	1.0E-05	1.1E-04
R11	2.4E-04	7.7E-06	2.5E-04	1.4E-05	2.0E-06	1.6E-05	4.0E-05	5.8E-06	4.5E-05	2.2E-05	4.8E-06	2.7E-05
R12	1.3E-04	3.3E-05	1.6E-04	1.4E-05	8.2E-06	2.2E-05	4.0E-05	2.3E-05	6.2E-05	2.9E-05	1.9E-05	4.7E-05
R13	1.8E-04	2.4E-05	2.0E-04	1.4E-05	6.0E-06	1.9E-05	3.9E-05	1.7E-05	5.5E-05	2.5E-05	1.4E-05	3.9E-05
R14	1.6E-05	2.6E-03	2.6E-03	1.8E-05	7.0E-04	7.1E-04	5.0E-05	2.0E-03	2.0E-03	4.5E-05	1.6E-03	1.7E-03

TABLE D.2: Predicted Hazard Quotients from Inhalation of Metals

COPC	Mercury			Molybdenum			Nickel			Selenium		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	3.0E-05	1.2E-05	3.0E-05	8.6E-07	3.6E-07	8.7E-07	4.6E-02	1.9E-02	4.6E-02	3.9E-07	1.6E-07	4.0E-07
FL-MPOI	3.6E-06	7.4E-07	3.6E-06	1.0E-07	2.1E-08	1.0E-07	5.4E-03	1.1E-03	5.5E-03	4.6E-08	9.7E-09	4.7E-08
R1	7.4E-08	3.0E-06	3.1E-06	2.1E-09	8.6E-08	8.8E-08	1.1E-04	4.5E-03	4.6E-03	9.7E-10	3.9E-08	4.0E-08
R2	1.9E-07	1.4E-08	2.0E-07	5.4E-09	4.1E-10	5.7E-09	2.9E-04	2.2E-05	3.0E-04	2.5E-09	1.9E-10	2.6E-09
R3	7.7E-08	1.5E-06	1.6E-06	2.2E-09	4.3E-08	4.5E-08	1.2E-04	2.3E-03	2.4E-03	1.0E-09	2.0E-08	2.1E-08
R4	5.3E-08	5.2E-09	5.8E-08	1.5E-09	1.5E-10	1.7E-09	8.0E-05	7.9E-06	8.8E-05	6.9E-10	6.8E-11	7.6E-10
R5	8.6E-08	8.6E-09	9.4E-08	2.5E-09	2.5E-10	2.7E-09	1.3E-04	1.3E-05	1.4E-04	1.1E-09	1.1E-10	1.2E-09
R6	7.6E-08	9.2E-06	9.3E-06	2.2E-09	2.6E-07	2.7E-07	1.2E-04	1.4E-02	1.4E-02	9.9E-10	1.2E-07	1.2E-07
R7	6.9E-08	3.6E-06	3.6E-06	2.0E-09	1.0E-07	1.0E-07	1.0E-04	5.4E-03	5.5E-03	9.0E-10	4.7E-08	4.8E-08
R8	2.0E-07	1.0E-05	1.0E-05	5.7E-09	2.9E-07	3.0E-07	3.0E-04	1.5E-02	1.6E-02	2.6E-09	1.3E-07	1.4E-07
R9	6.3E-07	2.6E-07	8.5E-07	1.8E-08	7.5E-09	2.4E-08	9.6E-04	4.0E-04	1.3E-03	8.2E-09	3.4E-09	1.1E-08
R10	4.6E-06	6.7E-08	4.6E-06	1.3E-07	1.9E-09	1.3E-07	7.0E-03	1.0E-04	7.1E-03	6.0E-08	8.7E-10	6.1E-08
R11	9.4E-07	3.0E-08	9.6E-07	2.7E-08	8.7E-10	2.8E-08	1.4E-03	4.6E-05	1.5E-03	1.2E-08	4.0E-10	1.3E-08
R12	5.0E-07	1.3E-07	6.1E-07	1.4E-08	3.7E-09	1.8E-08	7.6E-04	1.9E-04	9.3E-04	6.5E-09	1.7E-09	8.0E-09
R13	7.0E-07	9.4E-08	7.8E-07	2.0E-08	2.7E-09	2.2E-08	1.1E-03	1.4E-04	1.2E-03	9.2E-09	1.2E-09	1.0E-08
R14	6.4E-08	1.0E-05	1.0E-05	1.8E-09	2.9E-07	2.9E-07	9.7E-05	1.5E-02	1.6E-02	8.3E-10	1.3E-07	1.3E-07

TABLE D.2: Predicted Hazard Quotients from Inhalation of Metals

COPC	Uranium			Vanadium		
Averaging Time	Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	3.3E-04	1.3E-04	3.3E-04	5.6E-03	1.1E-02	1.4E-02
FL-MPOI	3.8E-05	8.0E-06	3.9E-05	6.2E-04	6.0E-04	6.9E-04
R1	8.0E-07	3.2E-05	3.3E-05	3.1E-04	2.5E-03	2.9E-03
R2	2.0E-06	1.5E-07	2.2E-06	3.6E-05	1.3E-05	4.9E-05
R3	8.3E-07	1.6E-05	1.7E-05	4.3E-05	1.6E-03	1.6E-03
R4	5.7E-07	5.6E-08	6.3E-07	1.1E-05	5.4E-06	1.6E-05
R5	9.3E-07	9.3E-08	1.0E-06	1.7E-05	8.8E-06	2.6E-05
R6	8.2E-07	1.0E-04	1.0E-04	7.2E-05	6.8E-03	6.9E-03
R7	7.4E-07	3.9E-05	3.9E-05	1.4E-04	3.2E-03	3.4E-03
R8	2.2E-06	1.1E-04	1.1E-04	2.0E-03	9.9E-03	1.2E-02
R9	6.8E-06	2.8E-06	9.2E-06	2.4E-04	2.1E-04	4.5E-04
R10	5.0E-05	7.2E-07	5.0E-05	7.4E-04	5.6E-05	7.8E-04
R11	1.0E-05	3.3E-07	1.0E-05	1.6E-04	2.6E-05	1.9E-04
R12	5.4E-06	1.4E-06	6.6E-06	1.8E-04	1.1E-04	2.7E-04
R13	7.6E-06	1.0E-06	8.4E-06	1.7E-04	7.7E-05	2.4E-04
R14	6.9E-07	1.1E-04	1.1E-04	2.3E-04	9.0E-03	9.3E-03

TABLE D.3: Predicted Hazard Quotients from Inhalation of Volatie Organic Compounds

COPC	Benzene			Toluene			Xylenes		
Averaging Time	Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.1E-03	4.1E-03	5.0E-03	1.5E-06	2.9E-06	3.6E-06	2.6E-05	5.1E-05	6.1E-05
FL-MPOI	1.7E-04	2.2E-04	2.5E-04	1.2E-07	1.5E-07	1.8E-07	2.1E-06	2.6E-06	3.0E-06
R1	1.2E-04	9.3E-04	1.0E-03	8.3E-08	6.6E-07	7.4E-07	1.4E-06	1.1E-05	1.3E-05
R2	1.0E-05	4.8E-06	1.5E-05	7.2E-09	3.4E-09	1.1E-08	1.2E-07	5.9E-08	1.8E-07
R3	1.5E-05	5.9E-04	6.0E-04	1.1E-08	4.2E-07	4.3E-07	1.9E-07	7.2E-06	7.4E-06
R4	3.1E-06	2.0E-06	5.1E-06	2.2E-09	1.4E-09	3.6E-09	3.8E-08	2.4E-08	6.2E-08
R5	4.9E-06	3.2E-06	8.2E-06	3.5E-09	2.3E-09	5.8E-09	6.0E-08	3.9E-08	1.0E-07
R6	2.7E-05	2.5E-03	2.5E-03	1.9E-08	1.7E-06	1.8E-06	3.2E-07	3.0E-05	3.0E-05
R7	5.1E-05	1.2E-03	1.2E-03	3.6E-08	8.4E-07	8.8E-07	6.2E-07	1.4E-05	1.5E-05
R8	7.6E-04	3.7E-03	4.4E-03	5.4E-07	2.6E-06	3.1E-06	9.3E-06	4.5E-05	5.4E-05
R9	8.2E-05	7.5E-05	1.6E-04	5.8E-08	5.3E-08	1.1E-07	1.0E-06	9.1E-07	1.9E-06
R10	2.0E-04	2.0E-05	2.1E-04	1.4E-07	1.4E-08	1.5E-07	2.4E-06	2.5E-07	2.6E-06
R11	4.5E-05	9.6E-06	5.4E-05	3.2E-08	6.8E-09	3.8E-08	5.5E-07	1.2E-07	6.6E-07
R12	5.8E-05	3.8E-05	9.4E-05	4.1E-08	2.7E-08	6.7E-08	7.1E-07	4.7E-07	1.1E-06
R13	5.0E-05	2.8E-05	7.8E-05	3.6E-08	2.0E-08	5.5E-08	6.1E-07	3.4E-07	9.5E-07
R14	8.9E-05	3.3E-03	3.4E-03	6.3E-08	2.3E-06	2.4E-06	1.1E-06	4.0E-05	4.1E-05

TABLE D.3: Predicted Hazard Quotients from Inhalation of Volatile Organic Compounds

COPC	Acetaldehyde			Acrolein			Formaldehyde		
Averaging Time	Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	7.6E-05	1.5E-04	1.8E-04	6.1E-04	1.2E-03	1.4E-03	2.4E-04	4.6E-04	5.6E-04
FL-MPOI	6.1E-06	7.7E-06	8.8E-06	4.9E-05	6.2E-05	7.0E-05	1.9E-05	2.4E-05	2.7E-05
R1	4.1E-06	3.3E-05	3.7E-05	3.3E-05	2.6E-04	3.0E-04	1.3E-05	1.0E-04	1.2E-04
R2	3.6E-07	1.7E-07	5.3E-07	2.9E-06	1.4E-06	4.3E-06	1.1E-06	5.3E-07	1.7E-06
R3	5.4E-07	2.1E-05	2.1E-05	4.4E-06	1.7E-04	1.7E-04	1.7E-06	6.5E-05	6.7E-05
R4	1.1E-07	7.0E-08	1.8E-07	8.8E-07	5.6E-07	1.4E-06	3.4E-07	2.2E-07	5.6E-07
R5	1.7E-07	1.1E-07	2.9E-07	1.4E-06	9.2E-07	2.3E-06	5.5E-07	3.6E-07	9.0E-07
R6	9.4E-07	8.7E-05	8.8E-05	7.6E-06	7.0E-04	7.1E-04	3.0E-06	2.7E-04	2.8E-04
R7	1.8E-06	4.2E-05	4.4E-05	1.5E-05	3.4E-04	3.5E-04	5.7E-06	1.3E-04	1.4E-04
R8	2.7E-05	1.3E-04	1.6E-04	2.2E-04	1.0E-03	1.3E-03	8.5E-05	4.0E-04	4.9E-04
R9	2.9E-06	2.6E-06	5.5E-06	2.3E-05	2.1E-05	4.5E-05	9.1E-06	8.3E-06	1.7E-05
R10	6.9E-06	7.1E-07	7.5E-06	5.5E-05	5.7E-06	6.0E-05	2.2E-05	2.2E-06	2.4E-05
R11	1.6E-06	3.4E-07	1.9E-06	1.3E-05	2.7E-06	1.5E-05	5.0E-06	1.1E-06	6.0E-06
R12	2.1E-06	1.4E-06	3.3E-06	1.7E-05	1.1E-05	2.7E-05	6.4E-06	4.3E-06	1.0E-05
R13	1.8E-06	9.9E-07	2.7E-06	1.4E-05	8.0E-06	2.2E-05	5.6E-06	3.1E-06	8.6E-06
R14	3.2E-06	1.2E-04	1.2E-04	2.5E-05	9.4E-04	9.6E-04	9.9E-06	3.7E-04	3.8E-04

TABLE D.3: Predicted Hazard Quotients from Inhalation of Volatie Organic Compounds

COPC	Propylene		
Averaging Time	Annual		
Receptor Location	Project	Baseline	Application
RSA-MPOI	2.5E-05	4.9E-05	5.9E-05
FL-MPOI	2.0E-06	2.5E-06	2.9E-06
R1	1.4E-06	1.1E-05	1.2E-05
R2	1.2E-07	5.7E-08	1.8E-07
R3	1.8E-07	6.9E-06	7.1E-06
R4	3.6E-08	2.3E-08	5.9E-08
R5	5.8E-08	3.8E-08	9.6E-08
R6	3.1E-07	2.9E-05	2.9E-05
R7	6.0E-07	1.4E-05	1.5E-05
R8	9.0E-06	4.3E-05	5.2E-05
R9	9.6E-07	8.8E-07	1.8E-06
R10	2.3E-06	2.4E-07	2.5E-06
R11	5.3E-07	1.1E-07	6.4E-07
R12	6.8E-07	4.5E-07	1.1E-06
R13	5.9E-07	3.3E-07	9.1E-07
R14	1.0E-06	3.9E-05	4.0E-05

TABLE D.4: Predicted Hazard Quotients from Inhalation of Polycyclic Aromatic Hydrocarbons

COPC	Acenaphthene			Acenaphthylene			Anthracene		
Averaging Time	Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.5E-06	4.9E-06	5.9E-06	5.0E-06	9.7E-06	1.2E-05	6.7E-07	1.3E-06	1.6E-06
FL-MPOI	2.0E-07	2.6E-07	2.9E-07	4.0E-07	5.0E-07	5.8E-07	5.4E-08	6.7E-08	7.7E-08
R1	1.4E-07	1.1E-06	1.2E-06	2.7E-07	2.2E-06	2.4E-06	3.6E-08	2.9E-07	3.2E-07
R2	1.2E-08	5.7E-09	1.8E-08	2.4E-08	1.1E-08	3.5E-08	3.2E-09	1.5E-09	4.7E-09
R3	1.8E-08	7.0E-07	7.1E-07	3.6E-08	1.4E-06	1.4E-06	4.8E-09	1.8E-07	1.9E-07
R4	3.6E-09	2.3E-09	6.0E-09	7.2E-09	4.6E-09	1.2E-08	9.6E-10	6.2E-10	1.6E-09
R5	5.8E-09	3.8E-09	9.7E-09	1.2E-08	7.5E-09	1.9E-08	1.5E-09	1.0E-09	2.5E-09
R6	3.1E-08	2.9E-06	2.9E-06	6.2E-08	5.7E-06	5.8E-06	8.3E-09	7.6E-07	7.7E-07
R7	6.1E-08	1.4E-06	1.5E-06	1.2E-07	2.8E-06	2.9E-06	1.6E-08	3.7E-07	3.8E-07
R8	9.0E-07	4.3E-06	5.2E-06	1.8E-06	8.5E-06	1.0E-05	2.4E-07	1.1E-06	1.4E-06
R9	9.7E-08	8.8E-08	1.9E-07	1.9E-07	1.7E-07	3.7E-07	2.5E-08	2.3E-08	4.9E-08
R10	2.3E-07	2.4E-08	2.5E-07	4.5E-07	4.7E-08	5.0E-07	6.1E-08	6.3E-09	6.6E-08
R11	5.3E-08	1.1E-08	6.4E-08	1.0E-07	2.2E-08	1.3E-07	1.4E-08	3.0E-09	1.7E-08
R12	6.9E-08	4.5E-08	1.1E-07	1.4E-07	9.0E-08	2.2E-07	1.8E-08	1.2E-08	2.9E-08
R13	5.9E-08	3.3E-08	9.2E-08	1.2E-07	6.5E-08	1.8E-07	1.6E-08	8.7E-09	2.4E-08
R14	1.1E-07	3.9E-06	4.0E-06	2.1E-07	7.7E-06	7.9E-06	2.8E-08	1.0E-06	1.1E-06

TABLE D.4: Predicted Hazard Quotients from Inhalation of Polycyclic Aromatic Hydrocarbons

COPC	Benzo(a)pyrene			Fluoranthene			Fluorene		
Averaging Time	Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	7.7E-09	-	-	2.2E-06	4.2E-06	5.1E-06	6.9E-06	1.3E-05	1.6E-05
FL-MPOI	6.2E-10	-	-	1.8E-07	2.2E-07	2.5E-07	5.6E-07	7.0E-07	8.0E-07
R1	4.2E-10	-	-	1.2E-07	9.4E-07	1.1E-06	3.8E-07	3.0E-06	3.4E-06
R2	3.7E-11	-	-	1.0E-08	4.9E-09	1.5E-08	3.3E-08	1.6E-08	4.9E-08
R3	5.5E-11	-	-	1.6E-08	6.0E-07	6.2E-07	5.0E-08	1.9E-06	2.0E-06
R4	1.1E-11	-	-	3.1E-09	2.0E-09	5.2E-09	1.0E-08	6.4E-09	1.6E-08
R5	1.8E-11	-	-	5.0E-09	3.3E-09	8.3E-09	1.6E-08	1.0E-08	2.6E-08
R6	9.6E-11	-	-	2.7E-08	2.5E-06	2.5E-06	8.6E-08	7.9E-06	8.0E-06
R7	1.8E-10	-	-	5.2E-08	1.2E-06	1.3E-06	1.7E-07	3.8E-06	4.0E-06
R8	2.8E-09	-	-	7.8E-07	3.7E-06	4.5E-06	2.5E-06	1.2E-05	1.4E-05
R9	3.0E-10	-	-	8.3E-08	7.6E-08	1.6E-07	2.6E-07	2.4E-07	5.1E-07
R10	7.0E-10	-	-	2.0E-07	2.1E-08	2.2E-07	6.3E-07	6.5E-08	6.9E-07
R11	1.6E-10	-	-	4.6E-08	9.7E-09	5.5E-08	1.4E-07	3.1E-08	1.8E-07
R12	2.1E-10	-	-	5.9E-08	3.9E-08	9.6E-08	1.9E-07	1.2E-07	3.0E-07
R13	1.8E-10	-	-	5.1E-08	2.9E-08	7.9E-08	1.6E-07	9.1E-08	2.5E-07
R14	3.2E-10	-	-	9.1E-08	3.4E-06	3.4E-06	2.9E-07	1.1E-05	1.1E-05

TABLE D.4: Predicted Hazard Quotients from Inhalation of Polycyclic Aromatic Hydrocarbons

COPC	Naphthalene			Naphthalene (carcinogenic)			Phenanthrene		
Averaging Time	Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	1.2E-03	2.3E-03	2.8E-03	1.2E-07	-	-	2.2E-05	4.3E-05	5.2E-05
FL-MPOI	9.4E-05	1.2E-04	1.4E-04	9.4E-09	-	-	1.8E-06	2.2E-06	2.6E-06
R1	6.4E-05	5.1E-04	5.7E-04	6.4E-09	-	-	1.2E-06	9.5E-06	1.1E-05
R2	5.6E-06	2.6E-06	8.2E-06	5.6E-10	-	-	1.1E-07	5.0E-08	1.5E-07
R3	8.4E-06	3.2E-04	3.3E-04	8.4E-10	-	-	1.6E-07	6.1E-06	6.2E-06
R4	1.7E-06	1.1E-06	2.8E-06	1.7E-10	-	-	3.2E-08	2.0E-08	5.2E-08
R5	2.7E-06	1.8E-06	4.5E-06	2.7E-10	-	-	5.1E-08	3.3E-08	8.4E-08
R6	1.5E-05	1.3E-03	1.4E-03	1.5E-09	-	-	2.7E-07	2.5E-05	2.6E-05
R7	2.8E-05	6.5E-04	6.8E-04	2.8E-09	-	-	5.3E-07	1.2E-05	1.3E-05
R8	4.2E-04	2.0E-03	2.4E-03	4.2E-08	-	-	7.9E-06	3.8E-05	4.6E-05
R9	4.5E-05	4.1E-05	8.6E-05	4.5E-09	-	-	8.4E-07	7.7E-07	1.6E-06
R10	1.1E-04	1.1E-05	1.2E-04	1.1E-08	-	-	2.0E-06	2.1E-07	2.2E-06
R11	2.5E-05	5.2E-06	3.0E-05	2.5E-09	-	-	4.6E-07	9.8E-08	5.6E-07
R12	3.2E-05	2.1E-05	5.2E-05	3.2E-09	-	-	6.0E-07	4.0E-07	9.7E-07
R13	2.8E-05	1.5E-05	4.3E-05	2.8E-09	-	-	5.2E-07	2.9E-07	8.0E-07
R14	4.9E-05	1.8E-03	1.9E-03	4.9E-09	-	-	9.2E-07	3.4E-05	3.5E-05

TABLE D.4: Predicted Hazard Quotients from Inhalation of Polycyclic Aromatic Hydrocarbons

COPC	Pyrene			Total BaP Equivalents		
Averaging Time	Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.0E-06	3.9E-06	4.7E-06	2.7E-08	-	-
FL-MPOI	1.6E-07	2.0E-07	2.3E-07	2.2E-09	-	-
R1	1.1E-07	8.7E-07	9.8E-07	1.5E-09	-	-
R2	9.6E-09	4.5E-09	1.4E-08	1.3E-10	-	-
R3	1.4E-08	5.5E-07	5.7E-07	2.0E-10	-	-
R4	2.9E-09	1.9E-09	4.7E-09	3.9E-11	-	-
R5	4.6E-09	3.0E-09	7.7E-09	6.3E-11	-	-
R6	2.5E-08	2.3E-06	2.3E-06	3.4E-10	-	-
R7	4.8E-08	1.1E-06	1.2E-06	6.5E-10	-	-
R8	7.2E-07	3.4E-06	4.1E-06	9.7E-09	-	-
R9	7.7E-08	7.0E-08	1.5E-07	1.0E-09	-	-
R10	1.8E-07	1.9E-08	2.0E-07	2.5E-09	-	-
R11	4.2E-08	9.0E-09	5.1E-08	5.7E-10	-	-
R12	5.5E-08	3.6E-08	8.8E-08	7.4E-10	-	-
R13	4.7E-08	2.6E-08	7.3E-08	6.4E-10	-	-
R14	8.4E-08	3.1E-06	3.2E-06	1.1E-09	-	-

TABLE D.5 Predicted Hazard Quotients from Inhalation of Constituents of Fugitive Dust

Criteria Air Contaminant	Diesel Particulate Matter			Coal Dust		
Averaging Time	Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.9E-01	5.5E-01	6.9E-01	3.5E+00	1.6E-03	3.5E+00
FL-MPOI	4.9E-02	3.9E-02	5.3E-02	4.3E-01	4.3E-02	4.3E-01
R1	1.9E-02	1.5E-01	1.7E-01	1.2E-02	1.9E-01	2.0E-01
R2	4.4E-03	1.1E-03	5.4E-03	1.7E-02	7.5E-04	1.8E-02
R3	3.6E-03	1.1E-01	1.2E-01	8.5E-03	9.9E-02	1.1E-01
R4	1.4E-03	4.5E-04	1.9E-03	4.5E-03	2.8E-04	4.7E-03
R5	2.0E-03	7.0E-04	2.7E-03	7.5E-03	4.6E-04	7.9E-03
R6	5.2E-03	3.6E-01	3.6E-01	8.6E-03	5.8E-01	5.9E-01
R7	8.2E-03	1.8E-01	1.9E-01	8.0E-03	2.3E-01	2.3E-01
R8	1.1E-01	5.0E-01	6.1E-01	5.8E-02	6.8E-01	7.4E-01
R9	2.4E-02	1.4E-02	3.7E-02	9.7E-02	1.5E-02	1.1E-01
R10	4.1E-02	3.9E-03	4.4E-02	4.8E-01	3.5E-03	4.9E-01
R11	1.4E-02	2.0E-03	1.6E-02	9.2E-02	1.6E-03	9.4E-02
R12	1.5E-02	7.3E-03	2.2E-02	6.8E-02	6.9E-03	7.5E-02
R13	1.3E-02	5.3E-03	1.8E-02	7.5E-02	5.0E-03	7.9E-02
R14	1.4E-02	4.4E-01	4.6E-01	9.1E-03	6.9E-01	7.0E-01

TABLE D.5 Predicted Hazard Quotients from Inhalation of Constituents of Fugitive Dust

Criteria Air Contaminant	Silica (PM2.5)								
Averaging Time	Annual								
Receptor Location	Project (Low)	Project (High)	Project (Mean)	Baseline (Low)	Baseline (High)	Baseline (Mean)	Application (Low)	Application (High)	Application (Mean)
RSA-MPOI	1.9E-01	5.2E-01	3.6E-01	6.5E-02	6.5E-02	6.5E-02	2.6E-01	5.9E-01	4.2E-01
FL-MPOI	2.3E-02	6.1E-02	4.2E-02	3.8E-03	3.8E-03	3.8E-03	2.7E-02	6.5E-02	4.6E-02
R1	1.4E-03	3.7E-03	2.6E-03	1.6E-02	1.6E-02	1.6E-02	1.7E-02	1.9E-02	1.8E-02
R2	1.2E-03	3.2E-03	2.2E-03	8.7E-05	8.7E-05	8.7E-05	1.3E-03	3.3E-03	2.3E-03
R3	6.1E-04	1.6E-03	1.1E-03	9.1E-03	9.1E-03	9.1E-03	9.7E-03	1.1E-02	1.0E-02
R4	3.3E-04	8.8E-04	6.0E-04	3.5E-05	3.5E-05	3.5E-05	3.6E-04	9.2E-04	6.4E-04
R5	5.2E-04	1.4E-03	9.6E-04	5.5E-05	5.5E-05	5.5E-05	5.8E-04	1.5E-03	1.0E-03
R6	7.1E-04	1.9E-03	1.3E-03	4.3E-02	4.3E-02	4.3E-02	4.3E-02	4.5E-02	4.4E-02
R7	8.0E-04	2.2E-03	1.5E-03	1.8E-02	1.8E-02	1.8E-02	1.9E-02	2.0E-02	2.0E-02
R8	7.0E-03	1.9E-02	1.3E-02	5.4E-02	5.4E-02	5.4E-02	6.1E-02	7.3E-02	6.7E-02
R9	4.7E-03	1.3E-02	8.6E-03	1.3E-03	1.3E-03	1.3E-03	6.0E-03	1.4E-02	1.0E-02
R10	2.9E-02	7.9E-02	5.4E-02	3.6E-04	3.6E-04	3.6E-04	3.0E-02	7.9E-02	5.4E-02
R11	5.8E-03	1.6E-02	1.1E-02	1.7E-04	1.7E-04	1.7E-04	6.0E-03	1.6E-02	1.1E-02
R12	3.3E-03	8.8E-03	6.0E-03	7.0E-04	7.0E-04	7.0E-04	4.0E-03	9.5E-03	6.7E-03
R13	4.7E-03	1.3E-02	8.7E-03	5.1E-04	5.1E-04	5.1E-04	5.2E-03	1.3E-02	9.2E-03
R14	1.1E-03	3.0E-03	2.0E-03	5.2E-02	5.2E-02	5.2E-02	5.3E-02	5.5E-02	5.4E-02

TABLE D.5 Predicted Hazard Quotients from Inhalation of Constituents of Fugitive Dust

Criteria Air Contaminant	Silica (PM10)								
Averaging Time	Annual								
Receptor Location	Project (Low)	Project (High)	Project (Mean)	Baseline (Low)	Baseline (High)	Baseline (Mean)	Application (Low)	Application (High)	Application (Mean)
RSA-MPOI	1.3E+00	2.5E+00	1.9E+00	6.3E-04	6.3E-04	6.3E-04	1.3E+00	2.5E+00	1.9E+00
FL-MPOI	1.6E-01	3.0E-01	2.3E-01	1.7E-02	1.7E-02	1.7E-02	1.8E-01	3.2E-01	2.5E-01
R1	4.5E-03	8.2E-03	6.3E-03	7.7E-02	7.7E-02	7.7E-02	8.1E-02	8.5E-02	8.3E-02
R2	6.5E-03	1.2E-02	9.2E-03	3.0E-04	3.0E-04	3.0E-04	6.8E-03	1.2E-02	9.5E-03
R3	3.2E-03	5.9E-03	4.6E-03	4.0E-02	4.0E-02	4.0E-02	4.3E-02	4.6E-02	4.4E-02
R4	1.7E-03	3.1E-03	2.4E-03	1.1E-04	1.1E-04	1.1E-04	1.8E-03	3.2E-03	2.5E-03
R5	2.9E-03	5.2E-03	4.0E-03	1.8E-04	1.8E-04	1.8E-04	3.0E-03	5.4E-03	4.2E-03
R6	3.3E-03	6.0E-03	4.7E-03	2.3E-01	2.3E-01	2.3E-01	2.3E-01	2.4E-01	2.4E-01
R7	3.0E-03	5.6E-03	4.3E-03	9.0E-02	9.0E-02	9.0E-02	9.4E-02	9.6E-02	9.5E-02
R8	2.2E-02	4.1E-02	3.1E-02	2.7E-01	2.7E-01	2.7E-01	2.9E-01	3.1E-01	3.0E-01
R9	3.7E-02	6.8E-02	5.3E-02	5.8E-03	5.8E-03	5.8E-03	4.3E-02	7.4E-02	5.8E-02
R10	1.8E-01	3.4E-01	2.6E-01	1.4E-03	1.4E-03	1.4E-03	1.9E-01	3.4E-01	2.6E-01
R11	3.5E-02	6.5E-02	5.0E-02	6.3E-04	6.3E-04	6.3E-04	3.6E-02	6.5E-02	5.1E-02
R12	2.6E-02	4.8E-02	3.7E-02	2.8E-03	2.8E-03	2.8E-03	2.9E-02	5.1E-02	4.0E-02
R13	2.9E-02	5.2E-02	4.0E-02	2.0E-03	2.0E-03	2.0E-03	3.0E-02	5.4E-02	4.2E-02
R14	3.5E-03	6.4E-03	4.9E-03	2.7E-01	2.7E-01	2.7E-01	2.8E-01	2.8E-01	2.8E-01

APPENDIX E: MULTIMEDIA MODEL EQUATIONS AND SAMPLE CALCULATIONS

Abbreviations

A	area factor (unitless)
AIR	air inhalation rate (m^3/d)
BCF_{PS}	plant to soil bioconcentration factor (kg soil / kg plant)
BCF_{WAP}	water to aquatic plant bioconcentration factor (L water/kg plant)
BTF	chemical specific biotransfer factor (mg/kg tissue / mg/d)
BTF_A	adjusted biotransfer factor (mg/kg tissue / mg/d)
BTF_{BM}	breast milk biotransfer factor (µg/kg milk / µg/d intake)
B_V	mass based air to plant biotransfer factor (µg/g plant / µg/g air)
B_{Vol}	volumetric air to plant biotransfer factor (unitless)
BW	body weight (kg)
C_{Air}	concentration of COPC in air (ug/m^3)
C_{BM}	concentration of COPC in breast milk (mg/kg)
C_{Dust}	concentration of COPC in dust (µg/m^3)
CF	conversion factor
C_{Game}	concentration of COPC in wild game (mg/kg)
COPC	chemical of potential concern
$C_{Organism}$	concentration of COPC in organism (mg/kg)
C_{PD}	concentration of COPC in plants due to direct deposition (mg/kg DW)
C_{Plant}	concentration of COPC in plants (mg/kg DW)
C_{PR}	concentration of COPC in plant roots (mg/kg)
C_{Prey}	concentration of COPC in prey (mg/kg DW)
C_{PV}	concentration of COPC in plants due to vapour uptake (mg/kg)
C_S	concentration of COPC in soil (mg/kg)
C_{s0}	concentration of COPC in surface soil (mg/kg)
C_{Sed}	concentration of COPC in sediment (mg/kg)
C_{SW}	concentration of COPC in surface water (mg/L)
D_{BS}	depth of benthic sediment (0.03 m)
D_{Dry}	dry deposition rate of COPC (mg/m^2/yr)
Di	duration of exposure during lifestage "i" (yr)
DL	dust level (kg/m^3)
D_S	deposition to soil (mg/kg/yr)
D_{s0}	deposition to surface soil (mg/kg/yr)
D_{Tot}	total deposition (mg/m^2/yr)

D_{WC}	depth of water column (1.0 m)
D_{Wet}	wet deposition rate of COPC (mg/m^2/yr)
E_{BM}	exposure from ingestion of breast milk adjusted to body weight (mg/kg BW/d)
EDI_{Adult}	estimated daily intake of adult receptor (mg/d)
E_{Dust}	exposure from dust inhalation adjusted to body weight (mg/kg BW/d)
E_{Food}	exposure from food ingestion adjusted to body weight (mg/kg BW/d)
E_{SC}	exposure from contact with surface soil adjusted to body weight (mg/kg BW/d)
E_{SI}	exposure from soil ingestion adjusted to body weight (mg/kg BW/d)
E_{SwimC}	exposure from contact with surface water adjusted to body weight (mg/kg BW/d)
E_{SwimI}	exposure from ingestion while swimming adjusted to body weight (mg/kg BW/d)
E_{Total}	total daily estimated exposure adjusted to body weight (mg/kg BW/d)
E_{WI}	exposure from water ingestion adjusted to body weight (mg/kg BW/d)
F_{BS}	fraction of total water body COPC concentration in benthic sediment (unitless)
FC	fat content (unitless)
F_V	fraction of COPC that is volatile (1, unitless)
F_W	fraction of COPC wet deposition that adheres to plant surfaces (0.6, unitless)
F_{Water}	fraction of forage that is water (0.85 for human intake, 0.62 for wildlife)
H	Henry's law constant (atm m^3/mol)
HHRA	human health risk assessment
HQ	predicted hazard from exposure to non-carcinogens
IR_{Air}	wildlife air inhalation rate (m^3/d)
IR_{BM}	breast milk ingestion rate (kg/d)
IR_{Game}	ingestion rate of wild game (kg/d)
IR_{Plant}	ingestion rate of plant type (kg/d)
IR_{WPlant}	wildlife plant ingestion rate (kg/d)
IR_{Prey}	wildlife prey ingestion rate (kg/d)
IR_S	wildlife soil ingestion rate (kg/d)
IR_{Sed}	wildlife sediment ingestion rate (kg/d)
IR_{SW}	wildlife water ingestion rate (L/d)
K_D	sediment partition coefficient (0.005 L/kg)
K_{OW}	octanol-water partition coefficient (unitless)
K_P	plant surface loss coefficient (yr^{-1})
K_{PW}	dermal permeability coefficient (cm/h)
K_{SW}	COPC surface water loss constant (63.3 yr^{-1})
K_T	soil loss constant for biotic and abiotic degradation (yrs^{-1})

LA	lake area (m^2)
LAFi	life stage adjustment factor for lifestage "i"
L_D	deposition loading onto surface water (mg/yr)
L_E	erosion load (mg/yr)
LE	life expectancy (yr)
L_R	runoff load (mg/yr)
L_T	total COPC water load (mg/yr)
MF	modification factor (0.01 for PAHs, 1 for VOCs)
P_{Air}	density of air (1.2 g/L)
P_{Forage}	density of forage (770 g/L)
P_{Sed}	sediment bulk density (1 kg/m^3)
PWC	fraction of total water body for mixing (100%)
R	gas constant (atm m^3/ mol)
RAF	relative dermal absorption factor (%)
R_F	reduction factor (100, unitless)
RfD	reference dose (mg/kg BW/d)
Risk	predicted risk from exposure to carcinogens
R_P	intercept fraction of edible portion of plants (unitless, 0.5 wildlife forage, 0.39 human consumption)
RsD	risk specific dose (mg/kg BW/d)
SAH	surface area of hands (cm^2)
SAO	surface area of other exposed skin (cm^2)
SAT	surface area exposed (cm^2)
SEF	swimming exposure factor (h/d)
SIR	soil ingestion rate (kg/d)
SLH	soil loading to hands (g/cm^2 per event)
SLO	soil loading to other exposed skin (g/cm^2 per event)
SWIR	water ingestion rate while swimming (L/h)
T	temperature (288K)
T_D	time period over which deposition occurs (80 years)
T_P	length of plant exposure (0.12 yr wildlife forage, 0.16 yr human consumption)
V_{FR}	average volumetric flow rate through the water body (m^3/yr)
V_{Gag}	empirical correction factor (1, unitless)
V_{SW}	volume of water body (m^3)
WIR	water ingestion rate (L/d)

Y_P	productivity (0.24 kg/m^2 wildlife forage, 2.24 kg/m^2 human consumption)
Z_S	soil mixing depth (m)
Z_{s0}	surface soil mixing depth (m)
θ_{BS}	bed sediment porosity (0.6, unitless)
ρ_B	soil bulk density (kg/m^3)

Multimedia Model Walk Through Example: Formaldehyde

The human health risk assessment (HHRA) included direct and indirect exposure to air emissions of chemicals of potential concern (COPCs) from the Project.

Health risks directly from inhalation were characterized by comparing modelled air concentrations of COPCs with regulatory guidelines considered to be protective of human health. Indirect exposure was predicted through a multimedia exposure model for non-volatile, persistent and bioaccumulative COPCs. Modelling formulas for COPC transport and bioaccumulation were based on US EPA (2005) guidance on human health risk assessment.

Environmental Media Concentrations

Chemical concentrations were estimated for the following media:

- Soil;
- Dust;
- Vegetation;
- Wildlife;
- Fish; and
- Surface Water.

The worked example is for Project emission exposure of a toddler to formaldehyde. The applied air concentration from the RSA-MPOI project case of the air quality assessment was 1.60×10^{-2} ug/m^3, and the applied deposition rates were 2.53 mg/m^2/yr (dry), and 1.46 mg/m^2/yr (wet).

Equation 1. Total Deposition

$$D_{Tot} = D_{Wet} + D_{Dry}$$

Where:
D_{Tot} = total deposition (mg/m^2/yr)
D_{Wet} = wet deposition rate of COPC (mg/m^2/yr)
D_{Dry} = dry deposition rate of COPC (mg/m^2/yr)

Sample Calculation:

$$D_{Tot} = 1.46\, mg/m^2/yr + 2.53\, mg/m^2/yr = 3.99\, mg/m^2/yr$$

Equation 2. Deposition to Surface Soil

$$D_{s0} = \frac{D_{Tot}}{Z_{s0} \times \rho_B}$$

Where:

D_{s0} = deposition to surface soil (mg/kg/yr)

D_{Tot} = total deposition (mg/m^2/yr)

Z_{s0} = surface soil mixing depth (m)

ρ_B = soil bulk density (kg/m^3)

Sample Calculation:

$$D_{s0} = \frac{3.99\ mg/m^2/yr}{0.02\ m \times 1500\ kg/m^3} = 1.33 \times 10^{-1}\ mg/\ kg/yr$$

Equation *3*. Deposition to Soil

$$D_S = \frac{D_{Tot}}{Z_S \times \rho_B}$$

Where:

D_S = deposition to soil (mg/kg/yr)

D_{Tot} = total deposition (mg/m^2/yr)

Z_S = soil mixing depth (m)

ρ_B = soil bulk density (kg/m^3)

Sample Calculation:

$$D_S = \frac{3.99\ mg/m^2/yr}{0.2\ m \times 1500\ kg/m^3} = 1.33\ \times 10^{-2}\ mg/\ kg/yr$$

Equation 4. Concentration in Surface Soil

$$C_{s0} = D_{s0}\frac{1 - e^{(-K_T \times T_D)}}{K_T}$$

Where:

C_{s0} = concentration of COPC in surface soil (mg/kg)

D_{s0} = deposition to surface soil (mg/kg/yr)

K_T = soil loss constant for biotic and abiotic degradation (yrs^{-1})

T_D = time period over which deposition occurs (80 years)

Sample Calculation:

$$C_{s0} = (1.33 \times 10^{-1} mg/kg)\frac{1 - e^{(-1.56\times10^{8} yr^{-1}\times 80 yrs)}}{1.56 \times 10^{8} yr^{-1}} = 8.54 \times 10^{-10}\ mg/kg$$

Equation 5. Concentration in Soil

$$C_S = D_S \frac{1 - e^{(-K_T \times T_D)}}{K_T}$$

Where:

C_S = concentration of COPC in soil (mg/kg)

D_S = deposition to soil (mg/kg/yr)

K_T = soil loss constant for biotic and abiotic degradation (yrs^{-1})

T_D = time period over which deposition occurs (80 years)

Sample Calculation:

$$C_S = (1.33 \times 10^{-2} mg/kg)\frac{1 - e^{(-1.56\times10^{8}\ yr^{-1}\times 80 yrs)}}{1.56 \times 10^{8}\ yr^{-1}} = 8.54 \times 10^{-11}\ mg/kg$$

Equation 6. Concentration in Airborne Dust

$$C_{Dust} = C_{s0} \times DL \times CF$$

Where:

C_{Dust} = concentration of COPC in dust (µg/m³)

C_{s0} = concentration of COPC in surface soil (mg/kg)

DL = dust level (kg/m³)

CF = conversion factor (1000 µg / mg)

Sample Calculation:

$$C_{Dust} = 8.54 \times 10^{-10} mg/kg \times 7.6 \times 10^{-10}\ kg/m^3 \times 1000 \mu g/mg = 6.49 \times 10^{-16} \mu g/m^3$$

Equation 7. Concentration in Surface Water

$$L_T = L_D + L_R + L_E$$

Where:

L_T = total COPC water load (mg/yr)

L_D = deposition loading onto surface water (mg/yr)

L_R = runoff load (mg/yr)

L_E = erosion load (mg/yr)

$$V_{SW} = LA \times D$$

Where:

V_{SW} = volume of water body (m^3)

LA = lake area (m^2)

D = lake depth (m)

$$C_{SW} = \frac{L_T}{(V_{FR} \times PWC) + (K_{SW} \times V_{SW})} \times CF$$

Where:

C_{SW} = concentration of COPC in surface water (mg/L)

L_T = total COPC water load (mg/yr)

V_{FR} = average volumetric flow rate through the water body (m^3/yr)

PWC = fraction of total water body for mixing (100%)

K_{SW} = COPC surface water loss constant (63.3 yr^{-1})

V_{SW} = volume of water body (m^3)

CF = conversion factor (0.001 m^3 / L)

Sample Calculation:

$$L_T = 7.21 \times 10^4 mg/yr + 1.12 \times 10^{-2} mg/yr + 2.10 \times 10^{-6} mg/yr = 7.21 \times 10^4 mg/yr$$

$$V_{SW} = 3.02 \times 10^5 m^2 \times 2.0m = 6.04 \times 10^5 m^3$$

$$C_{SW} = \frac{7.21 \times 10^4 mg/yr}{(5.36 \times 10^6 m^3/yr \times 1) + (63.3 yr^{-1} \times 6.04 \times 10^5 m^3)} \times 0.001 m^3/L = 1.65 \times 10^{-6} mg/L$$

Equation 8. Concentration in Aquatic Organisms

Concentrations in aquatic plants, aquatic invertebrates, and fish were determined based on the surface water concentration and a chemical specific bioconcentration factor (BCF). The sample calculation is completed for aquatic plants.

$$BCF_{WAP} = 10^{((0.819 \times K_{OW}) - 1.146)}$$

$$C_{Organism} = C_{SW} \times BCF_{WAP}$$

Where:

BCF_{WAP}= water to aquatic plant bioconcentration factor (L water/kg plant)

K_{OW} = octanol-water partition coefficient (unitless)

$C_{Organism}$= concentration in organism (mg/kg)

C_{SW} = concentration in surface water (mg/L)

Sample Calculation (aquatic plants):

$$BCF_{WAP} = 10^{((0.819\times0.35)-1.146)} = 1.38\times10^{-1}\text{L water/kg plant}$$

$$C_{Organism} = 1.65\times10^{-6}mg/L \times 1.38\times10^{-1}\ L\ water/kg\ plant = 2.29\times10^{-7}mg/kg$$

Equation 9. Concentration in Lake Sediment

$$C_{Sed} = C_{SW}\ \times CF\ X\ F_{BS} \times \frac{K_D}{\theta_{BS} + (K_D\ \times\ P_{Sed})} \times \frac{D_{WC} + D_{BS}}{D_{BS}}$$

Where:

C_{Sed} = concentration of COPC in sediment (mg/kg)

C_{SW} = concentration of COPC in surface water (mg/L)

CF = conversion factor (1000 L/m^3)

F_{BS} = fraction of total water body COPC concentration in benthic sediment (unitless)

K_D = sediment partition coefficient (0.005 L/kg)

θ_{BS} = bed sediment porosity (0.6, unitless)

P_{Sed} = sediment bulk density (1 kg/m^3)

D_{WC} = depth of water column (1.0 m)

D_{BS} = depth of benthic sediment (0.03 m)

Sample Calculation:

$$C_{Sed} = 1.65\times10^{-6}mg/L \times 1000L/m^3 \times 1.0\ \times \frac{0.005\ L/kg}{0.6 + (0.005\ L/kg \times 1000\ kg/m^3)} \times \frac{1.0m + 0.03m}{0.03m}$$
$$= 5.07\times10^{-5}mg/kg$$

Equation 10. Concentration in Plants due to Direct Deposition

$$A = R_P \frac{\left[1 - e^{(-K_P\times T_P)}\right]}{Y_P \times K_P}$$

Where:

A = area factor (unitless)

R_P = intercept fraction of edible portion of plants (unitless, 0.5 wildlife forage, 0.39 human consumption)

K_P = plant surface loss coefficient (yr^{-1})

T_P = length of plant exposure (0.12 yr wildlife forage, 0.16 yr human consumption)

Y_P = productivity (0.24 kg/m^2 wildlife forage, 2.24 kg/m^2 human consumption)

$$C_{PD} = \left[D_{Dry} \times (1 - F_V) + D_{Wet} \times (1 - F_V)\right] \times F_W \times A$$

Where:

C_{PD} = concentration of COPC in plants due to direct deposition (mg/kg DW)

D_{Dry} = overall dry deposition rate (mg/m^2/yr)

F_V = fraction of COPC that is volatile (1, unitless)

D_{Wet} = overall wet deposition rate (mg/m^2/yr)

F_W = fraction of COPC wet deposition that adheres to plant surfaces (0.6, unitless)

A = area factor (unitless)

Sample Calculation (wildlife forage):

$$A = 0.5\frac{\left[1 - e^{(-18yr^{-1} \times 0.12yr)}\right]}{0.24kg/m^2 \times 18yr^{-1}} = 1.02 \times 10^{-1}$$

$$C_{PD} = [2.53\ mg/m^2/yr \times (1 - 1) + 1.46\ mg/m^2/yr \times (1 - 1)] \times 0.6 \times 1.02 \times 10^{-1} = 0\ mg/kg$$

Equation 11. Concentration in Plants due to Vapour Uptake

$$logB_{Vol} = 1.065\ \times logK_{OW} - \log\left(\frac{H}{R \times T}\right) - 1.654$$

$$B_{Vol} = 10^{(logB_{Vol})}$$

Where:

B_{Vol} = volumetric air to plant biotransfer factor (unitless)

K_{OW} = octanol-water partition coefficient (unitless)

H = Henry's law constant (atm m^3/mol)

R = gas constant (atm m^3/ mol)

T = temperature (288K)

$$B_V = \frac{P_{Air} \times\ B_{Vol}}{(1 - F_{water}) \times P_{Forage}}$$

Where:

B_V = mass based air to plant biotransfer factor (µg/g plant / µg/g air)

P_{Air} = density of air (1.2 g/L)

F_{Water} = fraction of forage that is water (0.85 for human intake, 0.62 for wildlife)

P_{Forage} = density of forage (770 g/L)

$$C_{PV} = \frac{C_{Air} \times (B_V \div R_F) \times F_V \times V_{Gag}}{P_{Air} \times CF}$$

Where:

C_{PV} = concentration of COPC in plants due to vapour uptake (mg/kg)

C_{Air} = concentration of COPC in air (ug/m^3)

B_V = mass based air to plant biotransfer factor (µg/g plant / µg/g air)

R_F = reduction factor (100, unitless)

F_V = fraction of COPC that is volatile (1, unitless)

V_{Gag} = empirical correction factor (1, unitless)

CF = conversion factors (1000L/m^3, 1000µg/mg, 0.001kg/g)

Sample Calculation (wildlife forage):

$$logB_{Vol} = 1.065 \times \log(2.24) - \log\left(\frac{3.37 \times 10^{-7}\ atm\,m^3/mol}{8.2 \times 10^{-5} atm\,m^3/mol \times 288k}\right) - 1.654 = 3.58$$

$$B_{Vol} = 10^{(3.58)} = 3.79 \times 10^3$$

$$B_V = \frac{1.2g/L \times 3.79 \times 10^3}{(1 - 0.62) \times 770g/L} = 1.55 \times 10^1 \text{µg/g plant/µg/g air}$$

$$C_{PV} = \frac{1.60 \times 10^{-2}\mu g/m^3 \times (1.55\ \text{µg/g plant/µg/g} \times 10^1/100) \times 1 \times 1}{1.2g/L \times 1000\,L/m^3 \times 1000\,\mu g/mg \times 0.001\,kg/g} = 2.08 \times 10^{-6} mg/kg$$

Equation 12. Concentration in Plant Roots

$$logBCF_{PS} = 1.588 - (0.578 \times logK_{Ow})$$

$$BCF_{PS} = 10^{(logBCF_{ps})}$$

Where:

BCF_{PS} = plant to soil bioconcentration factor (kg soil / kg plant)

K_{OW} = octanol-water partition coefficient (unitless)

$$C_{PR} = C_S \times BCF_{PS}$$

Where:

C_{PR} = concentration of COPC in plant roots (mg/kg)

C_S = concentration of COPC in soil (mg/kg)

BCF_{PS} = plant to soil bioconcentration factor (kg soil / kg plant)

Sample Calculation (wildlife forage):

$$logBCF_{PS} = 1.588 - (0.578 \times \log(1.15)) = 9.23 \times 10^{-1}$$

$$BCF_{PS} = 10^{(9.23 \times 10^{-1})} = 8.38\ kg\ soil/kg\ plant$$

$$C_{PR} = 8.54 \times 10^{-11} mg/kg \times 8.38 kg\ soil/kg\ plant = 7.16 \times 10^{-10} mg/kg$$

Equation 13. Concentration in Wild Game

$$\mathrm{BTF_A} = \mathrm{BTF} \times \mathrm{FC} \times \mathrm{MF}$$

Where:

BTF_A = adjusted biotransfer factor (mg/kg tissue / mg/d)
BTF = chemical specific biotransfer factor (mg/kg tissue / mg/d)
FC = fat content (unitless)
MF = modification factor (0.01 for PAHs, 1 for VOCs)

$$C_{Game} = \left(C_S IR_S + C_{Sed} IR_{Sed} + C_{SW} IR_{SW} + C_{Air} IR_{Air} + C_{Dust} IR_{Air} + \sum C_{Plant} IR_{WPlant} + \sum C_{Prey} IR_{Prey}\right) \times \mathrm{BTF_A}$$

Where:

C_{Game} = concentration of COPC in wild game (mg/kg)
C_S = concentration of COPC in soil (mg/kg)
IR_S = wildlife soil ingestion rate (kg/d)
C_{Sed} = concentration of COPC in sediment (mg/kg)
IR_{Sed} = wildlife sediment ingestion rate (kg/d)
C_{SW} = concentration of COPC in surface water (mg/L)
IR_{SW} = wildlife water ingestion rate (L/d)
C_{Air} = concentration of COPC in air (mg/m^3)
IR_{Air} = wildlife air inhalation rate (m^3 air/d)
C_{Dust} = concentration of COPC in dust (mg/m^3)
IR_{Air} = wildlife air inhalation rate (m^3/d)
C_{Plant} = concentration of COPC in plants (mg/kg)
IR_{WPlant} = wildlife plant ingestion rate (kg/d)
C_{Prey} = concentration of COPC in prey (mg/kg)
IR_{Prey} = wildlife prey ingestion rate (kd/d)
BTF_A = adjusted biotransfer factor (mg/kg tissue / mg/d)

Sample Calculation (moose):

$$\mathrm{BTF_A} = 6.34 \times 10^{-4} \times 0.19 \times 1 = 1.20 \times 10^{-4} \text{ mg/kg tissue mg/d}$$

$$\sum C_{Plant} IR_{Plant} = \left[\left(2.08 \times 10^{-6} \frac{mg}{kg}\right)\left(\frac{6.4kg}{d}\right) + \left(2.29 \times 10^{-7} \frac{mg}{kg}\right)\left(\frac{1.6kg}{d}\right)\right] = 1.37 \times 10^{-5}\, mg/d$$

$$\sum C_{Prey} IR_{Prey} = 0\, mg/d$$

$$\begin{aligned} C_{Game} = \Bigg\{ & \left(8.54 \times 10^{-10} \frac{mg}{kg}\right)\left(\frac{0.16kg}{d}\right) + \left(5.07 \times 10^{-5} \frac{mg}{kg}\right)\left(\frac{0.40kg}{d}\right) + \left(1.65 \times 10^{-6} \frac{mg}{L}\right)\left(\frac{20L}{d}\right) \\ & + \left(1.60 \times 10^{-5} \frac{mg}{m^3}\right)\left(\frac{65.87m^3}{d}\right) + \left(6.49 \times 10^{-1912} \frac{mg}{m^3}\right)\left(\frac{65.87m^3}{d}\right) \\ & + (1.37 \times 10^{-5}\, mg/d) + (0\, mg/d) \Bigg\} \times 1.20 \times 10^{-4} \text{mg/kg tissue mg/d} \\ & = 1.33 \times 10^{-7} mg/kg \end{aligned}$$

Equation 14. Human Exposure Soil Ingestion

$$E_{SI} = \frac{C_{s0} \times SIR \times CF}{BW}$$

Where:

E_{SI} = exposure from soil ingestion adjusted to body weight (mg/kg BW/d)

C_{s0} = concentration of COPC in surface soil (mg/kg)

SIR = soil ingestion rate (kg/d)

BW = body weight (kg)

CF = conversion factor (0.001 kg/g)

Sample Calculation:

$$E_{SI} = \frac{8.54 \times 10^{-10} mg/kg \times 0.08 g/d \times 0.001 kg/g}{16.5 kg} = 4.14 \times 10^{-15} mg/kgBW/d$$

Equation 15. Human Exposure from Water Ingestion

$$E_{WI} = \frac{C_{SW} \times WIR}{BW}$$

Where:

E_{WI} = exposure from water ingestion adjusted to body weight (mg/kg BW/d)

C_{SW} = concentration of COPC in surface water (mg/L)

WIR = water ingestion rate (L/d)

BW = body weight (kg)

Sample Calculation:

$$E_{WI} = \frac{1.65 \times 10^{-6} mg/L \times 0.6 L/d}{16.5 kg} = 6.00 \times 10^{-8} mg/kgBW/d$$

Equation 16. Human Exposure from Dust Inhalation

$$E_{Dust} = \frac{C_{Dust} \times AIR}{BW}$$

Where:

E_{Dust} = exposure from dust inhalation adjusted to body weight (mg/kg BW/d)

C_{Dust} = concentration of COPC in dust (mg/kg)

AIR = air inhalation rate (m^3/d)

BW = body weight (kg)

CF = conversion factor (0.001mg/µg)

Sample Calculation:

$$E_{Dust} = \frac{6.49 \times 10^{-16} \mu g/m^3 \times 8.3 m^3/d \times 0.001 mg/\mu g}{16.5 kg} = 3.26 \times 10^{-19} mg/kgBW/d$$

Equation 17. Human Exposure from Food

$$E_{Food} = \frac{(\sum C_{Plant} IR_{Plant} + \sum C_{Game} IR_{Game}) \times CF}{BW}$$

Where:

E_{Food} = exposure from food ingestion adjusted to body weight (mg/kg BW/d)

C_{Plant} = concentration of COPC in plants (mg/kg)

IR_{Plant} = ingestion rate of plant type (kg/d)

C_{Game} = concentration of COPC in wild game (mg/kg)

IR_{Game} = ingestion rate of wild game (kg/d)

BW = body weight (kg)

CF = conversion factor (0.001 kg/g)

Sample Calculation:

$$\sum C_{Plant} IR_{Plant} = \left[\left(7.90 \times 10^{-7} \frac{mg}{kg}\right)\left(\frac{67g}{d}\right) + \left(5.84 \times 10^{-10} \frac{mg}{kg}\right)\left(\frac{105g}{d}\right) + \left(1.43 \times 10^{-10} \frac{mg}{kg}\right)\left(\frac{5g}{d}\right) + \left(3.29 \times 10^{-10} \frac{mg}{kg}\right)\left(\frac{1g}{d}\right) + (1.65 \times 10^{-10} \frac{mg}{kg})\left(\frac{1g}{d}\right)\right] = 5.30 \times 10^{-8} mg/d$$

$$\sum C_{Game}\, IR_{Game} = \left[\left(1.33 \times 10^{-7}\frac{mg}{kg}\right)\left(\frac{26.51g}{d}\right) + \left(3.79 \times 10^{-10}\frac{mg}{kg}\right)\left(\frac{14.17g}{d}\right) + \left(1.35 \times 10^{-9}\frac{mg}{kg}\right)\left(\frac{12.34g}{d}\right) + \left(7.07 \times 10^{-8}\frac{mg}{kg}\right)\left(\frac{15.99g}{d}\right) + \left(3.48 \times 10^{-8}\frac{mg}{kg}\right)\left(\frac{15.99g}{d}\right) + \left(5.64 \times 10^{-7}\frac{mg}{kg}\right)\left(\frac{95\,g}{d}\right)\right] = 3.53 \times 10^{-9}\, mg/d$$

$$E_{Food} = \frac{(5.30 \times 10^{-5} mg/d + 5.88 \times 10^{-5} mg/d) \times 0.001\ kg/g}{16.5kg} = 6.78 \times 10^{-9} mg/kgBW/d$$

Equation 18. Human Exposure from Contact with Surface Water (Swimming)

$$E_{SwimC} = \frac{C_{SW} \times K_{PW} \times SEF \times SAT}{BW}$$

Where:

E_{SwimC} = exposure from contact with surface water adjusted to body weight (mg/kg BW/d)

C_{SW} = concentration of COPC in surface water (mg/L)

K_{PW} = dermal permeability coefficient (cm/h)

SEF = swimming exposure factor (h/d)

SAT = surface area exposed (cm^2)

BW = body weight (kg)

CF = conversion factor (0.001L/cm^3)

Sample Calculation:

$$E_{SwimC} = \frac{1.65 \times 10^{-6} mg/L \times 1.83 \times 10^{-3}\ cm/h \times 0.255 h/d \times 6130 cm^2 \times 0.001 L/cm^3}{16.5kg}$$
$$= 2.86 \times 10^{-10} mg/kgBW/d$$

Equation 19. Human Exposure from Ingestion of Surface Water (Swimming)

$$E_{SwimI} = \frac{C_{SW} \times SEF \times SWIR}{BW}$$

Where:

E_{SwimI} = exposure from ingestion while swimming adjusted to body weight (mg/kg BW/d)

C_{SW} = concentration of COPC in surface water (mg/L)

SEF = swimming exposure factor (h/d)

SWIR = water ingestion rate while swimming (L/h)

BW = body weight (kg)

Sample Calculation:

$$E_{SwimI} = \frac{1.65 \times 10^{-6} mg/L \times 0.255 h/d \times 0.05 L/h}{16.5 kg} = 1.28 \times 10^{-9} mg/kgBW/d$$

Equation 20. Human Exposure from Contact with Surface Soil

$$E_{SC} = \frac{[(C_{s0} \times SAH \times SLH \times RAF) + (C_{s0} \times SAO \times SLO \times RAF)] \times CF}{BW}$$

Where:

E_{SC} = exposure from contact with surface soil adjusted to body weight (mg/kg BW/d)

C_{s0} = concentration of COPC in surface soil (mg/kg)

SAH = surface area of hands (cm^2)

SAO = surface area of other exposed skin (cm^2)

SLH = soil loading to hands (g/cm^2 per event)

SLO = soil loading to other exposed skin (g/cm^2 per event)

RAF = relative dermal absorption factor (%)

BW = body weight (kg)

CF = conversion factor (0.001 kg/g)

Sample Calculation:

$$E_{SC} = \frac{[(8.54 \times 10^{-10} mg/kg \times 430 cm^2 \times 0.0001 g/cm^2 \times 1) + (8.54 \times 10^{-10} mg/kg \times 2580 cm^2 \times 0.00001 g/cm^2 \times 1)] \times 0.001 kg/g}{16.5 kg}$$
$$= 1.34 \times 10^{-12} mg/kgBW/d$$

Equation 21. Human Exposure from Breast Milk Ingestion (Infants Only)

$$BTF_{BM} = 2.00 \times 10^{-7} \times K_{OW}$$

Where:

BTF_{BM} = breast milk biotransfer factor (µg/kg milk / µg/d intake)

K_{OW} = octanol-water partition coefficient (unitless)

$$C_{BM} = EDI_{Adult} \times BTF_{BM}$$

Where:

C_{BM} = concentration of COPC in breast milk (mg/kg)

EDI_{Adult} = estimated daily intake of adult receptor (mg/d)

BTF_{BM} = breast milk biotransfer factor (µg/kg milk / µg/d intake)

$$E_{BM} = \frac{C_{BM} \times IR_{BM}}{BW}$$

Where:

E_{BM} = exposure from ingestion of breast milk adjusted to body weight (mg/kg BW/d)

C_{BM} = concentration of COPC in breast milk (mg/kg)

IR_{BM} = breast milk ingestion rate (kg/d)

BW = body weight (kg)

Sample Calculation (infant):

$$\mathrm{BTF_{BM}} = 2.00 \times 10^{-7} \times 2.24 \ = 4.48 \ \times 10^{-7} \mu g/kg\ milk\ /\ \mu g/d\ intake$$

$$C_{BM} = 2.77 \times 10^{-6}\ mg/d \times \ 4.48 \times 10^{-7}\ \mu g/kg\ milk\ /\ \mu g/d\ intake \ = \ 1.24 \ \times 10^{-12}\ mg/kg$$

$$E_{BM} = \frac{1.24 \times 10^{-12} mg/kg \times 0.664 kg/d}{8.2 kg} = 1.00 \times 10^{-13} mg/kgBW/d$$

Equation 22. Toddler Total Daily Estimated Exposure

$$E_{Total} = E_{SI} + E_{WI} + E_{Dust} + E_{Food} + E_{SwimC} + E_{SwimI} + E_{SC}$$

Where:

E_{Total} = total daily estimated exposure adjusted to body weight (mg/kg BW/d)

E_{SI} = exposure from soil ingestion adjusted to body weight (mg/kg BW/d)

E_{WI} = exposure from water ingestion adjusted to body weight (mg/kg BW/d)

E_{Dust} = exposure from dust inhalation adjusted to body weight (mg/kg BW/d)

E_{Food} = exposure from food ingestion adjusted to body weight (mg/kg BW/d)

E_{SwimC} = exposure from contact with surface water adjusted to body weight (mg/kg BW/d)

E_{SwimI} = exposure from ingestion while swimming adjusted to body weight (mg/kg BW/d)

E_{SC} = exposure from contact with surface soil adjusted to body weight (mg/kg BW/d)

Sample Calculation:

$$\begin{aligned} E_{Total} = {} & 4.14 \times 10^{-15} mg/kgBW/d \\ & + 6.00 \times 10^{-8} mg/kgBW/d \\ & + 3.26 \times 10^{-19} mg/kgBW/d \\ & + 6.78 \times 10^{-9} mg/kgBW/d \\ & + 2.86 \times 10^{-10} mg/kgBW/d \\ & + 1.28 \times 10^{-9} mg/kgBW/d \\ & + \ 1.34 \times 10^{-12} mg/kgBW/d \\ & = \ 6.85 \ \times 10^{-8}\ mg/kgBW/d \end{aligned}$$

Equation 23. Predicted hazard quotient (HQ) from Non-Carcinogenic COPC Exposure

$$HQ = \frac{E_{Total}}{Rfd}$$

Where:

HQ = predicted hazard from exposure to non-carcinogens

E_{Total} = total daily estimated exposure adjusted to body weight (mg/kg BW/d)

RfD = reference dose (mg/kg BW/d)

Sample Calculation:

$$HQ = \frac{6.85 \times 10^{-8} mg/kg\ BW/d}{0.150 mg/kg\ BW/d} = 4.57 \times 10^{-7}$$

Equation 24. Predicted Incremental Lifetime Cancer Risk (ILCR) Quotient from Carcinogenic COPC Exposure

The following equation was used to calculate the ILCRs for carcinogenic COPCs, when applicable.

$$Risk = \sum_i \left. (E_{Total} \times D_i \times LAF_i) \right/ (RsD \times LE)$$

Where:

Risk = predicted risk from exposure to carcinogens

E_{Total} = total daily estimated exposure adjusted to body weight (mg/kg BW/d)

RsD = risk specific dose (mg/kg BW/d)

Di = duration of exposure during lifestage "i" (yr)

LE = life expectancy (yr)

LAFi = life stage adjustment factor for lifestage "i"

APPENDIX F: DETAILED MULTIMEDIA MODEL RESULTS

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Case	Acenaphthene						Acenpthylene					
		Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	Project	1.0E-08	8.4E-08	7.2E-08	4.8E-08	4.6E-08	4.5E-09	1.1E-07	8.6E-07	7.5E-07	4.9E-07	4.7E-07	4.9E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	8.3E-09	2.7E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	9.0E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.0E-08	2.8E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.1E-07
FL-MPOI	Project	5.1E-09	3.9E-08	3.4E-08	2.2E-08	2.1E-08	2.2E-09	5.7E-08	4.2E-07	3.7E-07	2.4E-07	2.3E-07	2.4E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	7.3E-10	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	7.9E-09
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.4E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.6E-08
R1	Project	1.6E-09	1.2E-08	1.1E-08	7.0E-09	6.7E-09	6.9E-10	1.8E-08	1.3E-07	1.1E-07	7.5E-08	7.1E-08	7.5E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	3.3E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	3.5E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	4.0E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	4.3E-08
R2	Project	5.3E-10	4.1E-09	3.5E-09	2.3E-09	2.2E-09	2.4E-10	6.0E-09	4.4E-08	3.8E-08	2.5E-08	2.4E-08	2.6E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	8.9E-11	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	9.7E-10
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	3.2E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	3.5E-09
R3	Project	6.1E-10	4.7E-09	4.1E-09	2.7E-09	2.6E-09	2.7E-10	6.8E-09	5.0E-08	4.4E-08	2.9E-08	2.8E-08	2.9E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.9E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.1E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.2E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.4E-08
R4	Project	2.5E-10	1.9E-09	1.7E-09	1.1E-09	1.1E-09	1.1E-10	2.9E-09	2.1E-08	1.8E-08	1.2E-08	1.2E-08	1.2E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	5.3E-11	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	5.8E-10
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.7E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.8E-09
R5	Project	4.1E-10	3.1E-09	2.7E-09	1.8E-09	1.7E-09	1.8E-10	4.6E-09	3.4E-08	2.9E-08	1.9E-08	1.9E-08	2.0E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	7.2E-11	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	7.8E-10
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.5E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.8E-09
R6	Project	8.7E-10	6.7E-09	5.8E-09	3.8E-09	3.6E-09	3.9E-10	9.8E-09	7.2E-08	6.3E-08	4.1E-08	3.9E-08	4.2E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	5.3E-09	2.7E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	5.7E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	5.7E-09	2.7E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	6.1E-08
R7	Project	6.6E-10	5.2E-09	4.5E-09	2.9E-09	2.8E-09	2.9E-10	7.4E-09	5.5E-08	4.8E-08	3.1E-08	3.0E-08	3.2E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.9E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	3.2E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	3.2E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	3.5E-08
R8	Project	4.3E-09	3.5E-08	3.0E-08	2.0E-08	1.9E-08	1.9E-09	4.8E-08	3.6E-07	3.2E-07	2.1E-07	2.0E-07	2.1E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	6.8E-09	2.7E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	7.4E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	8.7E-09	2.8E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	9.4E-08
R9	Project	2.4E-09	1.8E-08	1.6E-08	1.0E-08	1.0E-08	1.1E-09	2.7E-08	2.0E-07	1.7E-07	1.1E-07	1.1E-07	1.1E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	3.5E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	3.8E-09
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.4E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.5E-08
R10	Project	5.5E-09	4.2E-08	3.7E-08	2.4E-08	2.3E-08	2.5E-09	6.2E-08	4.6E-07	4.0E-07	2.6E-07	2.5E-07	2.7E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.7E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.8E-09
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.6E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.8E-08
R11	Project	2.1E-09	1.6E-08	1.4E-08	9.4E-09	9.0E-09	9.5E-10	2.4E-08	1.8E-07	1.5E-07	1.0E-07	9.7E-08	1.0E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.2E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.3E-09
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.1E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.2E-08
R12	Project	1.4E-09	1.1E-08	9.5E-09	6.2E-09	6.0E-09	6.3E-10	1.6E-08	1.2E-07	1.0E-07	6.7E-08	6.4E-08	6.8E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.5E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.7E-09
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	8.8E-10	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	9.6E-09
R13	Project	2.3E-09	1.8E-08	1.5E-08	1.0E-08	9.7E-09	1.0E-09	2.6E-08	1.9E-07	1.7E-07	1.1E-07	1.0E-07	1.1E-08
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	2.0E-10	2.5E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	2.2E-09
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	1.2E-09	2.6E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	1.3E-08
R14	Project	1.4E-09	1.1E-08	9.2E-09	6.0E-09	5.8E-09	6.0E-10	1.5E-08	1.1E-07	9.8E-08	6.5E-08	6.2E-08	6.5E-09
	Baseline	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	6.1E-09	2.7E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	6.6E-08
	Application	3.6E-06	1.3E-02	1.1E-02	7.9E-03	8.6E-03	6.7E-09	2.7E-06	8.9E-03	7.2E-03	5.2E-03	5.7E-03	7.3E-08

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Aluminum						Anthracene					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	1.0E-07	1.8E-07	1.3E-07	9.3E-08	1.0E-07	4.4E-08	3.5E-09	2.1E-07	1.9E-07	1.2E-07	1.1E-07	1.3E-09
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.4E-09
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	3.0E-09
FL-MPOI	5.2E-08	8.7E-08	6.3E-08	4.5E-08	4.9E-08	2.2E-08	1.8E-09	1.0E-07	9.3E-08	6.1E-08	5.6E-08	6.5E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.1E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	6.9E-10
R1	1.6E-08	2.7E-08	1.9E-08	1.4E-08	1.5E-08	6.8E-09	5.4E-10	3.2E-08	2.9E-08	1.9E-08	1.7E-08	2.0E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	9.4E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.1E-09
R2	5.4E-09	8.9E-09	6.4E-09	4.6E-09	5.0E-09	2.3E-09	1.8E-10	1.1E-08	9.8E-09	6.3E-09	5.9E-09	6.8E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.6E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	9.4E-11
R3	6.2E-09	1.0E-08	7.4E-09	5.3E-09	5.8E-09	2.7E-09	2.1E-10	1.3E-08	1.1E-08	7.3E-09	6.8E-09	7.8E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	5.6E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	6.4E-10
R4	2.6E-09	4.3E-09	3.1E-09	2.2E-09	2.4E-09	1.1E-09	8.8E-11	5.2E-09	4.7E-09	3.0E-09	2.8E-09	3.3E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.5E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	4.8E-11
R5	4.2E-09	6.9E-09	4.9E-09	3.5E-09	3.9E-09	1.8E-09	1.4E-10	8.4E-09	7.5E-09	4.9E-09	4.6E-09	5.3E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.1E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	7.3E-11
R6	8.9E-09	1.5E-08	1.1E-08	7.5E-09	8.3E-09	3.8E-09	3.0E-10	1.8E-08	1.6E-08	1.0E-08	9.7E-09	1.1E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.5E-09
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.6E-09
R7	6.7E-09	1.1E-08	8.2E-09	5.9E-09	6.4E-09	2.9E-09	2.3E-10	1.4E-08	1.2E-08	7.9E-09	7.3E-09	8.4E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	8.5E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	9.4E-10
R8	4.4E-08	7.7E-08	5.6E-08	4.0E-08	4.3E-08	1.9E-08	1.5E-09	8.9E-08	7.9E-08	5.1E-08	4.8E-08	5.5E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.0E-09
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.5E-09
R9	2.4E-08	4.0E-08	2.9E-08	2.1E-08	2.3E-08	1.0E-08	8.2E-10	4.9E-08	4.4E-08	2.8E-08	2.6E-08	3.0E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.0E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	4.1E-10
R10	5.6E-08	9.5E-08	6.9E-08	4.9E-08	5.4E-08	2.4E-08	1.9E-09	1.1E-07	1.0E-07	6.6E-08	6.2E-08	7.1E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	4.9E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	7.6E-10
R11	2.2E-08	3.6E-08	2.6E-08	1.9E-08	2.0E-08	9.4E-09	7.4E-10	4.4E-08	3.9E-08	2.6E-08	2.4E-08	2.7E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	3.5E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	3.1E-10
R12	1.4E-08	2.4E-08	1.7E-08	1.2E-08	1.4E-08	6.2E-09	4.9E-10	2.9E-08	2.6E-08	1.7E-08	1.6E-08	1.8E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	7.2E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	2.5E-10
R13	2.4E-08	3.9E-08	2.8E-08	2.0E-08	2.2E-08	1.0E-08	8.0E-10	4.8E-08	4.3E-08	2.8E-08	2.6E-08	3.0E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	5.8E-11
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	3.6E-10
R14	1.4E-08	2.3E-08	1.7E-08	1.2E-08	1.3E-08	5.9E-09	4.7E-10	2.8E-08	2.5E-08	1.6E-08	1.5E-08	1.7E-10
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.8E-09
	3.2E-01	3.6E+00	2.3E+00	1.7E+00	1.5E+00	1.8E-01	1.1E-06	2.8E-03	2.3E-03	1.7E-03	1.8E-03	1.9E-09

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Antimony						Barium					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	1.7E-06	1.1E-05	9.1E-06	6.1E-06	5.9E-06	7.2E-07	1.0E-06	3.6E-05	3.1E-05	2.0E-05	1.9E-05	4.9E-07
	4.7E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	2.0E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	1.7E-06	2.1E-01	1.1E-01	1.8E-01	1.5E-01	7.2E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.1E-03
FL-MPOI	8.0E-07	5.1E-06	4.3E-06	2.9E-06	2.8E-06	3.4E-07	4.9E-07	1.7E-05	1.5E-05	9.8E-06	9.1E-06	2.4E-07
	4.4E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.9E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	8.1E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	3.5E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R1	5.0E-08	3.1E-07	2.7E-07	1.8E-07	1.7E-07	2.1E-08	2.8E-08	9.9E-07	8.6E-07	5.6E-07	5.2E-07	1.4E-08
	2.0E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	8.7E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	2.5E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.1E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R2	6.9E-08	4.4E-07	3.7E-07	2.5E-07	2.4E-07	3.0E-08	4.2E-08	1.5E-06	1.3E-06	8.4E-07	7.8E-07	2.0E-08
	6.0E-09	2.1E-01	1.1E-01	1.8E-01	1.5E-01	2.6E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	7.5E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	3.2E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R3	5.4E-08	3.4E-07	2.9E-07	1.9E-07	1.9E-07	2.3E-08	3.3E-08	1.1E-06	1.0E-06	6.5E-07	6.0E-07	1.6E-08
	1.1E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	4.7E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	1.6E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	7.0E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R4	3.4E-08	2.1E-07	1.8E-07	1.2E-07	1.2E-07	1.4E-08	2.1E-08	7.2E-07	6.3E-07	4.1E-07	3.8E-07	9.9E-09
	3.5E-09	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.5E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	3.7E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.6E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R5	5.4E-08	3.4E-07	2.9E-07	1.9E-07	1.9E-07	2.3E-08	3.3E-08	1.2E-06	1.0E-06	6.5E-07	6.1E-07	1.6E-08
	4.5E-09	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.9E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	5.8E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	2.5E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R6	6.6E-08	4.2E-07	3.5E-07	2.3E-07	2.3E-07	2.8E-08	4.0E-08	1.4E-06	1.2E-06	7.9E-07	7.3E-07	1.9E-08
	3.8E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.6E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	4.4E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.9E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R7	3.8E-08	2.4E-07	2.1E-07	1.4E-07	1.3E-07	1.6E-08	2.3E-08	7.9E-07	6.9E-07	4.5E-07	4.2E-07	1.1E-08
	1.8E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	7.9E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	2.2E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	9.5E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R8	6.1E-08	3.9E-07	3.3E-07	2.2E-07	2.1E-07	2.6E-08	3.1E-08	1.1E-06	9.3E-07	6.1E-07	5.6E-07	1.5E-08
	3.7E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.6E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	4.3E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.8E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R9	2.3E-07	1.5E-06	1.2E-06	8.2E-07	8.0E-07	9.9E-08	1.4E-07	4.9E-06	4.3E-06	2.8E-06	2.6E-06	6.7E-08
	2.1E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	9.1E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	2.5E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.1E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R10	9.1E-07	5.8E-06	4.9E-06	3.3E-06	3.2E-06	3.9E-07	5.6E-07	2.0E-05	1.7E-05	1.1E-05	1.0E-05	2.7E-07
	1.0E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	4.4E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	9.2E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	3.9E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R11	2.9E-07	1.8E-06	1.5E-06	1.0E-06	9.9E-07	1.2E-07	1.8E-07	6.1E-06	5.3E-06	3.5E-06	3.2E-06	8.4E-08
	7.8E-09	2.1E-01	1.1E-01	1.8E-01	1.5E-01	3.3E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	2.9E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.3E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R12	1.5E-07	9.7E-07	8.3E-07	5.5E-07	5.3E-07	6.6E-08	9.3E-08	3.3E-06	2.8E-06	1.9E-06	1.7E-06	4.5E-08
	1.5E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	6.4E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	1.7E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	7.2E-08	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R13	2.9E-07	1.9E-06	1.6E-06	1.0E-06	1.0E-06	1.3E-07	1.8E-07	6.3E-06	5.5E-06	3.6E-06	3.3E-06	8.6E-08
	1.2E-08	2.1E-01	1.1E-01	1.8E-01	1.5E-01	5.1E-09	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	3.0E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.3E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
R14	4.3E-08	2.7E-07	2.3E-07	1.5E-07	1.5E-07	1.8E-08	2.4E-08	8.5E-07	7.4E-07	4.8E-07	4.5E-07	1.2E-08
	3.7E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.6E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03
	4.2E-07	2.1E-01	1.1E-01	1.8E-01	1.5E-01	1.8E-07	5.8E-03	2.2E+00	1.8E+00	1.3E+00	1.4E+00	3.0E-03

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Beryllium						Cadmium					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	1.4E-07	1.5E-06	1.3E-06	8.7E-07	8.3E-07	7.4E-08	1.6E-06	2.1E-04	1.9E-04	1.2E-04	1.2E-04	8.5E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
FL-MPOI	6.6E-08	7.3E-07	6.3E-07	4.1E-07	4.0E-07	3.6E-08	7.8E-07	1.0E-04	9.4E-05	6.1E-05	5.7E-05	4.2E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R1	3.7E-09	4.1E-08	3.5E-08	2.3E-08	2.2E-08	2.0E-09	1.5E-07	2.1E-05	1.8E-05	1.2E-05	1.1E-05	8.3E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R2	5.7E-09	6.2E-08	5.4E-08	3.5E-08	3.4E-08	3.1E-09	7.5E-08	1.0E-05	9.0E-06	5.9E-06	5.5E-06	4.0E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R3	4.4E-09	4.8E-08	4.1E-08	2.7E-08	2.6E-08	2.4E-09	7.5E-08	1.0E-05	9.0E-06	5.9E-06	5.5E-06	4.0E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R4	2.8E-09	3.0E-08	2.6E-08	1.7E-08	1.6E-08	1.5E-09	3.6E-08	4.9E-06	4.4E-06	2.8E-06	2.6E-06	2.0E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R5	4.4E-09	4.8E-08	4.2E-08	2.7E-08	2.6E-08	2.4E-09	5.8E-08	7.8E-06	7.0E-06	4.5E-06	4.2E-06	3.1E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R6	5.3E-09	5.8E-08	5.0E-08	3.3E-08	3.1E-08	2.9E-09	1.0E-07	1.4E-05	1.2E-05	8.0E-06	7.4E-06	5.5E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R7	3.0E-09	3.3E-08	2.9E-08	1.9E-08	1.8E-08	1.6E-09	7.2E-08	9.7E-06	8.7E-06	5.6E-06	5.2E-06	3.9E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R8	4.0E-09	4.3E-08	3.8E-08	2.5E-08	2.4E-08	2.1E-09	3.9E-07	5.2E-05	4.7E-05	3.0E-05	2.8E-05	2.1E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R9	1.9E-08	2.1E-07	1.8E-07	1.2E-07	1.1E-07	1.0E-08	3.0E-07	4.0E-05	3.6E-05	2.3E-05	2.2E-05	1.6E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R10	7.5E-08	8.2E-07	7.1E-07	4.7E-07	4.5E-07	4.0E-08	8.6E-07	1.2E-04	1.0E-04	6.7E-05	6.3E-05	4.6E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R11	2.3E-08	2.6E-07	2.2E-07	1.5E-07	1.4E-07	1.3E-08	3.1E-07	4.1E-05	3.7E-05	2.4E-05	2.2E-05	1.6E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R12	1.2E-08	1.4E-07	1.2E-07	7.8E-08	7.4E-08	6.8E-09	1.9E-07	2.5E-05	2.2E-05	1.5E-05	1.4E-05	1.0E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R13	2.4E-08	2.6E-07	2.3E-07	1.5E-07	1.4E-07	1.3E-08	3.2E-07	4.3E-05	3.9E-05	2.5E-05	2.4E-05	1.7E-07
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
R14	3.2E-09	3.5E-08	3.0E-08	2.0E-08	1.9E-08	1.7E-09	1.3E-07	1.8E-05	1.6E-05	1.0E-05	9.7E-06	7.2E-08
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03
	3.7E-03	5.7E-03	2.9E-03	2.2E-03	2.0E-03	1.4E-03	8.6E-03	4.4E+00	3.6E+00	2.5E+00	2.7E+00	5.0E-03

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Chromium (Total)						Cobalt					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	3.4E-09	1.7E-08	1.4E-08	9.3E-09	9.4E-09	1.8E-09	1.4E-06	4.2E-06	3.0E-06	2.2E-06	2.6E-06	7.5E-07
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
FL-MPOI	1.7E-09	8.2E-09	6.7E-09	4.5E-09	4.6E-09	9.0E-10	6.7E-07	1.9E-06	1.3E-06	9.7E-07	1.1E-06	3.6E-07
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R1	3.9E-10	1.9E-09	1.5E-09	1.0E-09	1.0E-09	2.1E-10	3.8E-08	1.0E-07	7.3E-08	5.2E-08	6.2E-08	2.0E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R2	1.7E-10	8.0E-10	6.6E-10	4.4E-10	4.4E-10	8.9E-11	5.7E-08	1.6E-07	1.1E-07	8.0E-08	9.4E-08	3.1E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R3	1.7E-10	8.4E-10	6.9E-10	4.6E-10	4.6E-10	9.4E-11	4.4E-08	1.2E-07	8.5E-08	6.1E-08	7.2E-08	2.4E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R4	8.0E-11	3.9E-10	3.2E-10	2.1E-10	2.1E-10	4.3E-11	2.8E-08	7.5E-08	5.4E-08	3.9E-08	4.6E-08	1.5E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R5	1.3E-10	6.2E-10	5.1E-10	3.4E-10	3.4E-10	6.9E-11	4.5E-08	1.2E-07	8.6E-08	6.2E-08	7.3E-08	2.4E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R6	2.4E-10	1.2E-09	9.5E-10	6.4E-10	6.4E-10	1.3E-10	5.4E-08	1.4E-07	1.0E-07	7.4E-08	8.8E-08	2.9E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R7	1.7E-10	8.6E-10	7.0E-10	4.7E-10	4.7E-10	9.4E-11	3.1E-08	8.3E-08	5.9E-08	4.3E-08	5.0E-08	1.7E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R8	1.0E-09	5.1E-09	4.1E-09	2.8E-09	2.8E-09	5.5E-10	4.0E-08	1.1E-07	7.8E-08	5.6E-08	6.6E-08	2.2E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R9	6.9E-10	3.3E-09	2.7E-09	1.8E-09	1.8E-09	3.7E-10	1.9E-07	5.1E-07	3.7E-07	2.6E-07	3.1E-07	1.0E-07
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R10	1.8E-09	9.1E-09	7.4E-09	5.0E-09	5.0E-09	1.0E-09	7.6E-07	2.1E-06	1.5E-06	1.1E-06	1.3E-06	4.1E-07
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R11	6.7E-10	3.3E-09	2.7E-09	1.8E-09	1.8E-09	3.6E-10	2.4E-07	6.5E-07	4.6E-07	3.3E-07	3.9E-07	1.3E-07
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R12	4.2E-10	2.1E-09	1.7E-09	1.1E-09	1.1E-09	2.3E-10	1.3E-07	3.4E-07	2.5E-07	1.8E-07	2.1E-07	6.8E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R13	7.2E-10	3.5E-09	2.8E-09	1.9E-09	1.9E-09	3.9E-10	2.4E-07	6.6E-07	4.7E-07	3.4E-07	4.0E-07	1.3E-07
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
R14	3.3E-10	1.6E-09	1.3E-09	8.9E-10	9.0E-10	1.8E-10	3.2E-08	8.7E-08	6.3E-08	4.5E-08	5.3E-08	1.8E-08
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02
	7.5E-05	2.5E-04	1.1E-04	8.5E-05	6.6E-05	3.9E-05	8.0E-02	3.8E-01	2.6E-01	2.0E-01	1.9E-01	3.0E-02

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Copper						Fluorene					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	2.2E-07	1.8E-06	1.5E-06	1.0E-06	9.8E-07	9.5E-08	2.4E-07	9.7E-06	8.6E-06	5.6E-06	5.2E-06	1.0E-07
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
FL-MPOI	1.1E-07	8.7E-07	7.5E-07	5.0E-07	4.8E-07	4.6E-08	1.2E-07	4.8E-06	4.3E-06	2.8E-06	2.6E-06	5.1E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R1	2.2E-08	1.8E-07	1.5E-07	1.0E-07	9.6E-08	9.4E-09	3.8E-08	1.5E-06	1.3E-06	8.6E-07	8.1E-07	1.6E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R2	1.0E-08	8.4E-08	7.2E-08	4.8E-08	4.6E-08	4.5E-09	1.3E-08	5.0E-07	4.5E-07	2.9E-07	2.7E-07	5.3E-09
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R3	1.1E-08	8.5E-08	7.3E-08	4.8E-08	4.6E-08	4.5E-09	1.5E-08	5.8E-07	5.2E-07	3.4E-07	3.1E-07	6.1E-09
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R4	5.1E-09	4.1E-08	3.5E-08	2.3E-08	2.2E-08	2.2E-09	6.1E-09	2.4E-07	2.2E-07	1.4E-07	1.3E-07	2.6E-09
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R5	8.1E-09	6.5E-08	5.6E-08	3.7E-08	3.5E-08	3.5E-09	9.8E-09	3.9E-07	3.5E-07	2.3E-07	2.1E-07	4.1E-09
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R6	1.4E-08	1.2E-07	1.0E-07	6.6E-08	6.3E-08	6.2E-09	2.1E-08	8.3E-07	7.4E-07	4.8E-07	4.5E-07	8.7E-09
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R7	1.0E-08	8.3E-08	7.1E-08	4.7E-08	4.5E-08	4.4E-09	1.6E-08	6.3E-07	5.6E-07	3.6E-07	3.4E-07	6.6E-09
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R8	5.6E-08	4.5E-07	3.9E-07	2.6E-07	2.5E-07	2.4E-08	1.0E-07	4.1E-06	3.7E-06	2.4E-06	2.2E-06	4.3E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R9	4.2E-08	3.4E-07	2.9E-07	1.9E-07	1.8E-07	1.8E-08	5.7E-08	2.3E-06	2.0E-06	1.3E-06	1.2E-06	2.4E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R10	1.2E-07	9.7E-07	8.3E-07	5.5E-07	5.3E-07	5.1E-08	1.3E-07	5.3E-06	4.7E-06	3.0E-06	2.8E-06	5.5E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R11	4.3E-08	3.4E-07	3.0E-07	2.0E-07	1.9E-07	1.8E-08	5.1E-08	2.0E-06	1.8E-06	1.2E-06	1.1E-06	2.1E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R12	2.6E-08	2.1E-07	1.8E-07	1.2E-07	1.1E-07	1.1E-08	3.4E-08	1.4E-06	1.2E-06	7.8E-07	7.3E-07	1.4E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R13	4.5E-08	3.6E-07	3.1E-07	2.1E-07	2.0E-07	1.9E-08	5.5E-08	2.2E-06	2.0E-06	1.3E-06	1.2E-06	2.3E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.1E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
R14	1.9E-08	1.5E-07	1.3E-07	8.7E-08	8.3E-08	8.1E-09	3.3E-08	1.3E-06	1.2E-06	7.5E-07	7.0E-07	1.4E-08
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05
	3.1E-03	2.4E-01	1.8E-01	1.4E-01	1.2E-01	1.1E-03	5.2E-05	4.9E-02	3.9E-02	2.9E-02	3.0E-02	2.2E-05

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Fluoranthene						Formaldehyde						Manganese					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	1.2E-07	1.2E-05	1.1E-05	7.2E-06	6.7E-06	3.2E-08	9.1E-08	1.4E-07	1.0E-07	6.8E-08	7.6E-08	5.0E-08	5.6E-08	3.9E-07	2.8E-07	2.2E-07	2.7E-07	2.4E-08
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	3.0E-06	1.7E-07	2.5E-07	1.8E-07	1.2E-07	1.4E-07	9.2E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.8E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	3.0E-06	2.1E-07	3.1E-07	2.3E-07	1.6E-07	1.8E-07	1.2E-07	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
FL-MPOI	5.9E-08	6.2E-06	5.5E-06	3.6E-06	3.3E-06	1.6E-08	4.5E-08	6.6E-08	4.9E-08	3.3E-08	3.7E-08	2.5E-08	2.8E-08	1.8E-07	1.3E-07	1.0E-07	1.3E-07	1.2E-08
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.5E-08	2.2E-08	1.6E-08	1.1E-08	1.2E-08	8.1E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	4.8E-08	7.1E-08	5.2E-08	3.5E-08	4.0E-08	2.7E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R1	1.8E-08	1.9E-06	1.7E-06	1.1E-06	1.0E-06	4.9E-09	1.4E-08	2.0E-08	1.5E-08	1.0E-08	1.2E-08	7.8E-09	8.6E-09	5.5E-08	4.0E-08	3.0E-08	3.8E-08	3.7E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	6.6E-08	9.7E-08	7.2E-08	4.8E-08	5.5E-08	3.6E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	8.0E-08	1.2E-07	8.7E-08	5.9E-08	6.6E-08	4.4E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R2	6.2E-09	6.5E-07	5.8E-07	3.8E-07	3.5E-07	1.7E-09	4.7E-09	6.9E-09	5.1E-09	3.4E-09	3.9E-09	2.6E-09	2.9E-09	1.8E-08	1.3E-08	1.0E-08	1.3E-08	1.3E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.8E-09	2.6E-09	1.9E-09	1.3E-09	1.5E-09	1.0E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	6.5E-09	9.5E-09	7.1E-09	4.7E-09	5.4E-09	3.6E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R3	7.1E-09	7.4E-07	6.6E-07	4.3E-07	4.0E-07	1.9E-09	5.5E-09	7.9E-09	5.9E-09	4.0E-09	4.5E-09	3.0E-09	3.4E-09	2.1E-08	1.5E-08	1.2E-08	1.5E-08	1.4E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	3.9E-08	5.8E-08	4.3E-08	2.9E-08	3.3E-08	2.2E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	4.5E-08	6.6E-08	4.9E-08	3.3E-08	3.7E-08	2.5E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R4	3.0E-09	3.1E-07	2.8E-07	1.8E-07	1.7E-07	8.0E-10	2.3E-09	3.3E-09	2.5E-09	1.6E-09	1.9E-09	1.3E-09	1.4E-09	8.7E-09	6.4E-09	4.8E-09	6.1E-09	6.0E-10
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.1E-09	1.6E-09	1.2E-09	7.8E-10	8.8E-10	5.9E-10	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	3.4E-09	4.9E-09	3.6E-09	2.4E-09	2.7E-09	1.9E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R5	4.8E-09	5.0E-07	4.5E-07	2.9E-07	2.7E-07	1.3E-09	3.7E-09	5.3E-09	3.9E-09	2.6E-09	3.0E-09	2.0E-09	2.3E-09	1.4E-08	1.0E-08	7.8E-09	9.7E-09	9.7E-10
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.5E-09	2.1E-09	1.6E-09	1.1E-09	1.2E-09	8.0E-10	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	5.1E-09	7.4E-09	5.5E-09	3.7E-09	4.2E-09	2.8E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R6	1.0E-08	1.1E-06	9.5E-07	6.2E-07	5.7E-07	2.7E-09	7.8E-09	1.1E-08	8.4E-09	5.6E-09	6.4E-09	4.3E-09	4.8E-09	3.0E-08	2.2E-08	1.7E-08	2.1E-08	2.1E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.1E-07	1.6E-07	1.2E-07	7.9E-08	8.9E-08	5.9E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.1E-07	1.7E-07	1.3E-07	8.5E-08	9.6E-08	6.3E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R7	7.7E-09	8.0E-07	7.2E-07	4.7E-07	4.3E-07	2.1E-09	5.9E-09	8.6E-09	6.4E-09	4.3E-09	4.9E-09	3.3E-09	3.6E-09	2.4E-08	1.8E-08	1.3E-08	1.7E-08	1.6E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	5.9E-08	8.8E-08	6.5E-08	4.4E-08	5.0E-08	3.3E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	6.5E-08	9.7E-08	7.2E-08	4.8E-08	5.5E-08	3.6E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R8	5.0E-08	5.2E-06	4.7E-06	3.0E-06	2.8E-06	1.4E-08	3.9E-08	5.7E-08	4.2E-08	2.8E-08	3.2E-08	2.1E-08	2.4E-08	1.7E-07	1.2E-07	9.2E-08	1.1E-07	1.0E-08
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.4E-07	2.0E-07	1.5E-07	1.0E-07	1.2E-07	7.6E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	3.0E-06	1.8E-07	2.6E-07	1.9E-07	1.3E-07	1.5E-07	9.7E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R9	2.8E-08	2.9E-06	2.6E-06	1.7E-06	1.6E-06	7.5E-09	2.1E-08	3.1E-08	2.3E-08	1.5E-08	1.7E-08	1.2E-08	1.3E-08	8.2E-08	6.0E-08	4.6E-08	5.7E-08	5.6E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	7.1E-09	1.0E-08	7.8E-09	5.2E-09	5.9E-09	4.0E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	2.8E-08	4.1E-08	3.1E-08	2.1E-08	2.3E-08	1.6E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R10	6.4E-08	6.7E-06	6.0E-06	3.9E-06	3.6E-06	1.7E-08	4.9E-08	7.2E-08	5.3E-08	3.6E-08	4.1E-08	2.7E-08	3.0E-08	2.0E-07	1.5E-07	1.1E-07	1.4E-07	1.3E-08
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	3.4E-09	5.0E-09	3.7E-09	2.5E-09	2.8E-09	1.9E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	5.3E-08	7.7E-08	5.7E-08	3.8E-08	4.3E-08	2.9E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R11	2.5E-08	2.6E-06	2.3E-06	1.5E-06	1.4E-06	6.8E-09	1.9E-08	2.8E-08	2.1E-08	1.4E-08	1.6E-08	1.1E-08	1.2E-08	7.4E-08	5.4E-08	4.1E-08	5.1E-08	5.1E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	2.5E-09	3.6E-09	2.6E-09	1.8E-09	2.0E-09	1.4E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	2.2E-08	3.1E-08	2.3E-08	1.6E-08	1.8E-08	1.2E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R12	1.7E-08	1.7E-06	1.5E-06	1.0E-06	9.4E-07	4.5E-09	1.3E-08	1.9E-08	1.4E-08	9.2E-09	1.0E-08	7.0E-09	7.8E-09	5.0E-08	3.7E-08	2.8E-08	3.5E-08	3.4E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	5.0E-09	7.4E-09	5.5E-09	3.7E-09	4.2E-09	2.8E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.8E-08	2.6E-08	1.9E-08	1.3E-08	1.5E-08	9.8E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R13	2.7E-08	2.8E-06	2.5E-06	1.6E-06	1.5E-06	7.3E-09	2.1E-08	3.0E-08	2.2E-08	1.5E-08	1.7E-08	1.1E-08	1.3E-08	8.0E-08	5.9E-08	4.5E-08	5.6E-08	5.5E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	4.1E-09	5.9E-09	4.4E-09	3.0E-09	3.4E-09	2.3E-09	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	2.5E-08	3.6E-08	2.7E-08	1.8E-08	2.0E-08	1.4E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
R14	1.6E-08	1.7E-06	1.5E-06	9.6E-07	8.9E-07	4.3E-09	1.2E-08	1.8E-08	1.3E-08	8.8E-09	1.0E-08	6.7E-09	7.5E-09	4.7E-08	3.5E-08	2.6E-08	3.3E-08	3.2E-09
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.2E-07	1.8E-07	1.4E-07	9.2E-08	1.0E-07	6.8E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02
	2.7E-05	4.9E-02	4.0E-02	2.9E-02	3.1E-02	2.9E-06	1.4E-07	2.0E-07	1.5E-07	1.0E-07	1.1E-07	7.5E-08	2.2E-01	2.6E+01	2.1E+01	1.5E+01	1.6E+01	8.1E-02

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Mercury						Molybdenum						Nickel					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	1.6E-07	1.9E-06	1.4E-06	1.0E-06	1.3E-06	6.9E-08	1.1E-07	2.2E-07	1.6E-07	1.1E-07	1.3E-07	4.7E-08	7.8E-07	8.6E-06	7.4E-06	4.9E-06	4.7E-06	3.3E-07
	4.0E-08	4.8E-07	3.5E-07	2.7E-07	3.4E-07	1.7E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	1.6E-07	1.9E-06	1.4E-06	1.1E-06	1.3E-06	6.9E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
FL-MPOI	7.7E-08	8.1E-07	5.9E-07	4.5E-07	5.8E-07	3.3E-08	5.3E-08	9.9E-08	7.2E-08	5.2E-08	5.8E-08	2.3E-08	3.7E-07	4.1E-06	3.5E-06	2.3E-06	2.2E-06	1.6E-07
	3.8E-09	4.0E-08	3.0E-08	2.3E-08	2.9E-08	1.6E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	7.8E-08	8.2E-07	6.0E-07	4.6E-07	5.8E-07	3.3E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R1	4.4E-09	4.3E-08	3.2E-08	2.4E-08	3.1E-08	1.9E-09	3.0E-09	5.4E-09	3.9E-09	2.8E-09	3.2E-09	1.3E-09	2.1E-08	2.3E-07	2.0E-07	1.3E-07	1.3E-07	9.0E-09
	1.7E-08	1.8E-07	1.4E-07	1.0E-07	1.3E-07	7.5E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	2.2E-08	2.3E-07	1.7E-07	1.3E-07	1.6E-07	9.3E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R2	6.6E-09	6.6E-08	4.9E-08	3.7E-08	4.7E-08	2.8E-09	4.5E-09	8.3E-09	6.0E-09	4.3E-09	4.8E-09	1.9E-09	3.2E-08	3.5E-07	3.0E-07	2.0E-07	1.9E-07	1.4E-08
	5.2E-10	5.2E-09	3.8E-09	2.9E-09	3.7E-09	2.2E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	7.1E-09	7.1E-08	5.2E-08	4.0E-08	5.1E-08	3.1E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R3	5.1E-09	5.1E-08	3.7E-08	2.8E-08	3.6E-08	2.2E-09	3.5E-09	6.4E-09	4.6E-09	3.3E-09	3.7E-09	1.5E-09	2.5E-08	2.7E-07	2.3E-07	1.5E-07	1.5E-07	1.1E-08
	9.3E-09	9.8E-08	7.2E-08	5.5E-08	7.0E-08	4.0E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	1.4E-08	1.5E-07	1.1E-07	8.3E-08	1.1E-07	6.2E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R4	3.2E-09	3.2E-08	2.4E-08	1.8E-08	2.3E-08	1.4E-09	2.2E-09	4.0E-09	2.9E-09	2.1E-09	2.3E-09	9.5E-10	1.6E-08	1.7E-07	1.5E-07	9.7E-08	9.3E-08	6.7E-09
	3.0E-10	3.0E-09	2.2E-09	1.7E-09	2.1E-09	1.3E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	3.5E-09	3.5E-08	2.6E-08	2.0E-08	2.5E-08	1.5E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R5	5.1E-09	5.1E-08	3.8E-08	2.9E-08	3.6E-08	2.2E-09	3.5E-09	6.4E-09	4.6E-09	3.3E-09	3.7E-09	1.5E-09	2.5E-08	2.7E-07	2.3E-07	1.5E-07	1.5E-07	1.1E-08
	3.9E-10	3.9E-09	2.9E-09	2.2E-09	2.8E-09	1.7E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	5.5E-09	5.5E-08	4.0E-08	3.1E-08	3.9E-08	2.4E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R6	6.2E-09	6.1E-08	4.5E-08	3.4E-08	4.3E-08	2.6E-09	4.2E-09	7.7E-09	5.5E-09	4.0E-09	4.5E-09	1.8E-09	3.0E-08	3.2E-07	2.8E-07	1.9E-07	1.8E-07	1.3E-08
	3.3E-08	3.9E-07	2.9E-07	2.2E-07	2.8E-07	1.4E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	3.9E-08	4.5E-07	3.3E-07	2.5E-07	3.2E-07	1.7E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R7	3.5E-09	3.5E-08	2.6E-08	2.0E-08	2.5E-08	1.5E-09	2.4E-09	4.4E-09	3.2E-09	2.3E-09	2.6E-09	1.0E-09	1.7E-08	1.9E-07	1.6E-07	1.1E-07	1.0E-07	7.3E-09
	1.6E-08	1.8E-07	1.3E-07	9.9E-08	1.3E-07	6.8E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	1.9E-08	2.1E-07	1.6E-07	1.2E-07	1.5E-07	8.3E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R8	4.6E-09	4.7E-08	3.4E-08	2.6E-08	3.3E-08	2.0E-09	3.2E-09	5.8E-09	4.2E-09	3.0E-09	3.4E-09	1.4E-09	2.2E-08	2.4E-07	2.1E-07	1.4E-07	1.3E-07	9.6E-09
	3.1E-08	3.6E-07	2.7E-07	2.0E-07	2.6E-07	1.3E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	3.6E-08	4.1E-07	3.0E-07	2.3E-07	2.9E-07	1.5E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R9	2.2E-08	2.2E-07	1.6E-07	1.2E-07	1.6E-07	9.4E-09	1.5E-08	2.7E-08	2.0E-08	1.4E-08	1.6E-08	6.4E-09	1.1E-07	1.2E-06	1.0E-06	6.6E-07	6.3E-07	4.5E-08
	1.8E-09	1.9E-08	1.4E-08	1.1E-08	1.4E-08	7.8E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	2.4E-08	2.4E-07	1.7E-07	1.3E-07	1.7E-07	1.0E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R10	8.7E-08	9.2E-07	6.8E-07	5.2E-07	6.6E-07	3.7E-08	6.0E-08	1.1E-07	8.1E-08	5.9E-08	6.6E-08	2.6E-08	4.2E-07	4.6E-06	4.0E-06	2.6E-06	2.5E-06	1.8E-07
	8.8E-10	9.0E-09	6.6E-09	5.0E-09	6.4E-09	3.8E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	8.8E-08	9.3E-07	6.8E-07	5.2E-07	6.6E-07	3.8E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R11	2.7E-08	2.8E-07	2.0E-07	1.6E-07	2.0E-07	1.2E-08	1.9E-08	3.5E-08	2.5E-08	1.8E-08	2.0E-08	8.1E-09	1.3E-07	1.4E-06	1.3E-06	8.3E-07	7.9E-07	5.7E-08
	6.7E-10	6.8E-09	5.0E-09	3.8E-09	4.8E-09	2.9E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	2.8E-08	2.8E-07	2.1E-07	1.6E-07	2.0E-07	1.2E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R12	1.5E-08	1.5E-07	1.1E-07	8.3E-08	1.0E-07	6.3E-09	1.0E-08	1.8E-08	1.3E-08	9.6E-09	1.1E-08	4.3E-09	7.0E-08	7.7E-07	6.7E-07	4.4E-07	4.2E-07	3.0E-08
	1.3E-09	1.3E-08	9.8E-09	7.5E-09	9.5E-09	5.5E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	1.6E-08	1.6E-07	1.2E-07	9.0E-08	1.1E-07	6.8E-09	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R13	2.8E-08	2.8E-07	2.1E-07	1.6E-07	2.0E-07	1.2E-08	1.9E-08	3.5E-08	2.5E-08	1.8E-08	2.1E-08	8.2E-09	1.4E-07	1.5E-06	1.3E-06	8.4E-07	8.1E-07	5.8E-08
	1.0E-09	1.1E-08	7.8E-09	5.9E-09	7.5E-09	4.4E-10	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	2.9E-08	2.9E-07	2.2E-07	1.6E-07	2.1E-07	1.2E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
R14	3.7E-09	3.7E-08	2.7E-08	2.1E-08	2.6E-08	1.6E-09	2.6E-09	4.7E-09	3.4E-09	2.4E-09	2.7E-09	1.1E-09	1.8E-08	2.0E-07	1.7E-07	1.1E-07	1.1E-07	7.8E-09
	3.2E-08	3.8E-07	2.8E-07	2.1E-07	2.7E-07	1.4E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03
	3.6E-08	4.1E-07	3.0E-07	2.3E-07	3.0E-07	1.5E-08	6.9E-04	3.0E-01	2.5E-01	1.8E-01	1.9E-01	4.0E-04	8.3E-03	6.1E-02	3.7E-02	2.8E-02	2.4E-02	4.4E-03

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Pyrene						Selenium						Thallium					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	2.8E-08	2.4E-06	2.1E-06	1.4E-06	1.3E-06	7.1E-09	8.4E-08	1.5E-06	1.3E-06	8.4E-07	8.0E-07	3.6E-08	1.7E-05	2.3E-04	2.0E-04	1.3E-04	1.3E-04	7.4E-06
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
FL-MPOI	1.4E-08	1.2E-06	1.1E-06	6.8E-07	6.4E-07	3.6E-09	4.0E-08	6.9E-07	6.1E-07	4.0E-07	3.8E-07	1.7E-08	8.3E-06	1.1E-04	9.7E-05	6.4E-05	6.0E-05	3.6E-06
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R1	4.3E-09	3.6E-07	3.3E-07	2.1E-07	2.0E-07	1.1E-09	2.3E-09	3.9E-08	3.4E-08	2.2E-08	2.1E-08	9.8E-10	4.7E-07	6.2E-06	5.5E-06	3.6E-06	3.4E-06	2.0E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R2	1.5E-09	1.2E-07	1.1E-07	7.1E-08	6.7E-08	3.7E-10	3.5E-09	5.9E-08	5.2E-08	3.4E-08	3.3E-08	1.5E-09	7.1E-07	9.5E-06	8.3E-06	5.4E-06	5.1E-06	3.1E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R3	1.7E-09	1.4E-07	1.3E-07	8.2E-08	7.6E-08	4.3E-10	2.7E-09	4.6E-08	4.0E-08	2.6E-08	2.5E-08	1.1E-09	5.5E-07	7.3E-06	6.4E-06	4.2E-06	4.0E-06	2.4E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R4	7.0E-10	5.9E-08	5.3E-08	3.4E-08	3.2E-08	1.8E-10	1.7E-09	2.9E-08	2.5E-08	1.7E-08	1.6E-08	7.2E-10	3.5E-07	4.6E-06	4.0E-06	2.6E-06	2.5E-06	1.5E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R5	1.1E-09	9.5E-08	8.5E-08	5.5E-08	5.1E-08	2.9E-10	2.7E-09	4.6E-08	4.0E-08	2.6E-08	2.5E-08	1.2E-09	5.5E-07	7.4E-06	6.4E-06	4.2E-06	4.0E-06	2.4E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R6	2.4E-09	2.0E-07	1.8E-07	1.2E-07	1.1E-07	6.1E-10	3.2E-09	5.5E-08	4.8E-08	3.2E-08	3.0E-08	1.4E-09	6.7E-07	8.8E-06	7.7E-06	5.1E-06	4.8E-06	2.9E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R7	1.8E-09	1.5E-07	1.4E-07	8.9E-08	8.3E-08	4.6E-10	1.8E-09	3.2E-08	2.8E-08	1.8E-08	1.7E-08	7.9E-10	3.8E-07	5.1E-06	4.4E-06	2.9E-06	2.7E-06	1.6E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R8	1.2E-08	1.0E-06	9.0E-07	5.9E-07	5.4E-07	3.0E-09	2.4E-09	4.1E-08	3.6E-08	2.4E-08	2.3E-08	1.0E-09	5.0E-07	6.6E-06	5.8E-06	3.8E-06	3.6E-06	2.1E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R9	6.5E-09	5.5E-07	4.9E-07	3.2E-07	3.0E-07	1.7E-09	1.1E-08	2.0E-07	1.7E-07	1.1E-07	1.1E-07	4.9E-09	2.4E-06	3.1E-05	2.7E-05	1.8E-05	1.7E-05	1.0E-06
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R10	1.5E-08	1.3E-06	1.1E-06	7.4E-07	6.9E-07	3.9E-09	4.5E-08	7.8E-07	6.9E-07	4.5E-07	4.3E-07	2.0E-08	9.4E-06	1.3E-04	1.1E-04	7.2E-05	6.8E-05	4.0E-06
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R11	5.9E-09	5.0E-07	4.4E-07	2.9E-07	2.7E-07	1.5E-09	1.4E-08	2.5E-07	2.2E-07	1.4E-07	1.3E-07	6.1E-09	3.0E-06	3.9E-05	3.4E-05	2.3E-05	2.1E-05	1.3E-06
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R12	3.9E-09	3.3E-07	3.0E-07	1.9E-07	1.8E-07	1.0E-09	7.6E-09	1.3E-07	1.1E-07	7.5E-08	7.2E-08	3.3E-09	1.6E-06	2.1E-05	1.8E-05	1.2E-05	1.1E-05	6.8E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R13	6.4E-09	5.4E-07	4.8E-07	3.1E-07	2.9E-07	1.6E-09	1.5E-08	2.5E-07	2.2E-07	1.4E-07	1.4E-07	6.3E-09	3.0E-06	4.0E-05	3.5E-05	2.3E-05	2.2E-05	1.3E-06
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
R14	3.7E-09	3.2E-07	2.8E-07	1.8E-07	1.7E-07	9.5E-10	2.0E-09	3.4E-08	2.9E-08	1.9E-08	1.8E-08	8.4E-10	4.0E-07	5.4E-06	4.7E-06	3.1E-06	2.9E-06	1.7E-07
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02
	1.6E-04	6.4E-02	5.1E-02	3.7E-02	4.0E-02	3.0E-05	4.1E-04	4.6E-01	3.7E-01	2.7E-01	2.9E-01	2.4E-04	1.5E-01	2.3E+01	1.9E+01	1.3E+01	1.5E+01	5.4E-02

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Uranium						Vanadium						Zinc					
	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	3.5E-06	4.0E-06	3.1E-06	2.4E-06	2.5E-06	5.0E-07	8.9E-06	6.3E-05	4.6E-05	3.5E-05	4.4E-05	5.0E-06	5.0E-07	1.2E-04	1.1E-04	7.1E-05	6.7E-05	2.1E-07
	8.8E-07	1.0E-06	7.8E-07	6.1E-07	6.2E-07	1.2E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	3.5E-06	4.0E-06	3.1E-06	2.4E-06	2.5E-06	5.0E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
FL-MPOI	1.7E-06	1.9E-06	1.5E-06	1.1E-06	1.2E-06	2.4E-07	4.4E-06	2.9E-05	2.1E-05	1.6E-05	2.0E-05	2.5E-06	2.5E-07	6.0E-05	5.4E-05	3.5E-05	3.3E-05	1.1E-07
	8.3E-08	9.3E-08	7.2E-08	5.6E-08	5.7E-08	1.2E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	1.7E-06	1.9E-06	1.5E-06	1.2E-06	1.2E-06	2.4E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R1	9.5E-08	1.1E-07	8.1E-08	6.4E-08	6.5E-08	1.3E-08	9.9E-07	6.3E-06	4.6E-06	3.4E-06	4.3E-06	5.5E-07	5.8E-08	1.4E-05	1.3E-05	8.3E-06	7.7E-06	2.5E-08
	3.8E-07	4.2E-07	3.3E-07	2.6E-07	2.6E-07	5.4E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	4.8E-07	5.3E-07	4.1E-07	3.2E-07	3.3E-07	6.7E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R2	1.5E-07	1.6E-07	1.2E-07	9.7E-08	9.9E-08	2.0E-08	4.3E-07	2.7E-06	2.0E-06	1.5E-06	1.8E-06	2.4E-07	2.4E-08	6.0E-06	5.4E-06	3.5E-06	3.3E-06	1.1E-08
	1.1E-08	1.3E-08	9.7E-09	7.6E-09	7.8E-09	1.6E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	1.6E-07	1.7E-07	1.3E-07	1.0E-07	1.1E-07	2.2E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R3	1.1E-07	1.2E-07	9.6E-08	7.5E-08	7.6E-08	1.6E-08	4.5E-07	2.8E-06	2.0E-06	1.5E-06	1.9E-06	2.5E-07	2.6E-08	6.3E-06	5.6E-06	3.7E-06	3.4E-06	1.1E-08
	2.0E-07	2.3E-07	1.8E-07	1.4E-07	1.4E-07	2.9E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	3.2E-07	3.5E-07	2.7E-07	2.1E-07	2.2E-07	4.4E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R4	7.1E-08	7.8E-08	6.0E-08	4.7E-08	4.8E-08	1.0E-08	2.1E-07	1.3E-06	9.4E-07	7.0E-07	8.8E-07	1.2E-07	1.2E-08	2.9E-06	2.6E-06	1.7E-06	1.6E-06	5.1E-09
	6.6E-09	7.3E-09	5.6E-09	4.4E-09	4.5E-09	9.3E-10	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	7.7E-08	8.5E-08	6.6E-08	5.2E-08	5.3E-08	1.1E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R5	1.1E-07	1.2E-07	9.6E-08	7.5E-08	7.7E-08	1.6E-08	3.4E-07	2.1E-06	1.5E-06	1.1E-06	1.4E-06	1.9E-07	1.9E-08	4.6E-06	4.1E-06	2.7E-06	2.5E-06	8.1E-09
	8.6E-09	9.5E-09	7.3E-09	5.8E-09	5.9E-09	1.2E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	1.2E-07	1.3E-07	1.0E-07	8.1E-08	8.3E-08	1.7E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R6	1.4E-07	1.5E-07	1.2E-07	9.1E-08	9.2E-08	1.9E-08	6.2E-07	3.9E-06	2.8E-06	2.1E-06	2.7E-06	3.5E-07	3.6E-08	8.8E-06	7.8E-06	5.1E-06	4.8E-06	1.5E-08
	7.3E-07	8.3E-07	6.4E-07	5.0E-07	5.1E-07	1.0E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	8.6E-07	9.8E-07	7.6E-07	5.9E-07	6.0E-07	1.2E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R7	7.7E-08	8.5E-08	6.6E-08	5.2E-08	5.3E-08	1.1E-08	4.5E-07	3.0E-06	2.1E-06	1.6E-06	2.0E-06	2.5E-07	2.6E-08	6.4E-06	5.7E-06	3.7E-06	3.5E-06	1.1E-08
	3.5E-07	3.9E-07	3.0E-07	2.4E-07	2.4E-07	4.9E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	4.2E-07	4.8E-07	3.7E-07	2.9E-07	2.9E-07	6.0E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R8	1.0E-07	1.1E-07	8.7E-08	6.8E-08	6.9E-08	1.4E-08	2.6E-06	1.8E-05	1.3E-05	1.0E-05	1.3E-05	1.4E-06	1.5E-07	3.8E-05	3.4E-05	2.2E-05	2.0E-05	6.6E-08
	6.8E-07	7.8E-07	6.0E-07	4.7E-07	4.8E-07	9.6E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	7.8E-07	8.9E-07	6.9E-07	5.4E-07	5.5E-07	1.1E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R9	4.8E-07	5.3E-07	4.1E-07	3.2E-07	3.3E-07	6.7E-08	1.8E-06	1.1E-05	8.1E-06	6.1E-06	7.7E-06	1.0E-06	1.0E-07	2.5E-05	2.2E-05	1.5E-05	1.4E-05	4.4E-08
	4.0E-08	4.5E-08	3.5E-08	2.7E-08	2.8E-08	5.6E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	5.2E-07	5.7E-07	4.4E-07	3.5E-07	3.5E-07	7.3E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R10	1.9E-06	2.1E-06	1.7E-06	1.3E-06	1.3E-06	2.7E-07	4.9E-06	3.2E-05	2.3E-05	1.7E-05	2.2E-05	2.7E-06	2.7E-07	6.7E-05	6.0E-05	3.9E-05	3.6E-05	1.2E-07
	1.9E-08	2.1E-08	1.7E-08	1.3E-08	1.3E-08	2.7E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	1.9E-06	2.2E-06	1.7E-06	1.3E-06	1.3E-06	2.7E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R11	6.0E-07	6.6E-07	5.1E-07	4.0E-07	4.1E-07	8.5E-08	1.8E-06	1.1E-05	8.0E-06	6.0E-06	7.6E-06	9.8E-07	9.9E-08	2.4E-05	2.2E-05	1.4E-05	1.3E-05	4.3E-08
	1.5E-08	1.6E-08	1.3E-08	9.9E-09	1.0E-08	2.1E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	6.2E-07	6.8E-07	5.3E-07	4.1E-07	4.2E-07	8.7E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R12	3.2E-07	3.5E-07	2.7E-07	2.1E-07	2.2E-07	4.5E-08	1.1E-06	7.0E-06	5.1E-06	3.8E-06	4.8E-06	6.1E-07	6.3E-08	1.5E-05	1.4E-05	8.9E-06	8.3E-06	2.7E-08
	2.8E-08	3.1E-08	2.4E-08	1.9E-08	1.9E-08	4.0E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	3.5E-07	3.8E-07	3.0E-07	2.3E-07	2.4E-07	4.9E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R13	6.1E-07	6.8E-07	5.3E-07	4.1E-07	4.2E-07	8.6E-08	1.9E-06	1.2E-05	8.6E-06	6.4E-06	8.1E-06	1.0E-06	1.1E-07	2.6E-05	2.3E-05	1.5E-05	1.4E-05	4.5E-08
	2.3E-08	2.5E-08	1.9E-08	1.5E-08	1.5E-08	3.2E-09	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	6.4E-07	7.0E-07	5.5E-07	4.3E-07	4.3E-07	9.0E-08	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.6E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
R14	8.2E-08	9.0E-08	7.0E-08	5.5E-08	5.6E-08	1.2E-08	8.5E-07	5.4E-06	3.9E-06	2.9E-06	3.7E-06	4.8E-07	5.0E-08	1.2E-05	1.1E-05	7.2E-06	6.7E-06	2.2E-08
	7.1E-07	8.1E-07	6.2E-07	4.9E-07	5.0E-07	1.0E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03
	7.9E-07	9.0E-07	6.9E-07	5.4E-07	5.5E-07	1.1E-07	2.6E-01	5.5E-01	3.1E-01	2.4E-01	2.8E-01	9.8E-02	3.9E-03	7.7E-01	6.0E-01	4.5E-01	3.9E-01	1.5E-03

TABLE F.1: Predicted Hazard Quotients - Mutli-Media Modeling

Receptor	Lead					
	Infant	Toddler	Child	Teen	Adult	Worker
RSA-MPOI	1.7E-05	3.0E-05	2.2E-05	1.6E-05	1.7E-05	7.4E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
FL-MPOI	8.5E-06	1.4E-05	1.0E-05	7.4E-06	8.1E-06	3.7E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R1	1.7E-06	2.8E-06	2.0E-06	1.5E-06	1.6E-06	7.3E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R2	8.2E-07	1.4E-06	9.7E-07	7.0E-07	7.6E-07	3.5E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R3	8.2E-07	1.4E-06	9.8E-07	7.0E-07	7.7E-07	3.5E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R4	4.0E-07	6.5E-07	4.7E-07	3.4E-07	3.7E-07	1.7E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R5	6.4E-07	1.0E-06	7.5E-07	5.4E-07	5.9E-07	2.7E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R6	1.1E-06	1.9E-06	1.3E-06	9.6E-07	1.0E-06	4.8E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R7	8.0E-07	1.4E-06	9.7E-07	6.9E-07	7.6E-07	3.4E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R8	4.3E-06	7.6E-06	5.5E-06	3.9E-06	4.3E-06	1.9E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R9	3.3E-06	5.5E-06	3.9E-06	2.8E-06	3.1E-06	1.4E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R10	9.4E-06	1.6E-05	1.1E-05	8.2E-06	9.0E-06	4.0E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R11	3.3E-06	5.6E-06	4.0E-06	2.9E-06	3.1E-06	1.4E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R12	2.1E-06	3.4E-06	2.5E-06	1.8E-06	1.9E-06	8.8E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R13	3.5E-06	5.9E-06	4.2E-06	3.0E-06	3.3E-06	1.5E-06
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
R14	1.5E-06	2.5E-06	1.8E-06	1.3E-06	1.4E-06	6.3E-07
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02
	8.0E-02	1.7E+00	1.2E+00	8.6E-01	8.6E-01	4.6E-02

TABLE F.2: Predicted ILCR - Multimedia Modelling

Receptor	Case	Arsenic							Benz[a]anthracene							B[a]P TPE						
		Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite
RSA-MPOI	Project	5.6E-10	1.1E-08	9.5E-09	6.2E-09	5.9E-09	3.1E-10	6.5E-09	7.5E-10	3.6E-09	3.0E-09	2.1E-09	2.0E-09	1.4E-10	2.2E-09	1.2E-08	3.9E-06	3.4E-06	2.3E-06	2.1E-06	2.1E-09	2.3E-06
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FL-MPOI	Project	2.8E-10	5.4E-09	4.7E-09	3.1E-09	2.9E-09	1.6E-10	3.2E-09	3.7E-10	1.5E-09	1.3E-09	8.7E-10	8.4E-10	7.0E-11	9.2E-10	6.0E-09	1.6E-06	1.5E-06	9.6E-07	8.9E-07	1.0E-09	9.8E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1	Project	8.1E-11	1.5E-09	1.4E-09	8.9E-10	8.4E-10	4.5E-11	9.2E-10	1.2E-10	4.8E-10	4.1E-10	2.8E-10	2.7E-10	2.2E-11	2.9E-10	1.9E-09	5.3E-07	4.7E-07	3.1E-07	2.9E-07	3.2E-10	3.2E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2	Project	2.9E-11	5.5E-10	4.8E-10	3.2E-10	3.0E-10	1.6E-11	3.3E-10	3.9E-11	1.5E-10	1.3E-10	9.0E-11	8.6E-11	7.4E-12	9.4E-11	6.2E-10	1.7E-07	1.5E-07	9.9E-08	9.2E-08	1.1E-10	1.0E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3	Project	3.2E-11	6.2E-10	5.4E-10	3.6E-10	3.4E-10	1.8E-11	3.7E-10	4.5E-11	1.8E-10	1.5E-10	1.0E-10	1.0E-10	8.5E-12	1.1E-10	7.2E-10	2.0E-07	1.8E-07	1.1E-07	1.1E-07	1.3E-10	1.2E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R4	Project	1.4E-11	2.7E-10	2.3E-10	1.5E-10	1.4E-10	7.7E-12	1.6E-10	1.9E-11	7.3E-11	6.3E-11	4.3E-11	4.1E-11	3.5E-12	4.5E-11	3.0E-10	8.1E-08	7.3E-08	4.7E-08	4.4E-08	5.2E-11	4.8E-08
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5	Project	2.2E-11	4.3E-10	3.7E-10	2.4E-10	2.3E-10	1.2E-11	2.5E-10	3.0E-11	1.2E-10	1.0E-10	6.9E-11	6.6E-11	5.7E-12	7.2E-11	4.8E-10	1.3E-07	1.2E-07	7.6E-08	7.0E-08	8.4E-11	7.8E-08
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R6	Project	4.6E-11	8.8E-10	7.7E-10	5.0E-10	4.8E-10	2.6E-11	5.3E-10	6.4E-11	2.6E-10	2.2E-10	1.5E-10	1.4E-10	1.2E-11	1.6E-10	1.0E-09	2.8E-07	2.5E-07	1.6E-07	1.5E-07	1.8E-10	1.7E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R7	Project	3.4E-11	6.6E-10	5.8E-10	3.8E-10	3.6E-10	1.9E-11	4.0E-10	4.9E-11	2.0E-10	1.7E-10	1.2E-10	1.1E-10	9.1E-12	1.2E-10	7.8E-10	2.2E-07	2.0E-07	1.3E-07	1.2E-07	1.4E-10	1.3E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R8	Project	2.2E-10	4.2E-09	3.7E-09	2.4E-09	2.3E-09	1.2E-10	2.5E-09	3.2E-10	1.5E-09	1.2E-09	8.5E-10	8.2E-10	6.0E-11	9.0E-10	5.2E-09	1.6E-06	1.4E-06	9.3E-07	8.7E-07	8.8E-10	9.6E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R9	Project	1.3E-10	2.4E-09	2.1E-09	1.4E-09	1.3E-09	7.1E-11	1.5E-09	1.8E-10	7.0E-10	6.0E-10	4.1E-10	3.9E-10	3.3E-11	4.3E-10	2.8E-09	7.7E-07	6.9E-07	4.5E-07	4.2E-07	4.9E-10	4.6E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R10	Project	3.1E-10	5.9E-09	5.2E-09	3.4E-09	3.2E-09	1.7E-10	3.5E-09	4.1E-10	1.6E-09	1.4E-09	9.6E-10	9.2E-10	7.7E-11	1.0E-09	6.5E-09	1.8E-06	1.6E-06	1.0E-06	9.7E-07	1.1E-09	1.1E-06
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R11	Project	1.2E-10	2.2E-09	2.0E-09	1.3E-09	1.2E-09	6.5E-11	1.3E-09	1.6E-10	6.2E-10	5.4E-10	3.6E-10	3.5E-10	3.0E-11	3.8E-10	2.5E-09	6.9E-07	6.1E-07	4.0E-07	3.7E-07	4.4E-10	4.1E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R12	Project	7.6E-11	1.5E-09	1.3E-09	8.4E-10	7.9E-10	4.2E-11	8.7E-10	1.0E-10	4.2E-10	3.6E-10	2.5E-10	2.4E-10	2.0E-11	2.6E-10	1.7E-09	4.7E-07	4.2E-07	2.7E-07	2.5E-07	2.9E-10	2.8E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R13	Project	1.3E-10	2.4E-09	2.1E-09	1.4E-09	1.3E-09	7.0E-11	1.4E-09	1.7E-10	6.8E-10	5.8E-10	3.9E-10	3.8E-10	3.2E-11	4.1E-10	2.7E-09	7.4E-07	6.6E-07	4.3E-07	4.0E-07	4.8E-10	4.4E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R14	Project	7.0E-11	1.3E-09	1.2E-09	7.7E-10	7.3E-10	3.9E-11	8.0E-10	1.0E-10	4.2E-10	3.5E-10	2.4E-10	2.3E-10	1.9E-11	2.5E-10	1.6E-09	4.6E-07	4.1E-07	2.6E-07	2.5E-07	2.8E-10	2.7E-07
	Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Application	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE F.2: Predicted ILCR - Multimedia Modelling

Receptor	Benzo[a]pyrene							Benzo[b]fluoranthene							Benzo[g,h,i]perylene						
	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite
RSA-MPOI	1.5E-09	1.3E-06	1.2E-06	7.8E-07	7.2E-07	5.8E-10	8.0E-07	4.8E-09	6.8E-07	6.1E-07	4.0E-07	3.7E-07	2.5E-10	4.1E-07	4.4E-10	1.2E-08	9.2E-09	6.6E-09	7.0E-09	1.3E-11	7.4E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FL-MPOI	7.5E-10	6.6E-07	5.9E-07	3.8E-07	3.6E-07	2.9E-10	3.9E-07	2.4E-09	3.4E-07	3.1E-07	2.0E-07	1.8E-07	1.3E-10	2.0E-07	7.1E-11	1.0E-09	7.7E-10	5.6E-10	5.9E-10	6.3E-12	6.2E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1	2.3E-10	2.0E-07	1.8E-07	1.2E-07	1.1E-07	9.0E-11	1.2E-07	7.4E-10	1.1E-07	9.5E-08	6.1E-08	5.7E-08	3.9E-11	6.3E-08	3.2E-11	6.8E-10	5.1E-10	3.7E-10	3.9E-10	1.9E-12	4.1E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2	7.9E-11	6.9E-08	6.2E-08	4.0E-08	3.7E-08	3.0E-11	4.1E-08	2.5E-10	3.6E-08	3.2E-08	2.1E-08	1.9E-08	1.3E-11	2.1E-08	6.1E-12	6.4E-11	4.8E-11	3.5E-11	3.6E-11	6.6E-13	3.9E-11
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3	9.0E-11	7.9E-08	7.1E-08	4.6E-08	4.3E-08	3.5E-11	4.7E-08	2.9E-10	4.1E-08	3.7E-08	2.4E-08	2.2E-08	1.5E-11	2.5E-08	7.6E-12	9.4E-11	7.0E-11	5.1E-11	5.3E-11	7.6E-13	5.7E-11
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R4	3.8E-11	3.3E-08	3.0E-08	1.9E-08	1.8E-08	1.5E-11	2.0E-08	1.2E-10	1.7E-08	1.5E-08	1.0E-08	9.3E-09	6.3E-12	1.0E-08	2.6E-12	2.0E-11	1.5E-11	1.1E-11	1.2E-11	3.2E-13	1.2E-11
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5	6.1E-11	5.3E-08	4.8E-08	3.1E-08	2.9E-08	2.4E-11	3.2E-08	1.9E-10	2.8E-08	2.5E-08	1.6E-08	1.5E-08	1.0E-11	1.7E-08	4.2E-12	3.3E-11	2.5E-11	1.8E-11	1.9E-11	5.1E-13	2.0E-11
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R6	1.3E-10	1.1E-07	1.0E-07	6.6E-08	6.1E-08	5.0E-11	6.8E-08	4.1E-10	5.9E-08	5.3E-08	3.4E-08	3.2E-08	2.2E-11	3.5E-08	1.2E-11	1.6E-10	1.2E-10	8.7E-11	9.1E-11	1.1E-12	9.7E-11
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R7	9.8E-11	8.6E-08	7.7E-08	5.0E-08	4.6E-08	3.8E-11	5.1E-08	3.1E-10	4.4E-08	4.0E-08	2.6E-08	2.4E-08	1.6E-11	2.7E-08	1.4E-11	3.0E-10	2.2E-10	1.6E-10	1.7E-10	8.2E-13	1.8E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R8	6.4E-10	5.6E-07	5.1E-07	3.3E-07	3.1E-07	2.5E-10	3.4E-07	2.0E-09	2.9E-07	2.6E-07	1.7E-07	1.6E-07	1.1E-10	1.7E-07	1.6E-10	4.4E-09	3.3E-09	2.3E-09	2.5E-09	5.3E-12	2.6E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R9	3.5E-10	3.1E-07	2.8E-07	1.8E-07	1.7E-07	1.4E-10	1.8E-07	1.1E-09	1.6E-07	1.4E-07	9.3E-08	8.6E-08	5.9E-11	9.6E-08	3.3E-11	4.9E-10	3.7E-10	2.6E-10	2.8E-10	2.9E-12	3.0E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R10	8.2E-10	7.2E-07	6.4E-07	4.2E-07	3.9E-07	3.2E-10	4.3E-07	2.6E-09	3.7E-07	3.3E-07	2.2E-07	2.0E-07	1.4E-10	2.2E-07	7.8E-11	1.2E-09	8.7E-10	6.3E-10	6.6E-10	6.9E-12	7.0E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R11	3.2E-10	2.8E-07	2.5E-07	1.6E-07	1.5E-07	1.2E-10	1.7E-07	1.0E-09	1.4E-07	1.3E-07	8.4E-08	7.8E-08	5.3E-11	8.6E-08	2.5E-11	2.8E-10	2.1E-10	1.5E-10	1.6E-10	2.7E-12	1.7E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R12	2.1E-10	1.8E-07	1.7E-07	1.1E-07	1.0E-07	8.2E-11	1.1E-07	6.7E-10	9.6E-08	8.6E-08	5.6E-08	5.2E-08	3.5E-11	5.7E-08	2.1E-11	3.5E-10	2.6E-10	1.9E-10	2.0E-10	1.8E-12	2.1E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R13	3.4E-10	3.0E-07	2.7E-07	1.8E-07	1.6E-07	1.3E-10	1.8E-07	1.1E-09	1.6E-07	1.4E-07	9.1E-08	8.4E-08	5.7E-11	9.3E-08	2.8E-11	3.1E-10	2.3E-10	1.7E-10	1.8E-10	2.9E-12	1.9E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R14	2.0E-10	1.8E-07	1.6E-07	1.0E-07	9.6E-08	7.8E-11	1.1E-07	6.4E-10	9.1E-08	8.2E-08	5.3E-08	4.9E-08	3.4E-11	5.5E-08	2.6E-11	5.2E-10	3.9E-10	2.8E-10	3.0E-10	1.7E-12	3.1E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE F.2: Predicted ILCR - Multimedia Modelling

Receptor	Benzo[k]fluoranthene							Chromium (VI)							Chrysene						
	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite
RSA-MPOI	1.4E-09	1.3E-07	1.2E-07	7.8E-08	7.2E-08	4.9E-11	8.0E-08	2.8E-09	1.4E-08	1.2E-08	7.8E-09	7.9E-09	1.5E-09	8.5E-09	2.2E-10	4.6E-08	4.1E-08	2.7E-08	2.5E-08	3.5E-11	2.8E-08
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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FL-MPOI	7.0E-10	6.6E-08	5.9E-08	3.8E-08	3.6E-08	2.4E-11	4.0E-08	1.4E-09	6.9E-09	5.6E-09	3.7E-09	3.8E-09	7.5E-10	4.1E-09	1.1E-10	2.3E-08	2.1E-08	1.3E-08	1.2E-08	1.7E-11	1.4E-08
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R1	2.2E-10	2.0E-08	1.8E-08	1.2E-08	1.1E-08	7.6E-12	1.2E-08	3.2E-10	1.6E-09	1.3E-09	8.6E-10	8.7E-10	1.7E-10	9.4E-10	3.4E-11	7.1E-09	6.4E-09	4.1E-09	3.8E-09	5.4E-12	4.3E-09
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2	7.3E-11	6.9E-09	6.2E-09	4.0E-09	3.7E-09	2.6E-12	4.1E-09	1.4E-10	6.7E-10	5.5E-10	3.7E-10	3.7E-10	7.4E-11	4.0E-10	1.2E-11	2.4E-09	2.2E-09	1.4E-09	1.3E-09	1.8E-12	1.4E-09
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3	8.4E-11	7.9E-09	7.1E-09	4.6E-09	4.3E-09	2.9E-12	4.8E-09	1.4E-10	7.0E-10	5.7E-10	3.8E-10	3.9E-10	7.8E-11	4.2E-10	1.3E-11	2.8E-09	2.5E-09	1.6E-09	1.5E-09	2.1E-12	1.7E-09
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R4	3.5E-11	3.3E-09	3.0E-09	1.9E-09	1.8E-09	1.2E-12	2.0E-09	6.6E-11	3.2E-10	2.6E-10	1.8E-10	1.8E-10	3.6E-11	1.9E-10	5.6E-12	1.2E-09	1.0E-09	6.7E-10	6.3E-10	8.7E-13	6.9E-10
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R5	5.6E-11	5.3E-09	4.8E-09	3.1E-09	2.9E-09	2.0E-12	3.2E-09	1.1E-10	5.2E-10	4.2E-10	2.8E-10	2.9E-10	5.8E-11	3.1E-10	9.0E-12	1.9E-09	1.7E-09	1.1E-09	1.0E-09	1.4E-12	1.1E-09
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R6	1.2E-10	1.1E-08	1.0E-08	6.6E-09	6.1E-09	4.2E-12	6.8E-09	2.0E-10	9.7E-10	7.9E-10	5.3E-10	5.4E-10	1.1E-10	5.8E-10	1.9E-11	4.0E-09	3.5E-09	2.3E-09	2.1E-09	3.0E-12	2.4E-09
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R7	9.1E-11	8.6E-09	7.7E-09	5.0E-09	4.7E-09	3.2E-12	5.2E-09	1.4E-10	7.1E-10	5.8E-10	3.9E-10	3.9E-10	7.8E-11	4.3E-10	1.4E-11	3.0E-09	2.7E-09	1.7E-09	1.6E-09	2.3E-12	1.8E-09
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R8	5.9E-10	5.7E-08	5.1E-08	3.3E-08	3.1E-08	2.1E-11	3.4E-08	8.4E-10	4.2E-09	3.4E-09	2.3E-09	2.3E-09	4.5E-10	2.5E-09	9.5E-11	2.0E-08	1.8E-08	1.1E-08	1.1E-08	1.5E-11	1.2E-08
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R9	3.3E-10	3.1E-08	2.8E-08	1.8E-08	1.7E-08	1.1E-11	1.9E-08	5.7E-10	2.8E-09	2.3E-09	1.5E-09	1.5E-09	3.1E-10	1.7E-09	5.2E-11	1.1E-08	9.7E-09	6.3E-09	5.8E-09	8.1E-12	6.5E-09
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R10	7.6E-10	7.2E-08	6.5E-08	4.2E-08	3.9E-08	2.7E-11	4.3E-08	1.5E-09	7.6E-09	6.2E-09	4.1E-09	4.2E-09	8.3E-10	4.5E-09	1.2E-10	2.5E-08	2.3E-08	1.5E-08	1.4E-08	1.9E-11	1.5E-08
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R11	2.9E-10	2.8E-08	2.5E-08	1.6E-08	1.5E-08	1.0E-11	1.7E-08	5.6E-10	2.7E-09	2.2E-09	1.5E-09	1.5E-09	3.0E-10	1.6E-09	4.7E-11	9.7E-09	8.7E-09	5.7E-09	5.3E-09	7.3E-12	5.8E-09
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R12	2.0E-10	1.9E-08	1.7E-08	1.1E-08	1.0E-08	6.9E-12	1.1E-08	3.5E-10	1.7E-09	1.4E-09	9.4E-10	9.5E-10	1.9E-10	1.0E-09	3.1E-11	6.5E-09	5.8E-09	3.8E-09	3.5E-09	4.9E-12	3.9E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R13	3.2E-10	3.0E-08	2.7E-08	1.8E-08	1.6E-08	1.1E-11	1.8E-08	6.0E-10	2.9E-09	2.4E-09	1.6E-09	1.6E-09	3.2E-10	1.7E-09	5.1E-11	1.1E-08	9.4E-09	6.1E-09	5.7E-09	7.9E-12	6.3E-09
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R14	1.9E-10	1.8E-08	1.6E-08	1.0E-08	9.6E-09	6.6E-12	1.1E-08	2.8E-10	1.4E-09	1.1E-09	7.4E-10	7.5E-10	1.5E-10	8.1E-10	3.0E-11	6.2E-09	5.5E-09	3.6E-09	3.3E-09	4.6E-12	3.7E-09
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TABLE F.2: Predicted ILCR - Multimedia Modelling

Receptor	Dibenz[a,h]anthracene							Fluoranthene							Indeno[1,2,3-cd]pyrene						
	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite	Infant	Toddler	Child	Teen	Adult	Worker	Composite
RSA-MPOI	1.8E-09	1.8E-06	1.5E-06	9.9E-07	9.4E-07	7.8E-10	1.0E-06	3.4E-10	3.5E-08	3.2E-08	2.1E-08	1.9E-08	9.1E-11	2.1E-08	2.3E-09	4.2E-08	3.7E-08	2.4E-08	2.3E-08	9.4E-11	2.5E-08
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FL-MPOI	8.5E-10	5.8E-07	5.1E-07	3.3E-07	3.1E-07	3.9E-10	3.4E-07	1.7E-10	1.8E-08	1.6E-08	1.0E-08	9.5E-09	4.6E-11	1.1E-08	1.1E-09	1.9E-08	1.7E-08	1.1E-08	1.0E-08	4.7E-11	1.2E-08
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1	2.7E-10	2.0E-07	1.7E-07	1.1E-07	1.1E-07	1.2E-10	1.2E-07	5.2E-11	5.4E-09	4.9E-09	3.2E-09	2.9E-09	1.4E-11	3.3E-09	3.5E-10	6.0E-09	5.4E-09	3.5E-09	3.3E-09	1.4E-11	3.6E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2	8.8E-11	5.8E-08	5.2E-08	3.4E-08	3.1E-08	4.1E-11	3.5E-08	1.8E-11	1.8E-09	1.7E-09	1.1E-09	1.0E-09	4.8E-12	1.1E-09	1.2E-10	2.0E-09	1.8E-09	1.2E-09	1.1E-09	4.9E-12	1.2E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3	1.0E-10	6.8E-08	6.0E-08	3.9E-08	3.7E-08	4.7E-11	4.0E-08	2.0E-11	2.1E-09	1.9E-09	1.2E-09	1.1E-09	5.5E-12	1.3E-09	1.4E-10	2.3E-09	2.0E-09	1.3E-09	1.3E-09	5.6E-12	1.4E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R4	4.2E-11	2.7E-08	2.4E-08	1.6E-08	1.5E-08	2.0E-11	1.6E-08	8.5E-12	8.9E-10	7.9E-10	5.2E-10	4.8E-10	2.3E-12	5.3E-10	5.7E-11	9.5E-10	8.5E-10	5.6E-10	5.2E-10	2.4E-12	5.8E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5	6.8E-11	4.4E-08	3.9E-08	2.5E-08	2.4E-08	3.2E-11	2.6E-08	1.4E-11	1.4E-09	1.3E-09	8.3E-10	7.7E-10	3.7E-12	8.5E-10	9.1E-11	1.5E-09	1.4E-09	9.0E-10	8.4E-10	3.8E-12	9.2E-10
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R6	1.5E-10	9.9E-08	8.7E-08	5.7E-08	5.3E-08	6.7E-11	5.9E-08	2.9E-11	3.0E-09	2.7E-09	1.8E-09	1.6E-09	7.8E-12	1.8E-09	1.9E-10	3.3E-09	2.9E-09	1.9E-09	1.8E-09	8.0E-12	2.0E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R7	1.1E-10	8.5E-08	7.4E-08	4.8E-08	4.6E-08	5.1E-11	5.0E-08	2.2E-11	2.3E-09	2.1E-09	1.3E-09	1.2E-09	5.9E-12	1.4E-09	1.5E-10	2.5E-09	2.3E-09	1.5E-09	1.4E-09	6.1E-12	1.5E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R8	7.7E-10	7.0E-07	5.9E-07	3.9E-07	3.7E-07	3.3E-10	4.1E-07	1.4E-10	1.5E-08	1.3E-08	8.7E-09	8.1E-09	3.9E-11	9.0E-09	9.6E-10	1.7E-08	1.5E-08	1.0E-08	9.5E-09	4.0E-11	1.0E-08
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R9	4.0E-10	2.7E-07	2.4E-07	1.6E-07	1.5E-07	1.8E-10	1.6E-07	7.9E-11	8.2E-09	7.4E-09	4.8E-09	4.5E-09	2.1E-11	4.9E-09	5.3E-10	9.0E-09	8.0E-09	5.3E-09	4.9E-09	2.2E-11	5.4E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R10	9.3E-10	6.3E-07	5.6E-07	3.7E-07	3.4E-07	4.3E-10	3.8E-07	1.8E-10	1.9E-08	1.7E-08	1.1E-08	1.0E-08	5.0E-11	1.1E-08	1.2E-09	2.1E-08	1.9E-08	1.2E-08	1.1E-08	5.1E-11	1.3E-08
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R11	3.6E-10	2.4E-07	2.1E-07	1.4E-07	1.3E-07	1.7E-10	1.4E-07	7.1E-11	7.4E-09	6.7E-09	4.3E-09	4.0E-09	1.9E-11	4.5E-09	4.8E-10	8.1E-09	7.2E-09	4.7E-09	4.4E-09	2.0E-11	4.9E-09
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R12	2.4E-10	1.7E-07	1.5E-07	9.5E-08	8.9E-08	1.1E-10	9.9E-08	4.7E-11	4.9E-09	4.4E-09	2.9E-09	2.7E-09	1.3E-11	3.0E-09	3.2E-10	5.4E-09	4.8E-09	3.2E-09	2.9E-09	1.3E-11	3.2E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R13	3.9E-10	2.6E-07	2.3E-07	1.5E-07	1.4E-07	1.8E-10	1.5E-07	7.7E-11	8.0E-09	7.2E-09	4.7E-09	4.4E-09	2.1E-11	4.8E-09	5.2E-10	8.7E-09	7.8E-09	5.1E-09	4.8E-09	2.1E-11	5.2E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R14	2.3E-10	1.7E-07	1.5E-07	9.7E-08	9.1E-08	1.0E-10	1.0E-07	4.5E-11	4.7E-09	4.2E-09	2.7E-09	2.6E-09	1.2E-11	2.8E-09	3.0E-10	5.2E-09	4.6E-09	3.0E-09	2.8E-09	1.3E-11	3.1E-09
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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TABLE F.2: Predicted ILCR - Multimedia Modelling

Receptor	Phenanthrene						
	Infant	Toddler	Child	Teen	Adult	Worker	Composite
RSA-MPOI	2.5E-10	1.5E-08	1.3E-08	8.6E-09	8.0E-09	9.3E-11	8.9E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
FL-MPOI	1.3E-10	7.4E-09	6.6E-09	4.3E-09	4.0E-09	4.6E-11	4.4E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R1	3.9E-11	2.3E-09	2.0E-09	1.3E-09	1.2E-09	1.4E-11	1.4E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R2	1.3E-11	7.8E-10	6.9E-10	4.5E-10	4.2E-10	4.8E-12	4.6E-10
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R3	1.5E-11	8.9E-10	8.0E-10	5.2E-10	4.8E-10	5.6E-12	5.3E-10
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R4	6.4E-12	3.7E-10	3.3E-10	2.2E-10	2.0E-10	2.3E-12	2.2E-10
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R5	1.0E-11	6.0E-10	5.4E-10	3.5E-10	3.2E-10	3.7E-12	3.6E-10
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R6	2.2E-11	1.3E-09	1.1E-09	7.4E-10	6.9E-10	7.9E-12	7.6E-10
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R7	1.7E-11	9.6E-10	8.6E-10	5.6E-10	5.2E-10	6.0E-12	5.8E-10
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R8	1.1E-10	6.3E-09	5.6E-09	3.7E-09	3.4E-09	3.9E-11	3.8E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R9	6.0E-11	3.5E-09	3.1E-09	2.0E-09	1.9E-09	2.2E-11	2.1E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R10	1.4E-10	8.1E-09	7.2E-09	4.7E-09	4.4E-09	5.0E-11	4.8E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R11	5.4E-11	3.1E-09	2.8E-09	1.8E-09	1.7E-09	2.0E-11	1.9E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R12	3.6E-11	2.1E-09	1.9E-09	1.2E-09	1.1E-09	1.3E-11	1.2E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R13	5.8E-11	3.4E-09	3.0E-09	2.0E-09	1.8E-09	2.1E-11	2.0E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
R14	3.4E-11	2.0E-09	1.8E-09	1.2E-09	1.1E-09	1.2E-11	1.2E-09
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

APPENDIX G: BASELINE MONITORING PROGRAM

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Appendix G-1 Vegetation and Soil Sampling Lab Results

1.0 INTRODUCTION

As part of the human health risk assessment, vegetation and soil samples were collected for chemical analyses. The baseline chemical concentrations of COPCs found in saskatoon berries, bearberry, and mineral soil collected throughout the LSA are summarized in Tables 3.0-1 to 3.0-3. Complete lab data are provided in Appendix G-1.

2.0 METHODS

Plant tissue and soil samples were collected across the Project area to determine baseline conditions of chemicals of potential concern (COPCs). This baseline data were used to assess existing conditions and risks as well as to model and assess potential risks to health and ecological systems that could result from Project activities.

Sampling for vegetation and soils was conducted on two occasions: July 22 - 31, 2014 and September 5 - 9, 2014. Sampling was undertaken in conjunction with the vegetation baseline monitoring program, in plots where suitable vegetation and soils could be found for the purpose of human health sampling. Vegetation samples were to be collected from plant species indigenous to the project area and collected from parts of the plant that are typically consumed by humans, such as berries, leaves, or edible roots. The vegetation typically collected for these purposes (willow, alder, and/or Labrador tea leaves) were not present in the Project area in densities high enough to sample. Bearberry (*Arctostaphylos uva-ursi*), which is frequently used by local First Nation's people in ceremonies and in the making of tobacco, was therefore collected instead. Berries were harvested from saskatoon (*Amelanchier alnifolia*). Mineral soils are preferred to Organic wetland soils for baseline human health assessments and therefore only mineral soil was collected.

Saskatoon berries and bearberry leaves were collected from 13 and 12 locations across the Project area, respectively. For each species, enough vegetation was collected to fill two 125 mL jars to ensure sufficient amounts of sample were available for chemical analyses. In total, 21 soil samples were collected, taken from the same location where the vegetation samples were collected. Mineral soil samples were collected from the top 15 cm of the soil profile, close to the rooting zone of the sampled vegetation. Enough soil was collected to fill one 125 mL jar and approximately 1/3 of a lab-provided soil sample bag (23 cm x 24.5 cm), to ensure sufficient of soil were collected for testing. Sampling locations are presented in Figure G-1.

3.0 RESULTS

The baseline chemical concentrations of COPCs found in saskatoon berries, bearberry, and mineral soil collected throughout the LSA are summarized in Tables 3.0-1 to 3.0-3. Complete lab data are provided in Appendix G-1.

Table 3.0-1 Baseline Chemistry Results for Saskatoon Berry Samples

COPC	Units	Detection Limit	Concentration [1]		
			Mean	Maximum	95th Percentile
Aluminum	µg/g	1	35.3	62.9	54.9
Antimony	µg/g	0.5	<0.5	<0.5	<0.5
Arsenic	µg/g	0.2	0.31	0.45	0.42
Barium	µg/g	0.03	379.9	634	570.4
Beryllium	µg/g	0.01	<0.01	<0.01	<0.01
Bismuth	µg/g	0.5	1.03	2.3	1.94
Boron	µg/g	0.5	25.73	33.3	32.94
Cadmium	µg/g	0.05	0.83	3.29	2.58
Chromium	µg/g	0.04	0.17	0.37	0.36
Cobalt	µg/g	0.05	0.15	0.22	0.21
Copper	µg/g	0.05	5.52	7.14	6.84
Iron	µg/g	1	87.1	123	120.6
Lead	µg/g	0.3	0.59	0.59	0.59
Lithium	µg/g	0.1	0.41	0.62	0.62
Magnesium	µg/g	1	3,777.7	5,560	5,350
Manganese	µg/g	0.3	435.1	1,330	1,222
Mercury	µg/g	0.003	0.01	0.011	0.010
Molybdenum	µg/g	0.05	0.60	2.23	2.05
Nickel	µg/g	0.1	1.49	5.3	3.72
Phosphorus	µg/g	1	6,483.9	13,200	11,340
Potassium	µg/g	5	16,563.9	27,700	25,000
Selenium	µg/g	0.3	1.69	3.58	2.87
Silicon	µg/g	1	154.7	270	266.4
Silver	µg/g	0.2	2.88	12.3	9.38
Sodium	µg/g	1	21.8	51.2	44
Strontium	µg/g	0.02	51.5	141	109.7
Sulfur	µg/g	1	1,206.2	1,830	1,668

Table 3.0-1 Baseline Chemistry Results for Saskatoon Berry Samples

COPC	Units	Detection Limit	Concentration [1]		
			Mean	Maximum	95th Percentile
Thallium	µg/g	0.3	0.31	0.31	0.31
Tin	µg/g	0.2	0.27	0.3	0.30
Titanium	µg/g	0.05	2.81	4.17	3.92
Vanadium	µg/g	0.1	13.09	20.1	19.56
Zinc	µg/g	0.1	71.9	116	112.4
Zirconium	µg/g	0.05	0.09	0.12	0.12
Naphthalene	µg/g	1	2.80	13.7	7.56
Acenaphthylene	µg/g	0.24	0.42	0.75	0.69
Acenaphthene	µg/g	0.15	0.47	1.06	1.05
Fluorene	µg/g	0.16	1.05	4.02	2.33
Phenanthrene	µg/g	0.2	8.31	51.5	26.28
Anthracene	µg/g	0.24	0.75	1.10	1.07
Fluoranthene	µg/g	0.2	0.98	4.19	2.55
Pyrene	µg/g	0.16	0.97	4.33	2.86
Benz(a)anthracene	µg/g	0.36	1.55	2.40	2.32
Chrysene	µg/g	0.2	1.90	12.40	8.16
Benzo(b+j)fluoranthene	µg/g	0.3	2.49	22.5	11.03
Benzo(k)fluoranthene	µg/g	0.2	0.25	0.25	0.25
Benzo(a)pyrene	µg/g	0.3	0.99	1.85	1.74
Indeno(1,2,3-cd)pyrene	µg/g	0.5	1.11	1.11	1.11
Dibenz(a,h)anthracene	µg/g	0.4	1.06	1.52	1.47
Benzo(ghi)perylene	µg/g	0.4	1.60	3.60	3.30

[1] sample size = 13

Table 3.0-2 Baseline Chemistry Results for Bearberry Leaf Samples

COPC	Units	Detection Limit	Concentration [1]		
			Mean	Maximum	95th Percentile
Aluminum	µg/g	1	112.0	410	358.9
Antimony	µg/g	0.5	0.61	0.71	0.70
Arsenic	µg/g	0.2	0.31	0.35	0.35
Barium	µg/g	0.03	100.8	173	160.4
Beryllium	µg/g	0.01	<0.01	<0.01	<0.01
Bismuth	µg/g	0.5	1.45	1.96	1.91
Boron	µg/g	0.5	10.29	14.7	14.26
Cadmium	µg/g	0.05	0.08	0.09	0.09
Chromium	µg/g	0.04	0.51	2.53	1.76
Cobalt	µg/g	0.05	0.15	0.5	0.39
Copper	µg/g	0.05	4.08	5.45	5.23
Iron	µg/g	1	196.10	791	630.95
Lead	µg/g	0.3	<0.3	<0.3	<0.3
Lithium	µg/g	0.1	0.20	0.43	0.35
Magnesium	µg/g	1	1,346.4	1,780	1,725
Manganese	µg/g	0.3	42.45	138	129.2
Mercury	µg/g	0.003	0.00	0.007	0.006
Molybdenum	µg/g	0.05	0.09	0.10	0.10
Nickel	µg/g	0.1	1.63	3.03	2.92
Phosphorus	µg/g	1	1,376.7	1,980	1,848
Potassium	µg/g	5	6,399.2	10,100	9,209
Selenium	µg/g	0.3	1.08	2.54	2.34
Silicon	µg/g	1	120.1	202	201.5
Silver	µg/g	0.2	2.59	9.82	7.69
Sodium	µg/g	1	21.7	108	63.0
Strontium	µg/g	0.02	20.3	54	39.27

Table 3.0-2 Baseline Chemistry Results for Bearberry Leaf Samples

COPC	Units	Detection Limit	Concentration [1]		
			Mean	Maximum	95th Percentile
Sulfur	µg/g	1	837.6	1,070	1,029.9
Thallium	µg/g	0.3	<0.3	<0.3	<0.3
Tin	µg/g	0.2	0.25	0.29	0.28
Titanium	µg/g	0.05	3.94	9.81	8.69
Vanadium	µg/g	0.1	4.89	6.47	6.26
Zinc	µg/g	0.1	47.52	90.8	76.39
Zirconium	µg/g	0.05	0.20	0.52	0.50
Naphthalene	µg/g	1	2.75	4.49	3.74
Acenaphthylene	µg/g	0.24	0.34	0.41	0.40
Acenaphthene	µg/g	0.15	0.31	0.64	0.56
Fluorene	µg/g	0.16	0.75	1.42	1.18
Phenanthrene	µg/g	0.2	5.20	11.31	8.70
Anthracene	µg/g	0.24	0.62	1.2	1.12
Fluoranthene	µg/g	0.2	0.64	1.26	1.12
Pyrene	µg/g	0.16	0.60	0.90	0.89
Benz(a)anthracene	µg/g	0.36	<0.36	<0.36	<0.36
Chrysene	µg/g	0.2	0.66	2.45	1.79
Benzo(b+j)fluoranthene	µg/g	0.3	1.06	3.18	2.31
Benzo(k)fluoranthene	µg/g	0.2	0.39	0.39	0.39
Benzo(a)pyrene	µg/g	0.3	<0.3	<0.3	<0.3
Indeno(1,2,3-cd)pyrene	µg/g	0.5	<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	µg/g	0.4	<0.4	<0.4	<0.4
Benzo(ghi)perylene	µg/g	0.4	0.63	0.75	0.74

[1] sample size = 13

Table 3.0-3 Baseline Chemistry Results for Soil Samples

COPC	Units	Detection Limit	Concentration [1, 2]		
			Mean	Maximum	95th Percentile
Mercury	mg/kg	0.01	0.04	0.1	0.09
Aluminum	mg/kg	20	10,327.14	19,300	18,300
Antimony	mg/kg	0.2	<0.2	<0.2	<0.2
Arsenic	mg/kg	0.2	4.18	11.6	7.3
Barium	mg/kg	1	256.3	417	387
Beryllium	mg/kg	0.1	0.65	1.1	0.9
Bismuth	mg/kg	0.5	0.54	0.7	0.66
Cadmium	mg/kg	0.01	0.76	2.04	1.73
Chromium	mg/kg	0.5	14.9	38	32.2
Calcium	mg/kg	200	6,547.6	57,900	11,700
Cobalt	mg/kg	0.1	8.4	17.5	13.8
Copper	mg/kg	1	19.1	49.8	34.3
Iron	mg/kg	100	18,281.0	36,300	33,200
Lead	mg/kg	5	12.46	17.2	16.1
Magnesium	mg/kg	100	3,004.8	9,900	8,100
Manganese	mg/kg	10	555.4	1,380	1,250
Molybdenum	mg/kg	1	1.28	1.4	1.39
Nickel	mg/kg	0.5	20.12	37.6	31.2
Phosphorus	mg/kg	30	601.7	1,310	850
Selenium	mg/kg	0.3	0.50	0.9	0.83
Silicon	mg/kg	50	671.0	910	830
Silver	mg/kg	0.1	0.24	0.6	0.48
Strontium	mg/kg	1	26.3	68	58
Thallium	mg/kg	0.05	0.14	0.22	0.18
Tin	mg/kg	1	1.41	1.9	1.9
Titanium	mg/kg	0.5	300.1	1,180	724

Table 3.0-3 Baseline Chemistry Results for Soil Samples

COPC	Units	Detection Limit	Concentration [1, 2]		
			Mean	Maximum	95th Percentile
Vanadium	mg/kg	0.1	35.07	69.5	64.8
Zinc	mg/kg	1	86.1	149	144
Naphthalene	mg/kg	0.01	0.80	3.26	3.18
Acenaphthylene	mg/kg	0.05	<0.05	<0.05	<0.05
Acenaphthene	mg/kg	0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg	0.05	0.24	0.58	0.53
Phenanthrene	mg/kg	0.01	1.60	8.01	7.30
Anthracene	mg/kg	0.003	0.02	0.02	0.02
Fluoranthene	mg/kg	0.01	0.30	0.41	0.40
Pyrene	mg/kg	0.01	0.41	0.55	0.55
Benzo(a)anthracene	mg/kg	0.01	0.23	0.3	0.3
Chrysene	mg/kg	0.05	1.12	2.11	2.10
Benzo(b+j)fluoranthene	mg/kg	0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	0.05	0.11	0.17	0.16
Benzo(a)pyrene	mg/kg	0.05	0.13	0.2	0.20
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	0.06	0.09	0.09
Dibenzo(a,h)anthracene	mg/kg	0.05	0.08	0.09	0.09
Benzo(g,h,i)perylene	mg/kg	0.05	0.14	0.19	0.19
IACR_Coarse	Index of Additive Cancer Risk	0.001	<0.001	<0.001	<0.001
IACR_Fine	Index of Additive Cancer Risk	0.001	<0.001	<0.001	<0.001
Nitrobenzene-d5	%	23-130	100.5	119	118.5
2-Fluorobiphenyl	%	30-130	88.9	101	98
p-Terphenyl-d14	%	18-137	91.3	128	122
Moisture	%	0.1	17.25	22.8	22.45
Benzo(b)fluoranthene	ug/g	0.03	0.74	1.16	1.16

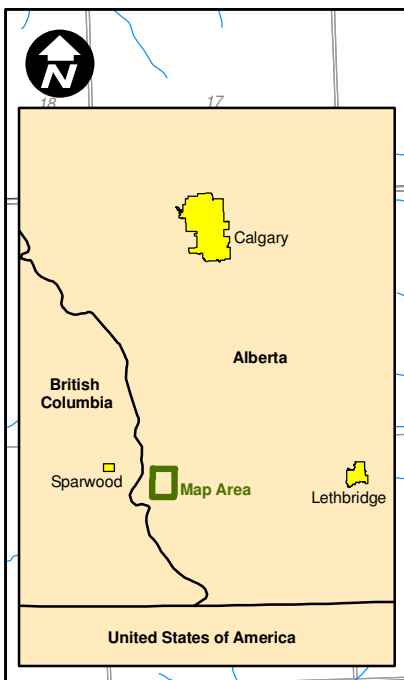
Table 3.0-3 Baseline Chemistry Results for Soil Samples

COPC	Units	Detection Limit	Concentration [1, 2]		
			Mean	Maximum	95th Percentile
2-Methylnaphthalene	ug/g	0.03	1.21	5.16	5.03
Naphthalene-D8 (surr)	%	50-130	94.47	103	102.3
Quinoline-d7	%	50-130	89.67	120	119.3

[1] sample size = 21

[2] depth of samples: 0-15 cm

FIGURES



Rg 4
Rg 3 W5M
Tp 9
Tp 8
Tp 7
Forestry Trunk Road
Daisy Creek
Caudron Creek
Nez Percé Creek
Blairmore Creek
Gold Creek
Morin Creek
Green Creek
Pelletier Creek
McGillivray Creek
Crowsnest River
York Creek
North York Creek
Coleman
Blairmore
Frank
40
3

LEGEND

- Human Health Sample Location
- Primary Highway
- Secondary Highway
- Existing Trails
- Existing Railway
- Road Access
- CHPP Facilities
- Existing Powerline
- Overland Conveyor
- Proposed Pipeline
- Proposed Powerline
- Railway Loop
- Mine Permit Boundary
- Coal Handling Processing Plant and Infrastructure
- Ultimate Pit Extent
- Ultimate Dump Extent
- Topsoil Storage
- Construction Camp
- Ponds and Ditches
- Undisturbed Area

Land Ownership

- Crown
- Crown (MLL Held By Riversdale)
- Private (Riversdale)
- Private (Other)
- MD of Crowsnest Pass
- Crown (ROE Held By Devon)

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

HUMAN HEALTH SAMPLE LOCATIONS

NOTES

AltaLIS, 2015; Golder, 2015; NRCAN, 2015; Riversdale, 2015
Datum/Projection: UTM NAD 83 Zone 11

PROJECT:	14-00201-01
DRAWN BY:	SL/JDC
CHECKED BY:	DT
DATE:	OCTOBER 06, 2015

0 1 2 4
Kilometres

FIGURE

G.1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\Veg\Fig G.1 - Human Health Sample Locations.mxd

APPENDIX G-1: VEGETATION AND SOIL SAMPLING LAB RESULTS

Sample ID			RP-5BE	GM051BE	GM148BE	GM107BE	GM302BE
Medium			Vegetation				
Northing[1]			5504575	5505278	5509896	5503424	5504032
Easting[1]			685311	686808	684804	681979	684221
# of Samples			1				
Type of Vegetation Sampled			Saskatoon Berries	Bearberry leaves	Bearberry leaves	Saskatoon berries	Bearberry leaves
Chemical Analysed	Detection Limit	Units	Chemical Concentration				
Aluminum	1	µg/g	10.1	75.9	317	36.8	49.5
Antimony	0.5	µg/g	ND	ND	ND	ND	ND
Arsenic	0.2	µg/g	ND	0.26	ND	0.28	ND
Barium	0.03	µg/g	259	81.5	150	169	121
Beryllium	0.01	µg/g	ND	ND	ND	ND	ND
Bismuth	0.5	µg/g	ND	ND	ND	ND	ND
Boron	0.5	µg/g	24.4	13.9	7.38	18	9.18
Cadmium	0.05	µg/g	0.9	0.09	ND	ND	ND
Chromium	0.04	µg/g	ND	ND	0.98	0.06	0.05
Cobalt	0.05	µg/g	ND	ND	ND	ND	ND
Copper	0.05	µg/g	4.7	5.45	2.81	5.09	5.05
Iron	1	µg/g	52.7	121	500	93.3	241
Lead	0.3	µg/g	ND	ND	ND	ND	ND
Lithium	0.1	µg/g	ND	ND	0.1	0.12	ND
Magnesium	1	µg/g	2220	1520	1390	4090	1780
Manganese	0.3	µg/g	85.8	138	25.6	200	122
Mercury	0.003	µg/g	0.004	0.004	0.007	0.007	0.005
Molybdenum	0.05	µg/g	0.21	ND	ND	0.47	ND
Nickel	0.1	µg/g	0.74	2.83	1.16	0.25	1.45
Phosphorus	1	µg/g	2610	1740	1100	3760	1980
Potassium	5	µg/g	13300	8480	4980	12500	10100
Selenium	0.3	µg/g	ND	ND	ND	ND	0.51
Silicon	1	µg/g	50.2	131	201	226	114
Silver	0.2	µg/g	ND	ND	ND	ND	ND
Sodium	1	µg/g	8.3	15.1	15.3	11.3	108
Strontium	0.02	µg/g	16.7	14.5	54	25.7	22.6
Sulfur	1	µg/g	1300	1070	667	1540	927
Thallium	0.3	µg/g	ND	ND	ND	ND	ND
Tin	0.2	µg/g	ND	ND	ND	ND	0.25
Titanium	0.05	µg/g	1.27	2.86	9.81	2.22	2.47
Vanadium	0.1	µg/g	5.47	3.87	4.2	10.1	4.41
Zinc	0.1	µg/g	62.3	64.6	45.9	33.4	64
Zirconium	0.05	µg/g	ND	ND	0.06	ND	ND
Naphthalene	1	µg/kg	1.3	2.9	1.7	ND	ND
Naphthalene (duplicate)	1	µg/kg	-	-	-	-	-
Acenaphthylene	0.24	µg/kg	ND	0.27	ND	ND	ND
Acenaphthylene (duplicate)	0.24	µg/kg	-	-	-	-	-
Acenaphthene	0.15	µg/kg	0.17	ND	ND	ND	0.64
Acenaphthene (duplicate)	0.15	µg/kg	-	-	-	-	-
Fluorene	0.16	µg/kg	0.51	0.96	0.28	0.76	0.70
Fluorene (duplicate)	0.16	µg/kg	-	-	-	-	-
Phenanthrene	0.2	µg/kg	2.9	6.5	2.0	3.1	1.4
Phenanthrene (duplicate)	0.2	µg/kg	-	-	-	-	-
Anthracene	0.24	µg/kg	0.40	1.2	0.27	ND	0.38
Anthracene (duplicate)	0.24	µg/kg	-	-	-	-	-
Fluoranthene	0.2	µg/kg	0.61	0.72	0.21	0.35	ND
Fluoranthene (duplicate)	0.2	µg/kg	-	-	-	-	-
Pyrene	0.16	µg/kg	0.38	0.49	0.29	0.69	ND
Pyrene (duplicate)	0.16	µg/kg	-	-	-	-	-
Benz(a)anthracene	0.36	µg/kg	ND	ND	ND	ND	ND
Benz(a)anthracene (duplicate)	0.36	µg/kg	-	-	-	-	-
Chrysene	0.2	µg/kg	0.20	0.48	ND	0.31	ND
Chrysene (duplicate)	0.2	µg/kg	-	-	-	-	-
Benzo(b+j)fluoranthene	0.3	µg/kg	0.41	1.6	ND	ND	ND
Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	-	-	-	-	-
Benzo(k)fluoranthene	0.2	µg/kg	0.25	ND	ND	ND	ND
Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	-	-	-	-	-
Benzo(a)pyrene	0.3	µg/kg	0.33	ND	ND	ND	ND
Benzo(a)pyrene (duplicate)	0.3	µg/kg					
Indeno(1,2,3-cd)pyrene	0.5	µg/kg	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg					
Dibenz(a,h)anthracene	0.4	µg/kg	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	-	-	-	-	-
Benzo(ghi)perylene	0.4	µg/kg	ND	ND	ND	ND	ND
Benzo(ghi)perylene (duplicate)	0.4	µg/kg	-	-	-	-	-

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Sample ID			Sample ID			GM308BE	GM515BL	GM515BL	GM516BL	GM517BL
Medium			Medium			Vegetation				
Northing[1]			Northing[1]			5505385	5500931	5500931	5501748	5502784
Easting[1]			Easting[1]			684389	683160	683160	683474	683910
# of Samples			# of Samples					1		
Type of Vegetation Sampled			Type of Vegetation Sampled			Saskatoon berries	Saskatoon berries	Bearberry leaves	Saskatoon berries	Saskatoon berries
Chemical Analysed	Detection Limit	Units	Chemical Analysed	Detection Limit	Units	Chemical Concentration				
Aluminum	1	µg/g	Aluminum	1	µg/g	7.79	62.9	72.6	44.6	39.4
Antimony	0.5	µg/g	Antimony	0.5	µg/g	ND	ND	0.71	ND	ND
Arsenic	0.2	µg/g	Arsenic	0.2	µg/g	ND	ND	ND	0.3	ND
Barium	0.03	µg/g	Barium	0.03	µg/g	191	442	102	528	360
Beryllium	0.01	µg/g	Beryllium	0.01	µg/g	ND	ND	ND	ND	ND
Bismuth	0.5	µg/g	Bismuth	0.5	µg/g	ND	0.59	1.96	0.53	0.95
Boron	0.5	µg/g	Boron	0.5	µg/g	16.4	32.1	12.7	32.7	31.9
Cadmium	0.05	µg/g	Cadmium	0.05	µg/g	0.42	0.11	ND	0.23	0.22
Chromium	0.04	µg/g	Chromium	0.04	µg/g	ND	0.37	0.21	ND	0.05
Cobalt	0.05	µg/g	Cobalt	0.05	µg/g	ND	ND	0.12	0.14	ND
Copper	0.05	µg/g	Copper	0.05	µg/g	7.14	5.87	4.5	6.64	6.44
Iron	1	µg/g	Iron	1	µg/g	67.5	123	105	119	103
Lead	0.3	µg/g	Lead	0.3	µg/g	ND	ND	ND	ND	ND
Lithium	0.1	µg/g	Lithium	0.1	µg/g	ND	0.39	0.26	0.61	0.5
Magnesium	1	µg/g	Magnesium	1	µg/g	3520	4290	1230	5210	3410
Manganese	0.3	µg/g	Manganese	0.3	µg/g	1330	496	23.8	784	436
Mercury	0.003	µg/g	Mercury	0.003	µg/g	0.003	0.008	0.005	0.009	0.009
Molybdenum	0.05	µg/g	Molybdenum	0.05	µg/g	0.21	0.23	ND	0.13	0.46
Nickel	0.1	µg/g	Nickel	0.1	µg/g	1.89	0.99	2.05	1.3	1.47
Phosphorus	1	µg/g	Phosphorus	1	µg/g	4670	6880	1680	7740	8770
Potassium	5	µg/g	Potassium	5	µg/g	27700	20700	7320	14500	14500
Selenium	0.3	µg/g	Selenium	0.3	µg/g	1.13	1.1	2.54	3.58	1.89
Silicon	1	µg/g	Silicon	1	µg/g	127	270	134	264	180
Silver	0.2	µg/g	Silver	0.2	µg/g	ND	12.3	9.82	5	3.37
Sodium	1	µg/g	Sodium	1	µg/g	6.02	39.2	12.1	32.7	25.1
Strontium	0.02	µg/g	Strontium	0.02	µg/g	45.8	38	11.5	40.7	39.4
Sulfur	1	µg/g	Sulfur	1	µg/g	1560	1830	997	1130	1100
Thallium	0.3	µg/g	Thallium	0.3	µg/g	ND	ND	ND	ND	ND
Tin	0.2	µg/g	Tin	0.2	µg/g	ND	ND	ND	ND	0.27
Titanium	0.05	µg/g	Titanium	0.05	µg/g	1.1	4.17	3.79	3.3	3.75
Vanadium	0.1	µg/g	Vanadium	0.1	µg/g	8.5	16.1	4.83	19.2	13.1
Zinc	0.1	µg/g	Zinc	0.1	µg/g	110	84	39.6	52.4	87.2
Zirconium	0.05	µg/g	Zirconium	0.05	µg/g	ND	0.12	0.06	0.07	ND
Naphthalene	1	µg/kg	Naphthalene	1	µg/kg	1.6	2.13	2.09	1.64	1.76
Naphthalene (duplicate)	1	µg/kg	Naphthalene (duplicate)	1	µg/kg	-	-	-	-	-
Acenaphthylene	0.24	µg/kg	Acenaphthylene	0.24	µg/kg	ND	0.37	ND	ND	0.29
Acenaphthylene (duplicate)	0.24	µg/kg	Acenaphthylene (duplicate)	0.24	µg/kg	-	-	-	-	-
Acenaphthene	0.15	µg/kg	Acenaphthene	0.15	µg/kg	ND	ND	0.16	0.17	ND
Acenaphthene (duplicate)	0.15	µg/kg	Acenaphthene (duplicate)	0.15	µg/kg	-	-	-	-	-
Fluorene	0.16	µg/kg	Fluorene	0.16	µg/kg	0.66	1.21	0.53	0.69	0.80
Fluorene (duplicate)	0.16	µg/kg	Fluorene (duplicate)	0.16	µg/kg	-	-	-	-	-
Phenanthrene	0.2	µg/kg	Phenanthrene	0.2	µg/kg	4.8	5.48	5.53	4.69	5.13
Phenanthrene (duplicate)	0.2	µg/kg	Phenanthrene (duplicate)	0.2	µg/kg	-	-	-	-	-
Anthracene	0.24	µg/kg	Anthracene	0.24	µg/kg	1.1	ND	ND	ND	ND
Anthracene (duplicate)	0.24	µg/kg	Anthracene (duplicate)	0.24	µg/kg	-	-	-	-	-
Fluoranthene	0.2	µg/kg	Fluoranthene	0.2	µg/kg	0.71	1.21	1.03	1.11	0.79
Fluoranthene (duplicate)	0.2	µg/kg	Fluoranthene (duplicate)	0.2	µg/kg	-	-	-	-	-
Pyrene	0.16	µg/kg	Pyrene	0.16	µg/kg	0.47	0.73	0.88	0.54	0.57
Pyrene (duplicate)	0.16	µg/kg	Pyrene (duplicate)	0.16	µg/kg	-	-	-	-	-
Benz(a)anthracene	0.36	µg/kg	Benz(a)anthracene	0.36	µg/kg	2.4	ND	ND	ND	ND
Benz(a)anthracene (duplicate)	0.36	µg/kg	Benz(a)anthracene (duplicate)	0.36	µg/kg	-	-	-	-	-
Chrysene	0.2	µg/kg	Chrysene	0.2	µg/kg	ND	0.92	0.47	0.37	0.30
Chrysene (duplicate)	0.2	µg/kg	Chrysene (duplicate)	0.2	µg/kg	-	-	-	-	-
Benzo(b+j)fluoranthene	0.3	µg/kg	Benzo(b+j)fluoranthene	0.3	µg/kg	0.39	1.07	0.65	0.56	0.81
Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	-	-	-	-	-
Benzo(k)fluoranthene	0.2	µg/kg	Benzo(k)fluoranthene	0.2	µg/kg	ND	ND	ND	ND	ND
Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	-	-	-	-	-
Benzo(a)pyrene	0.3	µg/kg	Benzo(a)pyrene	0.3	µg/kg	ND	0.78	ND	ND	ND
Benzo(a)pyrene (duplicate)	0.3	µg/kg	Benzo(a)pyrene (duplicate)	0.3	µg/kg					
Indeno(1,2,3-cd)pyrene	0.5	µg/kg	Indeno(1,2,3-cd)pyrene	0.5	µg/kg	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg	Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg					
Dibenz(a,h)anthracene	0.4	µg/kg	Dibenz(a,h)anthracene	0.4	µg/kg	ND	0.60	ND	ND	ND
Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	-	-	-	-	-
Benzo(ghi)perylene	0.4	µg/kg	Benzo(ghi)perylene	0.4	µg/kg	ND	0.57	ND	ND	ND
Benzo(ghi)perylene (duplicate)	0.4	µg/kg	Benzo(ghi)perylene (duplicate)	0.4	µg/kg	-	-	-	-	-

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Sample ID			Sample ID			GM517BL	GM520BL	GM520BL	GM522BL	HH01
Medium			Medium			Vegetation				
Northing[1]			Northing[1]			5502784	5500512	5500512	5502449	5509147
Easting[1]			Easting[1]			683910	683739	683739	684104	687065
# of Samples			# of Samples			1				
Type of Vegetation Sampled			Type of Vegetation Sampled			Bearberry leaves	Saskatoon berries	Bearberry leaves	Saskatoon berries	Saskatoon berries
Chemical Analysed	Detection Limit	Units	Chemical Analysed	Detection Limit	Units	Chemical Concentration				
Aluminum	1	µg/g	Aluminum	1	µg/g	41	33.5	50.5	31.8	49.5
Antimony	0.5	µg/g	Antimony	0.5	µg/g	ND	ND	ND	ND	ND
Arsenic	0.2	µg/g	Arsenic	0.2	µg/g	0.35	ND	ND	0.25	ND
Barium	0.03	µg/g	Barium	0.03	µg/g	43.5	414	115	260	634
Beryllium	0.01	µg/g	Beryllium	0.01	µg/g	ND	ND	ND	ND	ND
Bismuth	0.5	µg/g	Bismuth	0.5	µg/g	1.16	ND	ND	2.3	ND
Boron	0.5	µg/g	Boron	0.5	µg/g	12.7	33.3	14.7	20.5	24
Cadmium	0.05	µg/g	Cadmium	0.05	µg/g	ND	0.09	ND	0.07	1.71
Chromium	0.04	µg/g	Chromium	0.04	µg/g	0.1	ND	0.4	ND	ND
Cobalt	0.05	µg/g	Cobalt	0.05	µg/g	0.08	0.22	0.08	0.06	ND
Copper	0.05	µg/g	Copper	0.05	µg/g	3.81	5.72	4.2	4.53	5.28
Iron	1	µg/g	Iron	1	µg/g	66.3	80.8	75.8	73.4	98
Lead	0.3	µg/g	Lead	0.3	µg/g	ND	0.59	ND	ND	ND
Lithium	0.1	µg/g	Lithium	0.1	µg/g	0.19	0.4	0.18	0.6	0.62
Magnesium	1	µg/g	Magnesium	1	µg/g	1170	3800	1550	3160	3410
Manganese	0.3	µg/g	Manganese	0.3	µg/g	17.4	239	22.3	99.8	1150
Mercury	0.003	µg/g	Mercury	0.003	µg/g	0.005	0.009	0.004	0.006	0.005
Molybdenum	0.05	µg/g	Molybdenum	0.05	µg/g	ND	1.93	0.1	2.23	0.38
Nickel	0.1	µg/g	Nickel	0.1	µg/g	1.39	0.49	0.81	0.75	5.3
Phosphorus	1	µg/g	Phosphorus	1	µg/g	1410	13200	1310	6640	7900
Potassium	5	µg/g	Potassium	5	µg/g	5760	22700	5930	13800	13700
Selenium	0.3	µg/g	Selenium	0.3	µg/g	0.8	1.67	1.63	1.6	0.97
Silicon	1	µg/g	Silicon	1	µg/g	98.6	173	89.6	210	106
Silver	0.2	µg/g	Silver	0.2	µg/g	2.72	2.05	1.47	0.77	0.54
Sodium	1	µg/g	Sodium	1	µg/g	13.9	17.5	15.8	51.2	20.5
Strontium	0.02	µg/g	Strontium	0.02	µg/g	7.81	141	20.9	23.2	80.8
Sulfur	1	µg/g	Sulfur	1	µg/g	953	1360	874	1080	1050
Thallium	0.3	µg/g	Thallium	0.3	µg/g	ND	ND	ND	ND	0.31
Tin	0.2	µg/g	Tin	0.2	µg/g	0.21	ND	ND	ND	0.25
Titanium	0.05	µg/g	Titanium	0.05	µg/g	2.3	2.73	2.69	2.94	3.40
Vanadium	0.1	µg/g	Vanadium	0.1	µg/g	4.5	14	5.61	11.7	12.9
Zinc	0.1	µg/g	Zinc	0.1	µg/g	40.3	79.5	90.8	95.6	116
Zirconium	0.05	µg/g	Zirconium	0.05	µg/g	0.09	ND	0.11	ND	0.12
Naphthalene	1	µg/kg	Naphthalene	1	µg/kg	2.60	2.05	2.51	1.6	1.58
Naphthalene (duplicate)	1	µg/kg	Naphthalene (duplicate)	1	µg/kg	2.71	-	-	-	-
Acenaphthylene	0.24	µg/kg	Acenaphthylene	0.24	µg/kg	ND	0.26	ND	ND	ND
Acenaphthylene (duplicate)	0.24	µg/kg	Acenaphthylene (duplicate)	0.24	µg/kg	ND	-	-	-	-
Acenaphthene	0.15	µg/kg	Acenaphthene	0.15	µg/kg	0.33	0.16	0.19	ND	ND
Acenaphthene (duplicate)	0.15	µg/kg	Acenaphthene (duplicate)	0.15	µg/kg	0.43	-	-	-	-
Fluorene	0.16	µg/kg	Fluorene	0.16	µg/kg	0.73	0.97	0.86	0.80	0.72
Fluorene (duplicate)	0.16	µg/kg	Fluorene (duplicate)	0.16	µg/kg	0.87	-	-	-	-
Phenanthrene	0.2	µg/kg	Phenanthrene	0.2	µg/kg	5.55	5.65	6.00	4.43	5.04
Phenanthrene (duplicate)	0.2	µg/kg	Phenanthrene (duplicate)	0.2	µg/kg	6.53	-	-	-	-
Anthracene	0.24	µg/kg	Anthracene	0.24	µg/kg	ND	ND	ND	ND	ND
Anthracene (duplicate)	0.24	µg/kg	Anthracene (duplicate)	0.24	µg/kg	ND	-	-	-	-
Fluoranthene	0.2	µg/kg	Fluoranthene	0.2	µg/kg	1.26	0.60	0.90	ND	0.36
Fluoranthene (duplicate)	0.2	µg/kg	Fluoranthene (duplicate)	0.2	µg/kg	0.90	-	-	-	-
Pyrene	0.16	µg/kg	Pyrene	0.16	µg/kg	0.75	0.53	0.69	0.26	0.48
Pyrene (duplicate)	0.16	µg/kg	Pyrene (duplicate)	0.16	µg/kg	0.74	-	-	-	-
Benz(a)anthracene	0.36	µg/kg	Benz(a)anthracene	0.36	µg/kg	ND	ND	ND	ND	0.70
Benz(a)anthracene (duplicate)	0.36	µg/kg	Benz(a)anthracene (duplicate)	0.36	µg/kg	ND	-	-	-	-
Chrysene	0.2	µg/kg	Chrysene	0.2	µg/kg	0.25	ND	ND	ND	0.48
Chrysene (duplicate)	0.2	µg/kg	Chrysene (duplicate)	0.2	µg/kg	0.20	-	-	-	-
Benzo(b+j)fluoranthene	0.3	µg/kg	Benzo(b+j)fluoranthene	0.3	µg/kg	0.91	0.55	0.58	0.42	0.51
Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	0.79	-	-	-	-
Benzo(k)fluoranthene	0.2	µg/kg	Benzo(k)fluoranthene	0.2	µg/kg	ND	ND	ND	ND	ND
Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	ND	-	-	-	-
Benzo(a)pyrene	0.3	µg/kg	Benzo(a)pyrene	0.3	µg/kg	ND	ND	ND	ND	ND
Benzo(a)pyrene (duplicate)	0.3	µg/kg	Benzo(a)pyrene (duplicate)	0.3	µg/kg	ND				
Indeno(1,2,3-cd)pyrene	0.5	µg/kg	Indeno(1,2,3-cd)pyrene	0.5	µg/kg	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg	Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg	ND				
Dibenz(a,h)anthracene	0.4	µg/kg	Dibenz(a,h)anthracene	0.4	µg/kg	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	ND	-	-	-	-
Benzo(ghi)perylene	0.4	µg/kg	Benzo(ghi)perylene	0.4	µg/kg	ND	ND	ND	ND	ND
Benzo(ghi)perylene (duplicate)	0.4	µg/kg	Benzo(ghi)perylene (duplicate)	0.4	µg/kg	ND	-	-	-	-

MILLENNIUM
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Sample ID			Sample ID			HH09	HH08	HH02	HH05	HH03
Medium			Medium					Vegetation		
Northing[1]			Northing[1]			5509777	5508530	5509136	5504195	5507967
Easting[1]			Easting[1]			685099	685140	687060	685402	686921
# of Samples			# of Samples					1		
Type of Vegetation Sampled			Type of Vegetation Sampled			Saskatoon berries	Bearberry leaves	Bearberry leaves	Saskatoon berries	Saskatoon berries
Chemical Analysed	Detection Limit	Units	Chemical Analysed	Detection Limit	Units	Chemical Concentration				
Aluminum	1	µg/g	Aluminum	1	µg/g	48.6	59.5	98.7	27.1	29.5
Antimony	0.5	µg/g	Antimony	0.5	µg/g	ND	ND	ND	ND	ND
Arsenic	0.2	µg/g	Arsenic	0.2	µg/g	0.28	0.31	ND	ND	ND
Barium	0.03	µg/g	Barium	0.03	µg/g	454	60.7	103	502	459
Beryllium	0.01	µg/g	Beryllium	0.01	µg/g	ND	ND	ND	ND	ND
Bismuth	0.5	µg/g	Bismuth	0.5	µg/g	0.87	1.06	1.61	0.84	1.1
Boron	0.5	µg/g	Boron	0.5	µg/g	19.8	8.8	10.8	30.6	32.1
Cadmium	0.05	µg/g	Cadmium	0.05	µg/g	0.23	ND	ND	ND	3.29
Chromium	0.04	µg/g	Chromium	0.04	µg/g	0.11	0.23	0.27	ND	0.11
Cobalt	0.05	µg/g	Cobalt	0.05	µg/g	0.19	0.11	ND	ND	0.16
Copper	0.05	µg/g	Copper	0.05	µg/g	5.42	3.84	4.58	4.96	6.41
Iron	1	µg/g	Iron	1	µg/g	84.1	93.1	105	69	87.9
Lead	0.3	µg/g	Lead	0.3	µg/g	ND	ND	ND	ND	ND
Lithium	0.1	µg/g	Lithium	0.1	µg/g	0.33	0.12	0.23	0.36	0.26
Magnesium	1	µg/g	Magnesium	1	µg/g	4350	1330	1680	5560	4030
Manganese	0.3	µg/g	Manganese	0.3	µg/g	419	13.7	49.4	54	240
Mercury	0.003	µg/g	Mercury	0.003	µg/g	0.006	0.002	0.005	0.01	0.011
Molybdenum	0.05	µg/g	Molybdenum	0.05	µg/g	0.14	ND	ND	0.97	0.16
Nickel	0.1	µg/g	Nickel	0.1	µg/g	1.86	1.17	2.24	0.57	2.67
Phosphorus	1	µg/g	Phosphorus	1	µg/g	5130	1340	1380	10100	5160
Potassium	5	µg/g	Potassium	5	µg/g	18200	6070	6460	13800	23200
Selenium	0.3	µg/g	Selenium	0.3	µg/g	1.29	1.48	0.63	1.62	2
Silicon	1	µg/g	Silicon	1	µg/g	99	85.5	95.9	133	85
Silver	0.2	µg/g	Silver	0.2	µg/g	0.85	0.52	0.24	0.49	ND
Sodium	1	µg/g	Sodium	1	µg/g	19.4	8.72	26.1	21.9	16.8
Strontium	0.02	µg/g	Strontium	0.02	µg/g	88.8	27.2	18.8	36.4	75.8
Sulfur	1	µg/g	Sulfur	1	µg/g	778	846	880	945	1200
Thallium	0.3	µg/g	Thallium	0.3	µg/g	ND	ND	ND	ND	ND
Tin	0.2	µg/g	Tin	0.2	µg/g	ND	ND	ND	0.3	ND
Titanium	0.05	µg/g	Titanium	0.05	µg/g	3.16	3.39	3.89	2.99	2.65
Vanadium	0.1	µg/g	Vanadium	0.1	µg/g	16	5.18	6.47	20.1	15.2
Zinc	0.1	µg/g	Zinc	0.1	µg/g	39	31.2	60.2	63.9	55.9
Zirconium	0.05	µg/g	Zirconium	0.05	µg/g	0.08	0.11	ND	0.08	ND
Naphthalene	1	µg/kg	Naphthalene	1	µg/kg	1.28	3.23	3.02	2.43	2.53
Naphthalene (duplicate)	1	µg/kg	Naphthalene (duplicate)	1	µg/kg	-	3.34	-	-	-
Acenaphthylene	0.24	µg/kg	Acenaphthylene	0.24	µg/kg	ND	ND	ND	ND	ND
Acenaphthylene (duplicate)	0.24	µg/kg	Acenaphthylene (duplicate)	0.24	µg/kg	-	ND	-	-	-
Acenaphthene	0.15	µg/kg	Acenaphthene	0.15	µg/kg	ND	0.32	ND	1.06	0.21
Acenaphthene (duplicate)	0.15	µg/kg	Acenaphthene (duplicate)	0.15	µg/kg	-	0.32	-	-	-
Fluorene	0.16	µg/kg	Fluorene	0.16	µg/kg	0.93	0.59	1.05	0.92	0.71
Fluorene (duplicate)	0.16	µg/kg	Fluorene (duplicate)	0.16	µg/kg	-	0.65	-	-	-
Phenanthrene	0.2	µg/kg	Phenanthrene	0.2	µg/kg	2.97	4.40	11.31	9.47	2.89
Phenanthrene (duplicate)	0.2	µg/kg	Phenanthrene (duplicate)	0.2	µg/kg	-	4.45	-	-	-
Anthracene	0.24	µg/kg	Anthracene	0.24	µg/kg	ND	ND	ND	ND	ND
Anthracene (duplicate)	0.24	µg/kg	Anthracene (duplicate)	0.24	µg/kg	-	ND	-	-	-
Fluoranthene	0.2	µg/kg	Fluoranthene	0.2	µg/kg	0.34	0.33	0.58	1.05	0.41
Fluoranthene (duplicate)	0.2	µg/kg	Fluoranthene (duplicate)	0.2	µg/kg	-	0.31	-	-	-
Pyrene	0.16	µg/kg	Pyrene	0.16	µg/kg	0.32	0.42	0.90	1.07	0.38
Pyrene (duplicate)	0.16	µg/kg	Pyrene (duplicate)	0.16	µg/kg	-	0.39	-	-	-
Benz(a)anthracene	0.36	µg/kg	Benz(a)anthracene	0.36	µg/kg	ND	ND	ND	ND	ND
Benz(a)anthracene (duplicate)	0.36	µg/kg	Benz(a)anthracene (duplicate)	0.36	µg/kg	-	ND	-	-	-
Chrysene	0.2	µg/kg	Chrysene	0.2	µg/kg	ND	0.54	2.45	1.81	0.35
Chrysene (duplicate)	0.2	µg/kg	Chrysene (duplicate)	0.2	µg/kg	-	0.46	-	-	-
Benzo(b+j)fluoranthene	0.3	µg/kg	Benzo(b+j)fluoranthene	0.3	µg/kg	0.33	0.66	3.18	1.65	0.69
Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	-	0.64	-	-	-
Benzo(k)fluoranthene	0.2	µg/kg	Benzo(k)fluoranthene	0.2	µg/kg	ND	ND	0.39	ND	ND
Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	-	ND	-	-	-
Benzo(a)pyrene	0.3	µg/kg	Benzo(a)pyrene	0.3	µg/kg	ND	ND	ND	ND	ND
Benzo(a)pyrene (duplicate)	0.3	µg/kg	Benzo(a)pyrene (duplicate)	0.3	µg/kg		ND			
Indeno(1,2,3-cd)pyrene	0.5	µg/kg	Indeno(1,2,3-cd)pyrene	0.5	µg/kg	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg	Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg		ND			
Dibenz(a,h)anthracene	0.4	µg/kg	Dibenz(a,h)anthracene	0.4	µg/kg	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	-	ND	-	-	-
Benzo(ghi)perylene	0.4	µg/kg	Benzo(ghi)perylene	0.4	µg/kg	ND	ND	0.50	0.63	ND
Benzo(ghi)perylene (duplicate)	0.4	µg/kg	Benzo(ghi)perylene (duplicate)	0.4	µg/kg	-	ND	-	-	-

MILLENNIUM
EMS Solutions Ltd.

Sample ID			Sample ID			GM513BL	GM508BL	GM506BL	HH04	HH04
Medium			Medium					Vegatation		
Northing[1]			Northing[1]			5509604	5506977	5506136	5507636	5507636
Easting[1]			Easting[1]			685249	684583	687019	686500	686500
# of Samples			# of Samples					1		
Type of Vegetation Sampled			Type of Vegetation Sampled			Bearberry leaves	Bearberry leaves	Bearberry leaves	Bearberry leaves	Saskatoon berries
Chemical Analysed	Detection Limit	Units	Chemical Analysed	Detection Limit	Units	Chemical Concentration				
Aluminum	1	µg/g	Aluminum	1	µg/g	49.8	51	69	410	37.2
Antimony	0.5	µg/g	Antimony	0.5	µg/g	ND	ND	0.51	ND	ND
Arsenic	0.2	µg/g	Arsenic	0.2	µg/g	ND	ND	ND	ND	0.45
Barium	0.03	µg/g	Barium	0.03	µg/g	66.6	126	173	67.3	267
Beryllium	0.01	µg/g	Beryllium	0.01	µg/g	ND	ND	ND	ND	ND
Bismuth	0.5	µg/g	Bismuth	0.5	µg/g	ND	ND	ND	ND	ND
Boron	0.5	µg/g	Boron	0.5	µg/g	4.97	9	9.16	10.2	18.7
Cadmium	0.05	µg/g	Cadmium	0.05	µg/g	ND	ND	0.07	ND	1.87
Chromium	0.04	µg/g	Chromium	0.04	µg/g	0.22	0.35	0.22	2.53	0.31
Cobalt	0.05	µg/g	Cobalt	0.05	µg/g	0.08	ND	0.08	0.5	0.13
Copper	0.05	µg/g	Copper	0.05	µg/g	2.8	3.56	3.53	4.81	3.51
Iron	1	µg/g	Iron	1	µg/g	67.9	80.1	107	791	80.1
Lead	0.3	µg/g	Lead	0.3	µg/g	ND	ND	ND	ND	ND
Lithium	0.1	µg/g	Lithium	0.1	µg/g	0.13	0.16	0.16	0.43	0.31
Magnesium	1	µg/g	Magnesium	1	µg/g	907	1200	1300	1100	2060
Manganese	0.3	µg/g	Manganese	0.3	µg/g	12.1	17.6	31.7	35.8	123
Mercury	0.003	µg/g	Mercury	0.003	µg/g	0.003	0.002	0.003	0.005	0.006
Molybdenum	0.05	µg/g	Molybdenum	0.05	µg/g	ND	ND	0.08	ND	0.23
Nickel	0.1	µg/g	Nickel	0.1	µg/g	0.8	1.1	1.52	3.03	1.08
Phosphorus	1	µg/g	Phosphorus	1	µg/g	1250	1120	1110	1100	1730
Potassium	5	µg/g	Potassium	5	µg/g	6480	4820	5670	4720	6730
Selenium	0.3	µg/g	Selenium	0.3	µg/g	0.4	0.32	0.38	2.1	ND
Silicon	1	µg/g	Silicon	1	µg/g	87.4	111	91.4	202	87.3
Silver	0.2	µg/g	Silver	0.2	µg/g	ND	ND	2.36	0.97	0.58
Sodium	1	µg/g	Sodium	1	µg/g	11.4	10.3	13.6	9.95	13.4
Strontium	0.02	µg/g	Strontium	0.02	µg/g	22.2	11.5	25.3	6.73	16.7
Sulfur	1	µg/g	Sulfur	1	µg/g	739	708	659	731	807
Thallium	0.3	µg/g	Thallium	0.3	µg/g	ND	ND	ND	ND	ND
Tin	0.2	µg/g	Tin	0.2	µg/g	ND	ND	0.29	0.24	ND
Titanium	0.05	µg/g	Titanium	0.05	µg/g	2.69	2.75	2.9	7.77	2.8
Vanadium	0.1	µg/g	Vanadium	0.1	µg/g	3.57	4.89	5.05	6.09	7.76
Zinc	0.1	µg/g	Zinc	0.1	µg/g	20.8	28	45.5	39.3	55.2
Zirconium	0.05	µg/g	Zirconium	0.05	µg/g	ND	ND	0.46	0.52	0.07
Naphthalene	1	µg/kg	Naphthalene	1	µg/kg	2.77	2.19	4.49	3.33	13.7
Naphthalene (duplicate)	1	µg/kg	Naphthalene (duplicate)	1	µg/kg	-	-	-	-	-
Acenaphthylene	0.24	µg/kg	Acenaphthylene	0.24	µg/kg	0.41	ND	ND	ND	0.75
Acenaphthylene (duplicate)	0.24	µg/kg	Acenaphthylene (duplicate)	0.24	µg/kg	-	-	-	-	-
Acenaphthene	0.15	µg/kg	Acenaphthene	0.15	µg/kg	ND	ND	0.24	0.19	1.03
Acenaphthene (duplicate)	0.15	µg/kg	Acenaphthene (duplicate)	0.15	µg/kg	-	-	-	-	-
Fluorene	0.16	µg/kg	Fluorene	0.16	µg/kg	1.42	0.74	0.55	0.59	4.02
Fluorene (duplicate)	0.16	µg/kg	Fluorene (duplicate)	0.16	µg/kg	-	-	-	-	-
Phenanthrene	0.2	µg/kg	Phenanthrene	0.2	µg/kg	4.36	4.22	3.28	7.29	51.5
Phenanthrene (duplicate)	0.2	µg/kg	Phenanthrene (duplicate)	0.2	µg/kg	-	-	-	-	-
Anthracene	0.24	µg/kg	Anthracene	0.24	µg/kg	ND	ND	ND	ND	ND
Anthracene (duplicate)	0.24	µg/kg	Anthracene (duplicate)	0.24	µg/kg	-	-	-	-	-
Fluoranthene	0.2	µg/kg	Fluoranthene	0.2	µg/kg	0.65	0.29	0.33	0.75	4.19
Fluoranthene (duplicate)	0.2	µg/kg	Fluoranthene (duplicate)	0.2	µg/kg	-	-	-	-	-
Pyrene	0.16	µg/kg	Pyrene	0.16	µg/kg	0.62	0.39	0.36	0.86	4.33
Pyrene (duplicate)	0.16	µg/kg	Pyrene (duplicate)	0.16	µg/kg	-	-	-	-	-
Benz(a)anthracene	0.36	µg/kg	Benz(a)anthracene	0.36	µg/kg	ND	ND	ND	ND	ND
Benz(a)anthracene (duplicate)	0.36	µg/kg	Benz(a)anthracene (duplicate)	0.36	µg/kg	-	-	-	-	-
Chrysene	0.2	µg/kg	Chrysene	0.2	µg/kg	0.67	0.33	0.25	1.12	12.4
Chrysene (duplicate)	0.2	µg/kg	Chrysene (duplicate)	0.2	µg/kg	-	-	-	-	-
Benzo(b+j)fluoranthene	0.3	µg/kg	Benzo(b+j)fluoranthene	0.3	µg/kg	1.05	0.54	0.81	1.32	22.5
Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	Benzo(b+j)fluoranthene (duplicate)	0.3	µg/kg	-	-	-	-	
Benzo(k)fluoranthene	0.2	µg/kg	Benzo(k)fluoranthene	0.2	µg/kg	ND	ND	ND	ND	ND
Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	Benzo(k)fluoranthene (duplicate)	0.2	µg/kg	-	-	-	-	-
Benzo(a)pyrene	0.3	µg/kg	Benzo(a)pyrene	0.3	µg/kg	ND	ND	ND	ND	1.85
Benzo(a)pyrene (duplicate)	0.3	µg/kg	Benzo(a)pyrene (duplicate)	0.3	µg/kg					-
Indeno(1,2,3-cd)pyrene	0.5	µg/kg	Indeno(1,2,3-cd)pyrene	0.5	µg/kg	ND	ND	ND	ND	1.11
Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg	Indeno(1,2,3-cd)pyrene (duplicate)	0.5	µg/kg					-
Dibenz(a,h)anthracene	0.4	µg/kg	Dibenz(a,h)anthracene	0.4	µg/kg	ND	ND	ND	ND	1.52
Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	Dibenz(a,h)anthracene (duplicate)	0.4	µg/kg	-	-	-	-	-
Benzo(ghi)perylene	0.4	µg/kg	Benzo(ghi)perylene	0.4	µg/kg	ND	ND	ND	0.44	3.60
Benzo(ghi)perylene (duplicate)	0.4	µg/kg	Benzo(ghi)perylene (duplicate)	0.4	µg/kg	-	-	-	-	-

MEMS Sample ID			RP-5BE	GM051BE	GM148BE	GM107BE	GM302BE	GM308BE
Medium			Soil					
Northing[1]			5504575	5505278	5509896	5503424	5504032	5505385
Easting[1]			685311	686808	684804	681979	684221	684389
# of Samples			1					
Depth of Soil Samples			0 - 15 cm					
Chemical Analysed	Detection Limit	Units	Chemical Concentration					
Mercury	0.01	mg/kg	0.02	0.01	0.05	0.05	ND	ND
Aluminum	20.00	mg/kg	9470.00	8600.00	19300.00	8780.00	9180.00	7380.00
Antimony	0.20	mg/kg	ND	ND	ND	ND	ND	ND
Arsenic	0.20	mg/kg	3.50	3.60	6.70	2.10	2.40	2.20
Barium	1.00	mg/kg	180.00	292.00	278.00	225.00	233.00	154.00
Beryllium	0.10	mg/kg	0.80	0.70	0.70	0.40	0.60	0.50
Bismuth	0.50	mg/kg	0.70	0.60	0.50	0.60	0.50	0.50
Cadmium	0.01	mg/kg	1.29	1.09	0.63	0.47	0.23	0.15
Chromium	0.50	mg/kg	17.00	9.80	38.00	7.70	14.10	6.50
Calcium	200.00	mg/kg	1700.00	1000.00	2900.00	10700.00	1000.00	1000.00
Cobalt	0.10	mg/kg	10.70	8.70	17.50	5.10	8.80	5.90
Copper	1.00	mg/kg	23.10	13.10	49.80	11.00	10.60	5.00
Iron	100.00	mg/kg	19100.00	20800.00	36300.00	10100.00	19900.00	14800.00
Lead	5.00	mg/kg	14.10	12.00	11.60	11.50	12.00	12.40
Magnesium	100.00	mg/kg	2300.00	1500.00	7200.00	2000.00	1600.00	900.00
Manganese	10.00	mg/kg	571.00	867.00	769.00	559.00	700.00	804.00
Molybdenum	1.00	mg/kg	1.10	1.30	ND	ND	ND	ND
Nickel	0.50	mg/kg	30.10	17.10	37.60	9.30	12.30	5.80
Phosphorus	30.00	mg/kg	580.00	710.00	670.00	360.00	530.00	56.00
Selenium	0.30	mg/kg	0.30	ND	0.40	ND	ND	ND
Silicon	50.00	mg/kg	790.00	740.00	760.00	830.00	760.00	820.00
Silver	0.10	mg/kg	0.60	0.30	0.20	0.30	0.20	0.20
Strontium	1.00	mg/kg	11.00	14.00	43.00	33.00	17.00	17.00
Thallium	0.05	mg/kg	0.22	0.17	0.17	0.13	0.18	0.17
Tin	1.00	mg/kg	1.50	1.70	1.90	1.70	1.90	1.50
Titanium	0.50	mg/kg	109.00	205.00	617.00	301.00	212.00	353.00
Vanadium	0.10	mg/kg	33.20	23.60	69.50	17.70	33.70	34.10
Zinc	1.00	mg/kg	113.00	85.00	100.00	46.00	82.00	45.00
Naphthalene	0.01	mg/kg	0.02	ND	0.09	0.05	0.01	ND
Acenaphthylene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Acenaphthene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Fluorene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Phenanthrene	0.01	mg/kg	0.03	ND	0.08	0.08	0.02	ND
Anthracene	0.00	mg/kg	ND	ND	ND	ND	0.02	ND
Fluoranthene	0.01	mg/kg	ND	ND	ND	ND	ND	ND
Pyrene	0.01	mg/kg	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	0.01	mg/kg	ND	ND	ND	ND	ND	ND
Chrysene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Benzo(b+j)fluoranthene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	0.05	mg/kg	ND	ND	ND	ND	ND	ND
IACR_Coarse	0.00		ND	ND	ND	ND	ND	ND
IACR_Fine	0.00		ND	ND	ND	ND	ND	ND
Nitrobenzene-d5	23-130	%	92.00	92.00	87.00	119.00	117.00	96.00
2-Fluorobiphenyl	30-130	%	98.00	94.00	87.00	90.00	90.00	101.00
p-Terphenyl-d14	18-137	%	122.00	115.00	115.00	128.00	41.00	112.00

[1] UTM zone 11, NAD 83

[2] mg/kg and µg/kg are equivalent units

MEMS Sample ID			GM515BL	GM516BL	GM517BL	GM520BL	GM522BL	HH01
Medium			Soil					
Northing[1]			5500931	5501748	5502784	5500512	5502449	5509147
Easting[1]			683160	683474	683910	683739	684104	687065
# of Samples			1					
Depth of Soil Samples			0 - 15 cm					
Chemical Analysed	Detection Limit	Units	Chemical Concentration					
Mercury	0.01	mg/kg	ND	0.01	ND	0.02	0.04	0.09
Aluminum	20.00	mg/kg	10300.00	8090.00	6090.00	13900.00	6800.00	3570.00
Antimony	0.20	mg/kg	ND	ND	ND	ND	ND	ND
Arsenic	0.20	mg/kg	4.80	1.60	1.50	2.90	4.00	3.50
Barium	1.00	mg/kg	228.00	176.00	129.00	283.00	156.00	296.00
Beryllium	0.10	mg/kg	0.60	0.30	0.30	0.70	0.60	0.90
Bismuth	0.50	mg/kg	0.50	ND	ND	0.50	ND	ND
Cadmium	0.01	mg/kg	0.24	0.17	0.15	0.68	0.48	1.42
Chromium (III+VI)	0.50	mg/kg	13.20	8.80	6.80	14.80	9.40	7.40
Calcium	200.00	mg/kg	3500.00	3800.00	2100.00	8000.00	57900.00	4100.00
Cobalt	0.10	mg/kg	7.00	5.10	2.70	9.80	4.40	7.10
Copper	1.00	mg/kg	13.00	5.10	3.80	23.00	13.00	29.30
Iron	100.00	mg/kg	16300.00	10700.00	8950.00	17900.00	10700.00	8220.00
Lead	5.00	mg/kg	11.50	10.30	7.20	12.10	13.20	17.20
Magnesium	100.00	mg/kg	2400.00	1500.00	1200.00	2700.00	9900.00	700.00
Manganese	10.00	mg/kg	399.00	533.00	296.00	649.00	321.00	155.00
Molybdenum	1.00	mg/kg	ND	ND	ND	ND	ND	ND
Nickel	0.50	mg/kg	15.40	9.80	6.50	16.70	11.50	27.90
Phosphorus	30.00	mg/kg	510.00	270.00	210.00	780.00	840.00	390.00
Selenium	0.30	mg/kg	ND	ND	ND	0.50	0.30	0.70
Silicon	50.00	mg/kg	590.00	530.00	550.00	700.00	910.00	570.00
Silver	0.10	mg/kg	ND	ND	ND	ND	ND	0.10
Strontium	1.00	mg/kg	16.00	16.00	17.00	68.00	58.00	26.00
Thallium	0.05	mg/kg	0.09	0.08	0.07	0.11	0.09	0.16
Tin	1.00	mg/kg	1.30	1.20	1.20	ND	1.10	1.30
Titanium	0.50	mg/kg	300.00	255.00	229.00	305.00	138.00	56.70
Vanadium	0.10	mg/kg	29.20	18.00	15.10	28.20	24.70	29.80
Zinc	1.00	mg/kg	106.00	47.00	38.00	94.00	63.00	94.00
Moisture	0.10	%	19.20	20.00	18.00	20.50	22.30	18.30
Acenaphthene	0.03	ug/g	ND	ND	ND	ND	ND	ND
Acenaphthylene	0.03	ug/g	ND	ND	ND	ND	ND	ND
Anthracene	0.03	ug/g	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	0.03	ug/g	ND	ND	ND	ND	ND	0.30
Benzo(a)pyrene	0.03	ug/g	0.04	ND	ND	ND	ND	0.17
Benzo(b)fluoranthene	0.03	ug/g	0.03	ND	ND	ND	ND	1.16
Benzo(g,h,i)perylene	0.03	ug/g	ND	ND	ND	ND	ND	0.11
Benzo(k)fluoranthene	0.03	ug/g	ND	ND	ND	ND	ND	0.17
Chrysene	0.03	ug/g	0.06	ND	ND	ND	0.03	2.11
Dibenzo(a,h)anthracene	0.03	ug/g	ND	ND	ND	ND	ND	0.07
Fluoranthene	0.03	ug/g	ND	ND	ND	ND	ND	0.37
Fluorene	0.03	ug/g	ND	ND	ND	ND	ND	0.24
Indeno(1,2,3-c,d)pyrene	0.03	ug/g	ND	ND	ND	ND	ND	0.05
2-Methylnaphthalene	0.03	ug/g	0.29	0.06	0.07	0.14	0.13	5.16
Naphthalene	0.03	ug/g	0.11	ND	ND	0.06	0.06	3.26
Phenanthrene	0.03	ug/g	0.19	0.04	0.05	0.09	0.10	6.99
Pyrene	0.03	ug/g	ND	ND	ND	ND	ND	0.52
2-Fluorobiphenyl		%	81.00	91.00	83.00	86.00	92.00	78.00
Naphthalene-D8 (surr)		%	93.00	97.00	90.00	97.00	89.00	93.00
p-Terphenyl		%	77.00	81.00	83.00	86.00	87.00	83.00
Quinoline-d7		%	82.00	79.00	90.00	83.00	93.00	104.00

[1] UTM zone 11, NAD 83

[2] mg/kg and µg/kg are equivalent units

MEMS Sample ID			HH09	HH08	HH02	HH05	HH03
Medium			Soil				
Northing[1]			5509777	5508530	5509136	5504195	5507967
Easting[1]			685099	685140	687060	685402	686921
# of Samples			1				
Depth of Soil Samples			0 - 15 cm				
Chemical Analysed	Detection Limit	Units	Chemical Concentration				
Mercury	0.01	mg/kg	ND	0.01	0.04	0.10	ND
Aluminum	20.00	mg/kg	15900.00	18300.00	3410.00	3000.00	10600.00
Antimony	0.20	mg/kg	ND	ND	ND	ND	ND
Arsenic	0.20	mg/kg	4.70	11.60	2.50	4.00	2.80
Barium	1.00	mg/kg	293.00	387.00	268.00	367.00	322.00
Beryllium	0.10	mg/kg	0.40	0.60	0.80	0.80	0.90
Bismuth	0.50	mg/kg	ND	ND	ND	ND	0.50
Cadmium	0.01	mg/kg	0.32	1.23	1.27	2.04	0.94
Chromium (III+VI)	0.50	mg/kg	22.50	32.20	5.50	5.80	12.60
Calcium	200.00	mg/kg	3700.00	4800.00	3600.00	11700.00	2200.00
Cobalt	0.10	mg/kg	8.50	11.60	5.90	9.00	7.40
Copper	1.00	mg/kg	12.00	31.30	26.00	34.30	8.00
Iron	100.00	mg/kg	24500.00	33200.00	6660.00	9970.00	20300.00
Lead	5.00	mg/kg	9.60	11.20	15.10	15.70	16.10
Magnesium	100.00	mg/kg	3900.00	8100.00	600.00	1200.00	1100.00
Manganese	10.00	mg/kg	562.00	1250.00	228.00	243.00	271.00
Molybdenum	1.00	mg/kg	ND	1.30	ND	1.40	ND
Nickel	0.50	mg/kg	20.30	31.10	20.80	29.80	20.30
Phosphorus	30.00	mg/kg	790.00	790.00	390.00	830.00	1310.00
Selenium	0.30	mg/kg	ND	ND	0.60	0.90	ND
Silicon	50.00	mg/kg	660.00	480.00	600.00	660.00	710.00
Silver	0.10	mg/kg	ND	ND	0.10	0.20	ND
Strontium	1.00	mg/kg	21.00	31.00	26.00	32.00	22.00
Thallium	0.05	mg/kg	0.11	0.09	0.15	0.18	0.17
Tin	1.00	mg/kg	1.00	1.80	1.00	1.40	1.10
Titanium	0.50	mg/kg	607.00	724.00	50.80	39.20	131.00
Vanadium	0.10	mg/kg	53.70	64.80	20.80	24.70	35.80
Zinc	1.00	mg/kg	81.00	117.00	83.00	149.00	96.00
Moisture	0.10	%	19.00	11.20	18.70	12.70	22.80
Acenaphthene	0.03	ug/g	ND	ND	ND	ND	ND
Acenaphthylene	0.03	ug/g	ND	ND	ND	ND	ND
Anthracene	0.03	ug/g	ND	ND	ND	ND	ND
Benzo(a)anthracene	0.03	ug/g	ND	ND	0.30	0.25	ND
Benzo(a)pyrene	0.03	ug/g	ND	ND	0.19	0.20	ND
Benzo(b)fluoranthene	0.03	ug/g	ND	ND	1.10	1.15	ND
Benzo(g,h,i)perylene	0.03	ug/g	ND	ND	0.19	0.17	ND
Benzo(k)fluoranthene	0.03	ug/g	ND	ND	0.13	0.11	ND
Chrysene	0.03	ug/g	ND	ND	1.85	2.07	ND
Dibenzo(a,h)anthracene	0.03	ug/g	ND	ND	0.09	0.08	ND
Fluoranthene	0.03	ug/g	ND	ND	0.34	0.41	ND
Fluorene	0.03	ug/g	ND	ND	0.58	0.06	ND
Indeno(1,2,3-c,d)pyrene	0.03	ug/g	ND	ND	0.09	0.07	ND
2-Methylnaphthalene	0.03	ug/g	ND	0.03	4.92	2.54	0.03
Naphthalene	0.03	ug/g	ND	ND	2.37	3.12	0.04
Phenanthrene	0.03	ug/g	ND	ND	6.75	8.01	0.07
Pyrene	0.03	ug/g	ND	ND	0.55	0.44	ND
2-Fluorobiphenyl		%	88.00	95.00	82.00	86.00	92.00
Naphthalene-D8 (surr)		%	92.00	103.00	93.00	97.00	95.00
p-Terphenyl		%	94.00	87.00	94.00	93.00	84.00
Quinoline-d7		%	80.00	92.00	120.00	88.00	78.00

[1] UTM zone 11, NAD 83

[2] mg/kg and µg/kg are equivalent units

MEMS Sample ID			GM513BL	GM508BL	GM506BL	HH04
Medium			Soil			
Northing[1]			5509604	5506977	5506136	5507636
Easting[1]			685249	684583	687019	686500
# of Samples			1			
Depth of Soil Samples			0 - 15 cm			
Chemical Analysed	Detection Limit	Units	Chemical Concentration			
Mercury	0.01	mg/kg	ND	ND	0.02	0.04
Aluminum	20.00	mg/kg	16200.00	10500.00	17500.00	10000.00
Antimony	0.20	mg/kg	ND	ND	ND	ND
Arsenic	0.20	mg/kg	5.00	7.30	4.30	6.80
Barium	1.00	mg/kg	254.00	157.00	417.00	287.00
Beryllium	0.10	mg/kg	0.50	0.70	0.70	1.10
Bismuth	0.50	mg/kg	ND	ND	ND	ND
Cadmium	0.01	mg/kg	0.19	0.18	1.73	1.06
Chromium (III+VI)	0.50	mg/kg	26.40	13.60	24.20	16.30
Calcium	200.00	mg/kg	3700.00	3100.00	4100.00	2900.00
Cobalt	0.10	mg/kg	8.90	6.90	13.80	12.50
Copper	1.00	mg/kg	14.90	19.80	31.70	24.20
Iron	100.00	mg/kg	25800.00	20300.00	31200.00	18200.00
Lead	5.00	mg/kg	9.30	11.60	12.60	15.30
Magnesium	100.00	mg/kg	4900.00	2300.00	5400.00	1700.00
Manganese	10.00	mg/kg	516.00	148.00	1380.00	442.00
Molybdenum	1.00	mg/kg	ND	ND	ND	ND
Nickel	0.50	mg/kg	19.40	19.10	30.60	31.20
Phosphorus	30.00	mg/kg	630.00	510.00	850.00	630.00
Selenium	0.30	mg/kg	ND	ND	ND	0.30
Silicon	50.00	mg/kg	590.00	560.00	600.00	680.00
Silver	0.10	mg/kg	ND	ND	ND	ND
Strontium	1.00	mg/kg	28.00	25.00	22.00	9.00
Thallium	0.05	mg/kg	0.09	0.14	0.13	0.15
Tin	1.00	mg/kg	1.60	1.10	1.40	ND
Titanium	0.50	mg/kg	1180.00	208.00	236.00	46.30
Vanadium	0.10	mg/kg	58.70	37.60	48.90	34.70
Zinc	1.00	mg/kg	56.00	75.00	144.00	95.00
Moisture	0.10	%	14.40	18.60	14.70	8.36
Acenaphthene	0.03	ug/g	ND	ND	ND	ND
Acenaphthylene	0.03	ug/g	ND	ND	ND	ND
Anthracene	0.03	ug/g	ND	ND	ND	ND
Benzo(a)anthracene	0.03	ug/g	ND	0.21	ND	0.07
Benzo(a)pyrene	0.03	ug/g	ND	ND	ND	0.06
Benzo(b)fluoranthene	0.03	ug/g	ND	ND	ND	0.28
Benzo(g,h,i)perylene	0.03	ug/g	ND	ND	ND	0.08
Benzo(k)fluoranthene	0.03	ug/g	ND	ND	ND	0.04
Chrysene	0.03	ug/g	ND	1.21	ND	0.49
Dibenzo(a,h)anthracene	0.03	ug/g	ND	ND	ND	ND
Fluoranthene	0.03	ug/g	ND	ND	ND	0.07
Fluorene	0.03	ug/g	ND	ND	ND	0.09
Indeno(1,2,3-c,d)pyrene	0.03	ug/g	ND	ND	ND	0.03
2-Methylnaphthalene	0.03	ug/g	ND	ND	0.03	1.12
Naphthalene	0.03	ug/g	ND	ND	ND	0.42
Phenanthrene	0.03	ug/g	ND	ND	0.05	1.44
Pyrene	0.03	ug/g	ND	ND	ND	0.11
2-Fluorobiphenyl		%	90.00	89.00	90.00	83.00
Naphthalene-D8 (surr)		%	102.00	87.00	96.00	93.00
p-Terphenyl		%	75.00	86.00	94.00	81.00
Quinoline-d7		%	81.00	119.00	75.00	81.00

[1] UTM zone 11, NAD 83

[2] mg/kg and µg/kg are equivalent units

APPENDIX H: SCREENING WILDLIFE RISK ASSESSMENT

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1.0 INTRODUCTION

The screening-level wildlife risk assessment (screening-level WRA), conducted in parallel to the human health risk assessment (HHRA), evaluates potential adverse population-level effects to terrestrial wildlife that may be associated with chemical emissions from the Grassy Mountain Coal Project (the Project) in the Regional Study Area (RSA). While the human health risk assessment is focused on potential effects to individuals, the WRA is aimed at assessing population-level effects that could lead to a decline or change in the abundance or distribution of a population over time. The focus of the screening-level WRA is to examine long-term chronic health risks to wildlife, aiming to assess population-level effects over time.

Potential risks to wildlife associated with chemicals of potential concern (COPC) that may be emitted from the Project into the air, combined with existing or approved developments, and potentially deposited onto soil and surface water within the RSA were evaluated. The screening-level WRA used modelled air concentration data from the Air Quality Assessment (Consultant Report #1a) to evaluate long-term (chronic) and select short-term (acute) health risks to wildlife from exposure to air through inhalation. The multimedia model used for the HHRA (Consultants Report #12, Section 5.2.2 and Appendix E) was used to evaluate exposure from soil and surface water through ingestion. To assess potential risks to terrestrial wildlife, predicted air concentrations were compared with inhalation toxicity reference values (TRVs) protective of wildlife, predicted soil concentrations were compared to soil quality guidelines (protective of wildlife), and surface water concentrations were compared to surface water quality guidelines (protective aquatic life receptors and of wildlife).

The general assessment approach was the same as for the HHRA, including evaluation of the baseline, and application cases. Further details on the scope of the assessment including the project specific Provincial and Federal terms of reference (TOR); temporal and spatial assumptions; boundaries of the RSA and Local Study Area (LSA); and, predicted soil concentration methodology can be found in the HHRA (Consultant Report 12, Section 2.0). The methods and assumptions applied in the air dispersion modelling can be found in the Air Quality Assessment (Consultant Report #1, Section 2.5). The risk assessment methodology (problem formulation, hazard and exposure assessment, and risk characterization) was also the same as the HHRA (Consultant Report 12, Section 5.0), with exceptions as described below.

1.1 Methods

This screening-level WRA was conducted according to the principles and guidance presented in *Ecological Risk Assessment Guidance* (Environment Canada, 2012) and a *Framework for Ecological Risk Assessment* (CCME, 1996). As outlined in this guidance, a screening-level risk assessment is the initial tier in an ecological assessment and as such employs conservative assumptions regarding chemical exposure and toxicity to receptors. The steps of a screening-level assessment follow the traditional risk assessment framework that includes problem formulation, exposure assessment, toxicity assessment, and risk characterization. Each of these steps is further defined in the HHRA (Consultant Report 12, Section 5.0).

The Canadian Environmental Assessment Agency's *Guidelines for the Preparation of an Environmental Impact Statement* and the Alberta Energy Regulator's *Terms of Reference of Environmental Impact Assessment* prepared for the Grassy Mountain Coal Project guided the scope, requirements and principles adhered to in this screening-level WRA. For the purposes of this assessment health of the wildlife population in the RSA was identified as the valued component (VC).

In order to quantify or measure potential effects to wildlife populations a measurement metric is required. For air, a hazard quotient (HQ), the ratio between the predicted COPC concentrations in air and inhalation TRVs was calculated. An HQ less than 1.0 indicates no adverse effects are predicted for any receptors. Due to the number of conservative assumptions purposefully built into risk assessment methodology, an HQ greater than 1.0 does not automatically indicate a potential risk of adverse health effects. Instead, it is an indication that additional, in-depth assessment is required for the individual risk result. The additional assessment includes a review of the conservative assumptions made in the toxicity and exposure assessment steps in order to determine whether the result represents a potential risk of adverse health effects, or is a result of the conservative assumptions made during the calculations.

For soil, predicted COPC concentrations in soil from air deposition were compared to the corresponding soil quality guidelines for wildlife. For surface water, predicted COPC concentrations in surface water from air deposition were compared to the corresponding surface water quality guidelines for the protection of freshwater aquatic life (FAL) and wildlife watering. If the predicted air, soil and surface water concentrations are less than their respective inhalation TRV, soil quality guideline or surface water quality guideline, no impacts are predicted for wildlife.

2.0 PROBLEM FORMULATION

The purpose of the problem formulation is to focus the risk assessment and identify the COPC, wildlife receptors, and exposure pathways that will be considered.

2.1 Chemicals of Potential Concern

The COPC included in the screening-level WRA (Table H.1) are the same as those identified for the HHRA; any emissions which could potentially result in changes to environmental quality were considered as potential COPC. The methods applied for COPC screening are provided in the HHRA (Consultant Report 12, Section 5.1.1).

Table H.1 Chemicals of Potential Concern (COPCs) Emitted to Air

Chemical Group	Chemicals
Criteria Air Contaminants	Carbon Monoxide (CO) Nitrogen Dioxide (NO_2) Sulphur Dioxide (SO_2) Particulate Matter <2.5 µm ($PM_{2.5}$)
Metals	Aluminum Antimony Arsenic Barium Beryllium Cadmium Chromium II, III Chromium VI Cobalt Copper Lead Manganese Mercury Molybdenum Nickel Selenium Thallium Uranium Vanadium Zinc
Polycyclic Aromatic Hydrocarbons (PAH)	Acenaphthene Acenaphthylene Anthracene Benz[a]anthracene Benzo(a)pyrene

Table H.1 Chemicals of Potential Concern (COPCs) Emitted to Air	
Chemical Group	**Chemicals**
	Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Chrysene Dibenzo(a,h)anthracene Fluoranthene Fluorene Indeno(1,2,3-cd)pyrene Naphthalene Phenanthrene Pyrene
Volatile Organic Compounds (VOCs)	Benzene Toluene Xylenes Propylene Formaldehyde Acetaldehyde Acrolein

Of the chemicals listed in Table H.1, those that could potentially be deposited and accumulate in soils and surface water were determined through an evaluation of their physical-chemical properties. As outlined in the HHRA (Consultant Report 12, Section 5.1.1), those COPCs with low volatility indicating a potential to deposit and those which could potentially accumulate in plant or animal tissue over time were identified for assessment of the potential risks to wildlife associated with non-inhalation pathways. Results of this screening are presented below in Table H.2.

Table H.2 Chemicals of Potential Concern Included in the Soil and Surface Water Assessment	
Chemical Group	**Chemicals**
Metals	Aluminum Antimony Arsenic Barium Beryllium

Table H.2 Chemicals of Potential Concern Included in the Soil and Surface Water Assessment

Chemical Group	Chemicals
	Cadmium Chromium (II, III and VI) Cobalt Copper Lead Manganese Mercury Molybdenum Nickel Selenium Thallium Uranium Vanadium Zinc
Polycyclic Aromatic Hydrocarbons (PAH)	Acenaphthene Acenaphthylene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Chrysene Dibenzo(a,h)anthracene Fluoranthene Fluorene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene
Volatile Organic Compounds (VOC)	Formaldehyde

The fate of project related PAHs that could potentially be released to air is dependent on their physical-chemical properties. Low-volatile PAHs with more than five rings, characterized by having a low vapour pressure are found adsorbed onto airborne particulates after emission (Wania and Mackay, 1996). The settling of PAHs associated with particulates is subject to the weight and physical

parameters of the carrier particle (Maliszewska-Kordybach, 1999). Details of the deposition and accumulation of COPC in soil and surface water are provided in Appendix E.

2.2 Wildlife Receptors

Potential wildlife receptors include any species potentially present within the RSA, including resident and migratory populations. Potential risks to wildlife were not assessed for individual species. To assess risk predicted air concentrations of COPC were compared to wildlife toxicity data and predicted soil and surface water concentrations were compared against established soil and surface water quality guidelines protective of wildlife.

Since none of the identified COPCs are expected to biomagnify up the food chain and in most cases they are metabolized in higher organisms; exposures are expected to be highest for primary consumers (CCME, 2010; US EPA, 1999).

Receptors relevant to the study area are summarised in the Baseline Wildlife Survey (Consultant Report #9). A list of at risk wildlife including sensitive, special concern, and threatened or endangered species were reviewed (Consultant Report #9, Table 2.4-2) to ensure these receptors were sufficiently considered in the screening-level WRA.

2.3 Exposure Pathways

Exposure pathways are evaluated to identify potential routes by which wildlife could be exposed to COPC from the Project and the significance of these pathways to exposure. Potential risk can only exist when sufficient quantities of a contaminant reach a receptor via inhalation, ingestion or dermal exposure.

Project COPC will be emitted to air and direct inhalation of air is expected to be the primary exposure pathway. Maximum predicted air concentrations were used for assessing acute and chronic inhalation exposures for wildlife.

Secondary exposure via ingestion of soil, surface water, or local food sources that have accumulated COPC through deposition or uptake is also a potential exposure pathway. Soil concentrations were compared to available AEP (2016) Tier 1 surface soil guidelines protective of the wildlife soil and food ingestion pathway, and the US EPA (2010) ecological soil screening levels protective of avian and mammalian wildlife. In addition, secondary exposure via ingestion of surface water was also evaluated. Surface water concentrations were compared to the available Tier 1 surface water quality guidelines (ESRD 2014, AEP 2016). Applicable exposure pathways are summarized below in Table H.3.

Table H.3 Exposure Pathways

Exposure Pathway	Evaluated	Rationale
Inhalation	Yes	Wildlife may inhale chemicals emitted to air from Project operations.
Ingestion of surface water	Yes	This project is not expected to directly impact water quality (Consultant Report 5: Surface Water Quality and Consultant Report 6: Aquatic Assessments) but deposition was considered in the multimedia model. Surface water ingestion is considered to be the primary route of exposure for wildlife and dermal contact is adequately protected by meeting surface water quality guidelines for the protection of wildlife watering.
Dermal contact with surface water	Yes	
Dermal contact with soil	No	Dermal contact for wildlife is typically not quantitatively assessed due to the presence of hair and feathers on mammals and birds which prevent significant dermal exposure to soil; typically dermal exposure is expected to be <5% of total exposure (CCME, 2006).
Ingestion of soil	Yes	Airborne emissions from the Project may deposit onto soils. Wildlife ingest small amounts of soil during foraging preening and grooming.
Ingestion of plants	Yes	Airborne emissions from the Project may deposit onto plant surfaces and soils. Chemicals may be taken up by plants and become food sources for wildlife.
Ingestion of fish	No	No impacts on surface water are predicted (Consultant Report #6, Aquatic Assessment); comparison of predicted deposition of COPC onto surface water indicate estimated surface water concentrations are below guidelines protective of FAL.
Ingestion of prey	No	Identified COPCs are not expected to biomagnify up the food chain and in most cases they are metabolized in higher organisms; for COPC that do biomagnify this pathway is considered as part of the soil quality guideline however (CCME, 2006).

2.4 Conceptual Site Model

A tabular presentation of the source, exposure media, potential exposure pathways and example wildlife receptors is presented in Table H.4. As noted above, a COPC can only pose a potential health risk if it can reach a receptor through an exposure pathway at a concentration causing an adverse effect.

Table H.4 Conceptual Site Model for Wildlife

Source	Exposure Media	Potential Exposure Pathways	Example Wildlife Receptor	
			Avian	Mammalian
Air Emissions	Air	Inhalation	X	X
	Soil	Ingestion	X	X
	Surface Water	Ingestion	X	X
Source → **Receptor**				

3.0 EXPOSURE ASSESSMENT

The exposure assessment involves the estimation of the amount of each COPC that wildlife could potentially be exposed to, based on reasonable worst-case assumptions. Exposure *via* acute and chronic inhalation of airborne COPC was determined from predicted air quality concentrations for the exposure averaging period specific to acute or chronic exposure. Results of the air dispersion modelling are provided in the HHRA (Consultant Report #12 – Appendix C Acute Inhalation Results and Consultant Report #12 - Appendix E Chronic Inhalation Results); methods of the air dispersion modelling are provided in the Air Quality Assessment (Consultant Report #1, Section 5). Maximum predicted 1-hour, 24-hour and annual average concentrations of COPC were used in the acute and chronic inhalation assessment. For purposes of estimating exposure, it was assumed that wildlife would be continuously exposed for the averaging periods being evaluated.

Chronic exposure *via* inhalation to all COPC was considered. Exposures to criteria air contaminants (SO_2, NO_2, and $PM_{2.5}$) were identified to be driving the results of the HHRA; to ensure exposure to these contaminants were adequately assessed for wildlife both acute and inhalation exposure was considered, with the exception of CO for which chronic exposure is not considered. Acute exposure to other COPC was not evaluated. The air concentrations applied in the screening-level WRA were conservatively assumed to be the worst-case values predicted to occur at the RSA-maximum point of impingement (RSA-MPOI). As discussed above, the focus of this assessment was aimed at population effects over time for which chronic exposure is a more appropriate measure.

The concentrations of COPC in soil were measured in soil for the Baseline Case and predicted for the Application Case scenarios. The soil concentrations were predicted using multimedia modelling that estimated the movement of the COPC emitted by the Project and deposition onto soil. The concentrations of COPC in surface water were measured in water for the Baseline Case and predicted for the Application Case scenarios. The surface water concentrations were predicted using multimedia modelling that estimated the movement of the COPC emitted by the Project and deposition onto surface water. The model takes into account the physical/chemical properties of the COPC as well as the physical environment where deposition occurs. The predicted soil and surface water concentrations were calculated using the air concentrations predicted for the RSA-MPOI location.

Details of the multimedia model methods, assumptions and a worked example are provided in Appendix E.

4.0 TOXICITY ASSESSMENT

The toxicity assessment involves establishing exposure limits (TRVs) protective of wildlife receptors that would not have effects at the population level. TRVs are chemical-specific estimates of an exposure level that is not likely to cause unacceptable adverse effects on growth, reproduction or survival of wildlife receptors.

Information on the wildlife inhalation toxicity of the COPC was obtained from the scientific literature related to the exposure of laboratory test animals such as mice, rats and guinea pigs. Virtually no controlled studies have been identified where wildlife species were exposed to the COPC. This therefore requires that health effects be extrapolated from laboratory animals to the wildlife species being assessed. Uncertainty factors (UF) are applied to account for possible differences in physiology and sensitivity between species.

For the screen assessment, oral TRVs were not established for wildlife. To assess this exposure pathway, the predicted soil and surface water concentrations were conservatively compared to direct soil and surface water guidelines protective of wildlife species. The AEP (2016) wildlife soil and food ingestion guidelines and US EPA Ecological Soil Screening levels (Eco-SSL) (US EPA 2010) designed to be protective of ecological receptors that come in contact with and consume biota growing in the soil. The surface water guidelines are protective of fresh water aquatic life and other wildlife receptors.

4.1 Acute Toxicity Reference Values

Inhalation TRVs were established for short-term or acute exposure for criteria air contaminants (CAC) only. Acute exposures generally extend over a period ranging from hours to less than 30 days. Acute

toxicity information is often limited to lethal concentration values (LC_{50}) for most COPC, which is the concentration lethal to 50% of the test animals. The lowest value reported for all species was used to derive the acute TRV, and therefore no uncertainty factors were applied to account for differences between species. Consistent with CCME (2006) a UF of 10 was applied for using LC_{50} data instead of either a lowest observable adverse effect level (LOAEL) or no observable adverse effect level (NOAEL). An additional UF of 10 was applied to account for the limited amount of available literature.

One acute TRV was established for all mammalian wildlife receptors, based on mammalian laboratory animals; the same was done for avian receptors. The literature review for acute TRVs consisted of a search of the following:

- Agency for Toxic Substances and Disease Registry (ATSDR);
- International Programme on Chemical Safety (IPSCS);
- National Toxicity Program Chemical Repository (NTP);
- US National Library of Medicine's Hazardous Substances Databank (HSDB) and ChemIDplus.

Table H.5 provides the acute inhalation TRVs established for each of the COPC; where no data was available the COPC are marked ND (no data).

Table H.5 Acute Inhalation Wildlife TRVs – Criteria Air Contaminants

COPC	Receptor Group	Averaging Period	TRV (mg/m^3)	Endpoint	Rationale	Reference
Carbon Monoxide	Avian	1 hour	15.5	Mortality	An LC50 of 1,334 ppm (1,550 mg/m^3) was identified in wild birds. A UF of 100 was applied for use of an LC value (10) and the application of a single study (10).	ChemID Plus, 2012
	Mammal	1 hour	20.78	Mortality	An LC50 of 2,078 mg/m^3 was identified in rats exposed via inhalation to carbon monoxide for four hours. A UF of 100 was applied for use of an LC value (10) and the application of a single study (10).	Ramamoorthy *et al.*, 1995
Nitrogen Dioxide	Avian	ND	ND	ND	ND	ND
	Mammal	1 hour	0.56	Mortality	An LC50 of 56 mg/m^3 was identified in guinea pigs exposed via inhalation to nitrogen dioxide for 1 hour. A UF of 100 was applied for use of an LC value (10) and the application of a single study (10).	HSBD, 2012

Table H.5 Acute Inhalation Wildlife TRVs – Criteria Air Contaminants

COPC	Receptor Group	Averaging Period	TRV (mg/m^3)	Endpoint	Rationale	Reference
Sulphur Dioxide	Avian	1 hour	26	Mortality	An LC20 of 1,000 ppm (2,600 mg/m^3) was identified in white leghorn poultry continuously exposed to sulphur dioxide vapours of 0 to 5,000 ppm for 1 hour. A UF of 100 was applied for use of an LC value (10) and the application of a single study (10).	Fedde and Kuhlman, 1979
	Mammal	1 hour	26	Mortality	An LC50 of 2,600 mg/m^3 was obtained for mice exposed to sulphur dioxide for 4 hours via inhalation. A UF of 100 was applied for use of an LC value (10) and the application of a single study (10).	HSBD, 2012
Particulate Matter <2.5 μm	Mammal	24 hour	30 $\mu g/m^3$	Mortality and morbidity	This TRV is based on the 3 year average of the annual 98th percentile of the 24-hour average concentration. Developed for humans this value is based on the epidemiological association between acute exposure to ambient fine particulates and increase population mortality and morbidity.	CCME, 2000; 2012

No wildlife toxicity information was available for $PM_{2.5.}$ A substantial portion of the predicted air concentration for $PM_{2.5}$ is predicted to be associated with Project activity. Due to the wildlife data limitations a human inhalation TRV was conservatively applied for both the acute and chronic assessments. These values were established to be protective of adverse human health effects, and believed to be a highly conservative application to wildlife.

4.2 Chronic Toxicity Reference Values

Inhalation TRVs were identified for long-term or chronic exposure for all COPC where data permits. Chronic exposures occur continuously over extended periods longer than 30 days, ideally throughout an animal's lifetime. Chronic TRVs were established using guidance described by the British Columbia Ministry of Water, Land and Air Protection (BC MWLAP, 1998). Based on this guidance, the goal of a screening-level WRA is to protect enough individuals so that a viable population and community of organisms can be maintained. Consideration of endpoints that have an effect on a species' population including reproduction, development and survivorship were considered in establishing chronic TRVs; development and growth endpoints were considered acceptable if these were the only endpoints available.

Chronic TRVs were established for all COPC from available toxicological data based on ecological population-level endpoints. The lowest reported NOAEL value for all species associated with population-level effects was selected. Preference was given to an available NOAEL to reduce the likelihood of underestimating potential risk to sensitive wildlife species, however, in the absence of an available value the lowest LOAEL was used as the TRV applying an uncertainty factor to account for the use of a LOAEL. The literature review for chronic TRVs consisted of a search of the following:

- ATSDR;
- Government of California, Office of Environmental Health Hazard Assessment (OEHHA);
- Health Canada and Environment Canada (Government of Canada);
- International programme on chemical safety (IPSCS);
- Massachusetts Government Department of Environmental Protection;
- National Toxicity Program Chemical Repository (NTP);
- Netherlands' National Institute of Public Health and Environment (RIVM);
- US National Library of Medicine's Hazardous Substances Databank (HSDB) and ChemIDplus;
- World Health Organization (WHO); and
- United States Environmental Protection Agency (US EPA).

No inhalation toxicity values are available for propylene, beryllium, lead, molybdenum, selenium, thallium, zinc, and the aromatic non-volatile polycyclic aromatic hydrocarbon (PAH) group (C17-C34) which includes benz(a)anthracene, benzo(a)pyrene, benzo(b) fluoranthene, benzo(g,h,i)perylene, benzo(k)lfuoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

The CCME (2010) conducted a detailed literature review of available mammalian and wildlife studies of non-carcinogenic endpoints and reported limited mammalian data for non-carcinogenic end-points is limited and no chronic data for the evaluation of avian species. Predominantly the available data describes studies of laboratory mammals for human health investigations of carcinogenic endpoints (CCME 2010).

For the purposes of the current assessment, oral toxicity values provided as daily threshold effect doses (DTEDs) for PAHs were obtained from CCME (2010) and then converted to an inhalation based TRVs using the formula below.

$TRV_i = TRV_o(BW)/I_a$

Where:

TRV_o = toxicity reference value – oral exposure
BW = body weight (kg live weight)
I_a = inhalation rate (m^3 air/d),
TRV_i = toxicity reference value – inhalation exposure

CCME (2010) TRVs were not available for benzo(g,h,i)perylene, dibenz(a,h)anthracene, or indeno(1,2,3-cd)pyrene, and for those compounds the 10th percentile NOAEL for aromatics toxicity data, for a mouse, of 0.6 mg/kg day, was applied. The aromatics TRV is a conservative value that is considerably lower than the DTED values provided for the various other PAHs (CCME 2010).

As reliable inhalation rates for wildlife are not readily available, allometric equations, based on body mass, were used to estimate inhalation rates of resting mammals (Stahl 1967).

$I_a = (0.54576(BW)^{0.8})$

Where:

I_a = inhalation rate (m^3 air/d)
BW = body weight (kg live weight)

A table summarizing the calculated inhalation rates for various identified wildlife receptors is included in Table H-6. As the calculated inhalation rates are based on body weight, the smallest identified species of concern, the Little Brown Bat, was used to derive inhalation based TRVs that would be protective of wildlife species in the Study Area. An avian receptor was not included in this assessment as the basis of the oral TRVs were mammalian.

Table H.6 Calculated Wildlife Inhalation Rates

Species	Body weight (kg)[a]	Calculated Inhalation Rate (m^3/d)
Little Brown Bat	0.008	0.011
Hoary Bat	0.026	0.029
Silver-haired Bat	0.010	0.014
Water Vole	0.35	0.24
Red-tailed Chipmunk	0.06	0.058

Table H.6 Calculated Wildlife Inhalation Rates		
Species	**Body weight (kg)[a]**	**Calculated Inhalation Rate (m^3/d)**
American Badger	9	3.2
Bobcat	18.3	5.6
Canada Lynx	17	5.3
Fisher	6	2.3
Wolverine	18	5.5
Grizzly Bear	350	59

a – HWW (2016)

No chronic duration studies were identified for avian receptors. This therefore requires that health effects be extrapolated from mammalian laboratory animals. A UF of 10 was applied to mammalian TRVs in order to account for the possibility of inter-species differences. Table H.7 provides the chronic inhalation TRVs established for each of the COPC; where no data was available the COPC are marked ND (no data).

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
Criteria Air Contaminants					
Nitrogen Dioxide	Mammal/Avian	0.0025	Developmental effects	A NOAEL of 0.1 mg/m^3 was obtained from rats exposed to 0, 0.05, 0.1, 1 or 10 mg/m^3 for 6 hours/day, 7 days/week through gestation until 2 months old.	Tabacova *et al.*, 1985
	Human	40[5]	Respiratory effects in humans	See Appendix B	WHO 2005; 2000.
Sulphur Dioxide	Mammal/Avian	0.26	Respiratory effects	This TRV was identified in guinea pigs exposed continuously to a sulphur dioxide concentrations of 0.34, 2.6 or 15 mg/m^3 for 52 weeks.	HSBD, 2012
Particulate Matter <2.5 µm	Human/ Mammal/Avian	10	Premature mortality	This TRV is the annual average standard set by CCME, developed for humans, and based on various epidemiological studies.	CCME, 2012
Polycyclic Aromatic Hydrocarbons					
Acenaphthene[2]	Mammal/Avian	12.3	Developmental and reproductive effects	A NOAEL of 100 ppm (491 mg/m^3) was identified in pregnant mice exposed to 0, 100, 500, or 1,500 ppm high flash aromatic naptha for 6 hours/day on gestation day 6 -15. This value was adjusted for continuous exposure.	MA DEP, 2003
Acenaphthylene[2]					
Anthracene[2]					

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
Benzo(a)anthracene[3]	Mammal/Avian	1.4	Immune	Oral toxicity value converted to an inhalation TRV.	CCME, 2010
Benzo(a)pyrene[3]	Mammal/Avian	0.14	Reproduction		CCME, 2010
Benzo(b)fluoranthene[3]	Mammal/Avian	1.4	Immune		CCME, 2010
Benzo(g,h,i)perylene[3,4]	Mammal/Avian	0.042	Reproduction		CCME, 2010
Benzo(k)fluoranthene[3]	Mammal/Avian	1.4	Immune		CCME, 2010
Chrysene[3]	Mammal/Avian	1.4	Immune		CCME, 2010
Dibenzo(a,h)anthracene[3,4]	Mammal/Avian	0.042	Reproduction		CCME, 2010
Fluoranthene[2]	Mammal/Avian	12.3	Developmental and reproductive effects	A NOAEL of 100 ppm ($491 mg/m^3$) was identified in pregnant mice exposed to 0, 100, 500, or 1,500 ppm high flash aromatic naptha for 6 hours/day on gestation day 6 -15. This value was adjusted for continuous.	MA DEP, 2003
Fluorene[2]					
Indeno(1,2,3-cd)pyrene[3,4]	Mammal/Avian	0.042	Reproduction	Oral toxicity value converted to an inhalation TRV.	CCME, 2010
Phenanthrene[2]	Mammal/Avian	12.3	Developmental and reproductive effects	A NOAEL of 100 ppm ($491 mg/m^3$) was identified in pregnant mice exposed to 0, 100, 500, or 1,500 ppm high flash aromatic naptha for 6 hours/day on gestation day 6 -15. This value was adjusted for continuous exposure.	MA DEP, 2003
Pyrene[2]					

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
Volatile Organic Compounds					
Benzene	Mammal/Avian	1.5	Developmental effects	A LOAEL of 47 ppm (150 mg/m^3) was obtained by exposing rats to 0, 47, 141, 470 or 939 ppm benzene on gestation days 7 - 14 for 24hours/day. The TRV applied an uncertainty factor of 10 for the use of a LOAEL.	Government of Canada, 1993
Toluene	Mammal/Avian	0.73	Reproductive effects	A LOAEL of 100 ppm (375 mg/m^3) in mice was obtained after exposure to toluene via inhalation for 6.5 hours/day, 5 day/week for 14 weeks. The LOAEL was adjusted for continuous exposure. An uncertainty factor of 10 was applied to account for the use of a LOAEL.	ATSDR, 2000; Government of Canada, 1992
Xylenes	Mammal/Avian	1.5	Developmental effects	A LOAEL of 150 mg/m^3 in rats exposed to xylenes for gestation days 7 through 14 was obtained. An uncertainty factor of 10 was applied for the use of a LOAEL.	ATSDR, 2007b
Acetaldehyde	Mammal/Avian	1.3	Growth effects	Rats were exposed to 400, 1000, 2200 or 5000 ppm acetaldehyde for 6 hours/day, 5 days/week for 4 weeks. A NOAEL of 400 ppm (720 mg/m^3) was obtained and adjusted for continuous exposure. An uncertainty factor of 10 was applied for the use of a subchronic.	Government of Canada, 2000
Acrolein	Mammal/Avian	0.016	Growth effects	Rats were exposed to 0, 0.4, 1.4, or 4.9 ppm acrolein for 6 hours/day, 5 days/week for 13 weeks. A NOAEL of 0.4 ppm (0.9 mg/m^3) was identified and adjusted for continuous exposure.	US EPA, 2003

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
Formaldehyde	Mammal/Avian	0.045	Reproductive survival and growth effects	A NOAEL of 2 ppm (2.5 mg/m^3) was identified in rats exposed to 0, 2, 5.6, or 14.3 ppm formaldehyde for 6 hours/day, 5 days/week for 24 months. This value was adjusted for continuous exposure.	ATSDR, 1999a; ATSDR 2010
Propylene	Mammal/Avian	ND	ND	ND	ND
Metals					
Aluminum	Mammal/Avian	0.011	Growth	A NOAEL of 0.65 mg/m^3 was identified in F344 rats exposed for 6 hours/day, 5 days/week for 12 to 24 months. This value was adjusted for continuous.	ATSDR, 2008a
Antimony	Mammal/Avian	0.36	Mortality	A NOAEL of 17.5 mg/m^3 was identified in rats exposed for 7 hours/day, 5 days/week for 52 weeks. This value was adjusted for continuous.	ATSDR, 1992
Arsenic	Mammal/Avian	0.2	Developmental effects	A NOAEL of 8 mg/m^3 was identified in rats exposed to 0.2 mg/m^3 (arsenic trioxide) for 6 hours/day from 14 days prior to mating through gestation day 19. This value was adjusted for continuous.	ATSDR, 2007a
Barium	Mammal/Avian	0.011	Growth effects	A NOAEL of 0.8 mg/m^3 was identified in rats exposed to 0.8 or 3.6 mg/m^3 barium (as barium carbonate dust) for 4 hours/day, 6 days/week for 4 months. The NOAEL was adjusted to continuous exposure.	WHO 2001a; RIVM 2001; US EPA 1998
Beryllium	Mammal/Avian	ND	ND	ND	ND
Cadmium	Mammal/Avian	0.00003	Developmental effects	A LOAEL of 0.02 mg/m^3 was identified in rats	ATSDR,

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
				exposed to cadmium (as cadmium oxide) for 5 hours/day, 5 days/week for 5 months prior to mating, during mating and the first 20 days of gestation. The LOAEL was adjusted to continuous exposure. An uncertainty factor of 10 was applied for use of a LOAEL.	2012a
Chromium (total)	Mammal/Avian	0.0092	Reproductive and growth effects	A NOAEL of 0.1 mg/mg^3 was identified in rats exposed to a 3:2 mixture of chromium (VI) trioxide and chromium (III) oxide for 22 hours/day, 7 days/week for 18 months. This value was adjusted for continuous.	ATSDR, 2012b
Chromium (VI)	Mammal/Avian	0.009	Growth	A NOAEL of 0.1 mg/m^3 was identified for male Wistar rats exposed to hexavalent chromium for 22 hours/day, 7 days/week for 18 months. This value was adjusted for continuous.	ATSDR, 2012b
Cobalt	Mammal/Avian	0.0002	Reproductive effects	A LOAEL of 1.14 mg/m^3 exposed to 0, 1.14, 3.8, or 11.38 mg/m^3 cobalt sulphate heptahydrate for 6 hours/day, 5 days/week, for 13 weeks. This value was adjusted for continuous exposure.	ATSDR, 2004
Copper	Mammal/Avian	0.025	Respiratory	A LOAEL of 2.5 mg/m^3 was identified in rats exposed to 2.5 or 19.6 mg/m^3 copper (as copper chloride) for 4 months. An uncertainty factor of 10 was applied to account for use of a LOAEL.	WHO 1998
Lead	Mammal/Avian	ND	ND	ND	ND
Manganese	Mammal/Avian	0.005	Developmental effects	A LOAEL of 0.05 mg/m^3 was identified in the offspring of rats exposed to 0, 0.05, 0.5 or 1	ATSDR,

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
				mg/m^3 manganese sulphate for 6 hours/day, 7 days/week, from breeding up to post-natal day 18. No adjustment for continuous exposure was made due to the nature of the critical endpoint.	2012c
Mercury	Mammal/Avian	0.005	Developmental effects	A LOAEL of 0.05 mg/m^3 was identified in offspring of Sprague Dawley rats exposed to inorganic mercury for 1 to 4 hours/day, 7 days/week during post-partum days 11 to 17. No adjustment for continuous exposure was made due to the nature of the critical endpoint.	ATSDR, 1999b; ATSDR 2013a
Molybdenum	Mammal/Avian	ND	ND	ND	ND
Nickel	Mammal/Avian	0.002	Growth effects	A NOAEL of 0.11 mg/m^3 was identified in rats exposed to 0, 0.11, or 0.73 mg/m^3 nickel subsulphide for 6 hours/day, 5 days/week for 104 weeks. This value was adjusted for continuous exposure.	ATSDR, 2005
Selenium	Mammal/Avian	ND	ND	ND	ND
Thallium	Mammal/Avian	ND	ND	ND	ND
Uranium	Mammal/Avian	0.05	Mortality (4.5%)	A LOAEL of 5 mg/m^3 was identified in dogs exposed to uranium dioxide for 5.4 hour/day, 5 days/week for 5 yr. An uncertainty factor of 10 was applied for use of a LOAEL.	ATSDR, 2013b

Table H.7 Chronic Inhalation Wildlife TRVs

COPC	Receptor Group	TRV (mg/m^3)	Endpoint	Rationale[1]	Reference
Vanadium	Mammal/Avian	0.00089	Respiratory	A NOAEL of 0.5 mg/m^3 was identified in rats and mice exposed to vanadium pentoxide for 6 hours/day, 5 days/week for 13 weeks. The NOAEL was adjusted to continuous exposure. An uncertainty factor of 10 was applied to account for subchronic.	ATSDR, 2012d
Zinc	Mammal/Avian	ND	ND	ND	ND

1 - no avian data was available; an uncertainty factor of 10 was applied the mammalian TRV to account for inter species differences and protection of avian receptors.

2 - toxicology on compounds within the C9-C16 carbon range were assessed as a group

3 – non-carcinogenic TRVs for these PAHs were only available for oral exposure for mammalian specifies. Oral toxicity values for PAHs CCME (2010) were applied and then converted to inhalation based TRVs using the following formula: $TRV_o(BW)/I_a = TRV_i$ where; TRV_o = oral exposure TRV, BW = body weight (kg), Ia = inhalation rate (m^3 air/d) and TRV_i = inhalation TRV

4 – oral TRV based on the work of Foster Wheeler (1997) as referenced in CCME (2010).

5 – The estimated TRV was much lower than the human TRV and below what the WHO considers as background ambient levels (15 µg/m3) (WHO 1997); this value was considered to be too conservative as the vales use in HHRA for protection of individual human health human was much higher. Thus, the human TRV was conservatively applied in the wildlife risk assessment.

ND - no data

4.3 Soil Quality Guidelines

The AEP *Tier 1 Soil Quality Guidelines* were developed to be protective of wildlife soil and food ingestion for the most stringent land use (*i.e.* agricultural or natural land use) (AEP, 2016). The Alberta soil quality guidelines were consistent with CCME (2006) protocols and were calculated using the same models.

The US EPA Eco-SSLs refer to the concentration in soil that is considered protective of wildlife receptors that come in contact with, and consume biota living in or on soil (US EPA, 2010). Eco-SSL values are currently available for metals and organics. Eco-SSL values for mammalian wildlife were derived for high molecular weight PAHs (1.1 mg/kg) and low molecular weight PAHs (100 mg/kg); Eco-SSL values for PAHs in this assessment were assigned by their molecular weight. Table H.8 summarizes the soil quality guidelines available from the AEP and US EPA and the respective test organisms.

Where a soil quality guideline value was unavailable, a search of regulatory agencies was conducted to identify an appropriate soil quality guideline; soil quality guidelines from other sources. Preference was given to guidelines from Canadian regulatory agencies and guidelines that specified mammal or applicable wildlife receptors.

Table H.8 Soil Quality Guidelines Protective of Wildlife (mg/kg)

COPC	AEP SQG[1]	US EPA Eco-SSL[2]				Other
	Wildlife	Avian	Avian Test Organism	Mammal	Mammal Test Organism	
Polycyclic Aromatic Compounds						
Acenapthene	21.5	ND	ND	100	Ground insectivore, shrew	-
Acenaphthylene	ND	ND	ND	100	Ground insectivore, shrew	-
Anthracene	61.5	ND	ND	100	Ground insectivore, shrew	-
Benz(a)anthracene	6.2	ND	ND	100	Ground insectivore, shrew	-

Table H.8 Soil Quality Guidelines Protective of Wildlife (mg/kg)

COPC	AEP SQG[1]	US EPA Eco-SSL[2]				Other
	Wildlife	Avian	Avian Test Organism	Mammal	Mammal Test Organism	
Benzo(a)pyrene	0.6	ND	ND	1.1	Ground insectivore, shrew	-
Benzo(b)fluoranthene	6.2	ND	ND	1.1	Ground insectivore, shrew	-
Benzo(g,h,i)perylene	ND	ND	ND	1.1	Ground insectivore, shrew	-
Benzo(k)fluoranthene	6.2	ND	ND	1.1	Ground insectivore, shrew	-
Chrysene	6.2	ND	ND	100	Ground insectivore, shrew	-
Dibenz(a,h)anthracene	ND	ND	ND	1.1	Ground insectivore, shrew	-
Fluoranthene	15.4	ND	ND	100	Ground insectivore, shrew	-
Fluorene	15.4	ND	ND	100	Ground insectivore, shrew	-
Indeno(1,2,3-cd)pyrene	ND	ND	ND	1.1	Ground insectivore, shrew	-
Phenanthrene	43	ND	ND	100	Ground insectivore, shrew	-
Pyrene	7.7	ND	ND	100	Ground insectivore, shrew	-

Table H.8 Soil Quality Guidelines Protective of Wildlife (mg/kg)

COPC	AEP SQG[1]	US EPA Eco-SSL[2]				Other
	Wildlife	Avian	Avian Test Organism	Mammal	Mammal Test Organism	
Volatile Organic Compounds						
Formaldehyde	ND	ND	ND	ND	ND	ND
Metals						
Aluminum[3]	ND	ND	ND	ND	ND	50
Antimony	ND	ND	ND	0.27	Ground insectivore, shrew	-
Arsenic	ND	43	Ground insectivore, woodcock	46	Ground insectivore, shrew	-
Barium	10,000	ND	ND	2,000	Ground insectivore, shrew	-
Beryllium	ND	ND	ND	21	Herbivore, vole	-
Cadmium	3.8	0.77	Ground insectivore, woodcock	0.36	Ground insectivore, shrew	-
Chromium (total)	ND	26	Ground insectivore, woodcock	34	Ground insectivore, shrew	-
Chromium (VI)	ND	ND	ND	130	Ground insectivore, shrew	-
Cobalt	ND	120	Ground insectivore, woodcock	230	Ground insectivore, shrew	-
Copper	ND	28	Ground insectivore, woodcock	49	Ground insectivore, shrew	-

Table H.8 Soil Quality Guidelines Protective of Wildlife (mg/kg)

COPC	AEP SQG[1]	US EPA Eco-SSL[2]				Other
	Wildlife	Avian	Avian Test Organism	Mammal	Mammal Test Organism	
Lead	ND	11	Ground insectivore, woodcock	56	Ground insectivore, shrew	-
Manganese	ND	4,300	Ground insectivore, woodcock	4,000	Ground insectivore, shrew	-
Mercury[4]	ND	ND	ND	ND	ND	2
Molybdenum[4]	ND	ND	ND	ND	ND	10
Nickel	ND	210	Herbivore, dove	130	Carnivore, weasel	-
Selenium	ND	1.2	Ground insectivore, woodcock	0.63	Ground insectivore, shrew	-
Thallium[5]	ND	ND	ND	ND	ND	56.9
Uranium[6]	ND	ND	ND	ND	ND	5
Vanadium	ND	7.8	Ground insectivore, woodcock	280	Ground insectivore, shrew	-
Zinc	ND	46	Ground insectivore, woodcock	79	Ground insectivore, shrew	-

1 - AEP, 2016

2 - US EPA, 2010

3 - ORNL, 1997; US EPA 2005 - objective protective of phototoxic effects to biota

4 - MDDEP, 2002 objective protective of wildlife, flora and the environment

5 - US EPA, 2003b - objective protective of mammals

6 - ORNL, 1997; US EPA, 2005 - objective protective of phytotoxic effects to biota

ND - no data

4.4 Surface Water Quality Guidelines

The AEP Tier 1 Surface Water Quality Guidelines were developed in keeping with the intent of the *Environmental Protection and Enhancement Act* (EPEA), the *Water Act*, the Framework for Water Management and Planning (including the strategy for the Protection of the Aquatic Environment that it contains), and the Water for Life (WFL) strategy, and the idea that all existing and potential uses of water should be protected (ESRD, 2014).

Predicted concentrations for all COPCs included in the multimedia model were compared to the current Alberta surface water quality guidelines for both FAL and wildlife watering (ESRD, 2014; AEP, 2016). In the absence of an available wildlife watering value the surface water quality guideline for livestock watering (ESRD, 2014) has been provided (Table H.9). In all cases, the FAL guidelines are either equal to or are more conservative than the water quality guidelines for wildlife watering.

Table H.9 Comparison of Maximum Predicted Surface Water Concentrations (mg/L) to Surface Water Quality Guidelines Protective of both Aquatic and Wildlife

COPC	Surface Water Quality Guideline (mg/L)	
	Aquatic Life[a]	Wildlife Water[b]
Acenaphthene	0.0058	NGR
Acenaphthylene	-	-
Aluminium	0.05	5[C]
Anthracene	0.000012	NGR
Antimony	-	-
Arsenic	0.005	0.025[C]
Barium	-	-
Benz(a)anthracene	0.000018	NGR
Benzo(a)pyrene	0.000015	NGR
Benzo(b)fluoranthene	-	-
Benzo(g,h,i)perylene	-	-
Benzo(k)fluoranthene	-	NGR
Beryllium	0.1	0.1[C]
Cadmium	0.00004	0.08[C]
Chromium	0.0089	0.05[C]

Table H.9 Comparison of Maximum Predicted Surface Water Concentrations (mg/L) to Surface Water Quality Guidelines Protective of both Aquatic and Wildlife

COPC	Surface Water Quality Guideline (mg/L)	
	Aquatic Life[a]	Wildlife Water[b]
Chrysene	-	-
Cobalt	0.0025	1[C]
Copper	0.007	0.5[C]
Dibenz(ah)anthracene	-	-
Fluoranthene	0.00004	NGR
Fluorene	0.003	NGR
Formaldehyde	-	-
Indeno(1,2,3-cd)pyrene	-	-
Lead	0.001	0.1[C]
Manganese	0.2	-
Mercury	0.000005	0.003[C]
Molybdenum	0.073	0.5[C]
Nickel	0.004	1[C]
Phenanthrene	0.0004	NGR
Pyrene	0.000025	NGR
Selenium	0.001	0.05[C]
Thallium	0.0008	-
Uranium	0.015	0.2[C]
Vanadium	0.1	0.1[C]
Zinc	0.03	0.05[C]

a – Protection of Freshwater Aquatic Life Guidelines (FAL) obtained from Alberta Environment & Sustainable Resource Development (ESRD) Environmental Quality Guidelines for Alberta Surface Waters (ESRD 2014).

b – Wildlife Watering Guidelines obtained from Alberta Environment & Parks (AEP).Tier 1 Soil and Groundwater Remediation Guidelines – Appendix C Table C-11 (AEP 2016).

c – Livestock Watering Guidelines are presented in absence of an available Wildlife Watering Guideline and were obtained from ESRD (2014).

NGR – no guideline required as the calculated guideline value exceeds aqueous solubility (AEP 2016).

5.0 RISK CHARACTERIZATION

Risk characterization is the final step in the screening level risk assessment that combines the exposure and toxicity assessments to evaluate potential risks to wildlife receptors. Potential risk is estimated through a comparison of the predicted environmental concentrations with the appropriate TRV and/or guideline for each COPC. For the screening-level WRA, the worst-case air concentrations predicted to occur at the RSA-MPOI were assumed.

A risk quotient of less than 1.0 indicates that the predicted exposure is less than the exposure limit and adverse effects are not expected. A risk quotient exceeding 1.0 does not necessarily indicate that an adverse effect will occur, but rather that there is less confidence that adverse effects will not occur based on the screening-level assessment. Several conservative assumptions are purposely built into a screening level risk assessment; when a hazard quotient (HQ) exceeds 1.0 a closer examination of assumptions and input parameters may be undertaken to determine whether a risk of potential adverse health effect exists, or if the predicted exposure is within the conservative margin of safety.

5.1 Inhalation Exposure Assessment

Risk characterization for inhalation exposure involved comparing the maximum predicted COPC concentration in air for each of the assessment cases to the wildlife inhalation TRV using the following equation:

Inhalation Hazard Quotient = Maximum predicted air concentration (mg/m^3) / TRV (mg/m^3)

The HQ values for the baseline and application assessment case for the RSA-MPOI are presented for acute and chronic inhalation in Table H.10 and H.11, respectively.

Table H.10 Maximum Acute Inhalation Hazard Quotients for Wildlife

Parameter	Predicted Risk Quotients			
	RSA-MPOI			
	Baseline (mammals)	Application (mammals)	Baseline (avian)	Application (avian)
Criteria Air Contaminants				
Carbon Monoxide	7.9E-05	6.8E-03	1.1E-02	9.2E-01
Nitrogen Dioxide	1.2E-03	1.3E-02	-	-
Sulphur Dioxide	1.3E-07	2.8E-05	1.3E-05	2.8E-03
Particulate Matter <2.5 µm	5.7E-01	**1.4E+00**	5.7E-01	**1.4E+00**

*MPOI – Maximum Point of Impingement.

Acute inhalation risk estimates, expressed as HQ values, are based on a 1-hour exposure averaging period for all COPC, with the exception of $PM_{2.5}$ that applied an exposure period of 24-hours to correspond with the available TRV. All HQs for mammals and avian receptors were below 1.0 for the Baseline and Application Cases, with the exception of $PM_{2.5}$ in the Application Case, where a HQ of 1.4 was calculated. It is worth noting that that due to data limitations the TRV applied to wildlife for $P.M_{2.5}$ was derived for humans, and is based on human epidemiological studies that take into account sensitive human groups (see Toxicity Assessment, and Tables H.5 and H.7). This TRV was considered a highly conservative value for use in a WRA. In consideration of all conservative assumptions in assessing risk to wildlife, the minimal increase in HQ is not considered to indicate a potential risk of population-level adverse health effects in wildlife due to the predicted Project emissions.

Table H.11 Predicted Chronic Inhalation Hazard Quotients for Wildlife

Parameter	Predicted Risk Quotients	
	RSA-MPOI	
	Baseline (mammals/avian)	Application (mammals/avian)
Criteria Air Contaminants		
Nitrogen Dioxide	5.0E-01	1.4E+00
Sulphur Dioxide	8.1E-05	1.3E-03
Particulate Matter <2.5 µm	3.1E-05	7.8E-04
Polycyclic Aromatic Hydrocarbons		
Acenaphthene	1.8E-08	1.8E-08
Acenaphthylene	3.6E-08	3.6E-08
Anthracene	4.8E-09	4.8E-09
Benz(a)anthracene	2.1E-08	2.1E-08
Benzo(a)pyrene	8.8E-08	8.8E-08
Benzo(b)fluoranthene	3.8E-08	3.8E-08
Benzo(g,h,i)perylene	6.3E-07	6.4E-07
Benzo(k)fluoranthene	7.5E-09	7.5E-09
Chrysene	5.2E-08	5.3E-08
Dibenz(a,h)anthracene	3.9E-07	4.0E-07

Table H.11 Predicted Chronic Inhalation Hazard Quotients for Wildlife

Parameter	Predicted Risk Quotients	
	RSA-MPOI	
	Baseline (mammals/avian)	Application (mammals/avian)
Fluoranthene	1.6E-08	1.6E-08
Fluorene	5.0E-08	5.0E-08
Indeno(1,2,3-cd)pyrene	4.7E-07	4.7E-07
Phenanthrene	1.6E-07	1.6E-07
Pyrene	1.4E-08	1.4E-08
Volatile Organic Compounds		
Benzene	2.5E-05	2.5E-05
Toluene	1.8E-05	1.8E-05
Xylenes	6.2E-06	6.2E-06
Acetaldehyde	9.3E-07	9.3E-07
Acrolein	2.4E-05	2.4E-05
Formaldehyde	8.4E-05	8.4E-05
Propylene	-	-
Metals		
Aluminum	8.7E-05	8.7E-05
Antimony	1.1E-07	3.3E-07
Arsenic	7.5E-06	7.6E-06
Barium	9.6E-04	3.0E-03
Beryllium	-	-
Cadmium	2.9E-03	5.8E-03
Chromium (total)	5.7E-05	9.0E-05
Chromium (VI)[1]	5.8E-05	9.2E-05
Cobalt	1.4E-03	4.5E-03
Copper	7.0E-05	1.4E-04
Lead	-	-

Table H.11 Predicted Chronic Inhalation Hazard Quotients for Wildlife		
Parameter	**Predicted Risk Quotients**	
	RSA-MPOI	
	Baseline (mammals/avian)	**Application (mammals/avian)**
Manganese	3.4E-05	3.4E-05
Mercury	1.1E-06	3.5E-06
Molybdenum	-	-
Nickel	4.9E-04	1.6E-03
Selenium	-	-
Thallium	-	-
Uranium	1.6E-06	5.1E-06
Vanadium	2.2E-03	3.6E-03
Zinc	-	-

"-" No TRV

*MPOI – Maximum Point of Impingement.

Chronic HQs are based on the annual exposure averaging period for all COPC. All chronic HQ values were below 1.0 for the Baseline and Applications Cases, with the exception of nitrogen dioxide (Application HQ = 1.4). Additional evaluation of this input parameter of this COPC results was conducted to determine whether and HQ = 1.4 indicated potential risk of adverse health effects, or is the result of conservative assumptions typical to health risk assessment methodology. The use of a human TRV is considered a conservative value for use in a WRA as it is designed to be protective of individual not a population (see Toxicity Assessment, Table H.7). The RSA-MPOI for NO_2 is predicted to occur on the edge of the pit boundary (Consultants Report #1a, Figure 5.2-4 and 5.4-4); a location unlikely to be frequented on a long term basis due to the Project mining activities. The HQs calculated for other locations within the LSA and RSA were substantially lower than those predicted at the RSA-MPOI (Consultant Report #12, Section 6.2, Tables 6.2-3). Evaluation of all these lines of evidence indicate that the predict HQ of 1.4 for chronic inhalation of NO2 to wildlife not an indication of potential health risk within the LSA or RSA.

5.2 Soil Assessment

A comparison of maximum predicted COPC concentrations in soil to soil quality guidelines is presented in Table H.12. The predicted soil concentrations did not exceed soil quality guidelines for any of the COPC assessed; therefore, it is expected that potential risks to wildlife would be negligible.

Table H.12 Comparison of Maximum Predicted Soil Concentration (mg/kg) to Soil Quality Guidelines Protective of Wildlife.

COPC	Regional Study Area			Soil Quality Guidelines for Wildlife (mg/kg)			
	Application	Baseline	Project	AEP SQG[1]	US EPA Eco-SSL[2]		
				Wildlife	Avian	Mammal	Other
Polycyclic Aromatic Compounds							
Acenapthene	1.18E-10	1.16E-10	7.19E-11	21.5	ND	100	-
Acenaphthylene	3.54E-10	3.47E-10	2.15E-10	ND	ND	100	-
Anthracene	2.00E-05	2.00E-05	6.74E-12	61.5	ND	100	-
Benz(a)anthracene	2.28E-13	2.23E-13	1.39E-13	6.2	ND	100	-
Benzo(a)pyrene	1.82E-13	1.78E-13	1.10E-13	0.6	ND	1.1	-
Benzo(b)fluoranthene	1.41E-13	1.38E-13	8.58E-14	6.2	ND	1.1	-
Benzo(g,h,i)perylene	6.17E-15	6.03E-15	3.75E-15	ND	ND	1.1	-
Benzo(k)fluoranthene	2.15E-14	2.10E-14	1.30E-14	6.2	ND	1.1	-
Chrysene	2.23E-13	2.19E-13	1.36E-13	6.2	ND	100	-
Dibenz(a,h)anthracene	6.07E-14	5.94E-14	3.69E-14	ND	ND	1.1	-
Fluoranthene	3.85E-11	3.76E-11	2.34E-11	15.4	ND	100	-
Fluorene	5.29E-04	5.29E-04	7.01E-11	15.4	ND	100	-
Indeno(1,2,3-cd)pyrene	9.37E-16	9.17E-16	5.69E-16	ND	ND	1.1	-
Phenanthrene	3.55E-10	3.47E-10	2.16E-10	43	ND	100	-
Pyrene	5.46E-04	5.46E-04	8.46E-12	7.7	ND	100	-
Volatile Organic Compounds							
Formaldehyde	9.74E-12	9.52E-12	5.92E-12	ND	ND	ND	ND
Metals							
Aluminum[3]	1.83E+01	1.83E+01	1.83E-09	ND	ND	ND	50
Antimony	2.73E-06	6.25E-07	2.73E-06	ND	ND	0.27	-

Table H.12 Comparison of Maximum Predicted Soil Concentration (mg/kg) to Soil Quality Guidelines Protective of Wildlife.

COPC	Regional Study Area			Soil Quality Guidelines for Wildlife (mg/kg)			
	Application	Baseline	Project	AEP SQG[1]	US EPA Eco-SSL[2]		
				Wildlife	Avian	Mammal	Other
Arsenic	7.30E-03	7.30E-03	3.59E-06	ND	43	46	-
Barium	8.13E+01	1.89E+01	8.09E+01	10,000	ND	2,000	-
Beryllium	9.00E-04	9.00E-04	2.11E-07	ND	ND	21	-
Cadmium	1.75E-03	1.73E-03	1.96E-05	3.8	0.77	0.36	-
Chromium (total)	3.20E-02	3.20E-02	9.56E-07	ND	26	34	-
Chromium (VI)	3.20E-02	3.20E-02	9.56E-07	ND	ND	130	-
Cobalt	1.38E-02	1.38E-02	2.05E-05	ND	120	230	-
Copper	3.44E-02	3.43E-02	8.31E-05	ND	28	49	-
Lead	1.61E-02	1.61E-02	1.68E-06	ND	11	56	-
Manganese	1.25E+00	1.25E+00	7.23E-09	ND	4,300	4,000	-
Mercury[4]	9.15E-05	9.03E-05	1.51E-06	ND	ND	ND	2
Molybdenum[4]	1.39E-03	1.39E-03	9.67E-06	ND	ND	ND	10
Nickel	3.12E-02	3.12E-02	2.22E-05	ND	210	130	-
Selenium	8.31E-04	8.30E-04	5.51E-07	ND	1.2	0.63	-
Thallium[5]	1.80E-04	1.80E-04	4.59E-09	ND	ND	ND	56.9
Uranium[6]	6.09E-07	1.39E-07	6.09E-07	ND	ND	ND	5
Vanadium	6.48E-02	6.48E-02	3.19E-06	ND	7.8	280	-
Zinc	1.44E-01	1.44E-01	4.17E-04	ND	46	79	-

1 - AEP, 2016

2 - US EPA, 2010

3 - ORNL, 1997; US EPA 2005 - objective protective of phototoxic effects to biota

4 - MDDEP, 2002 objective protective of wildlife, flora and the environment

5 - US EPA, 2003b - objective protective of mammals

6 - ORNL, 1997; US EPA, 2005 - objective protective of phytotoxic effects to biota

ND - no data

No soil concentration exceeded their respective soil quality guideline; therefore, it was concluded that potential risks to wildlife from soil would be negligible.

5.3 Surface Water Assessment

All modelled surface water concentrations in the RSA are below the Alberta surface water quality guidelines for FAL and wildlife watering (ESRD, 2014; AEP, 2016). In cases where guidelines are not available, predicted COPC concentrations are well below laboratory detection limits (antimony and PAH COPCs), or below guidelines for other exposure pathways, such as human drinking water ingestion (barium). No adverse health risks to human health (Consultant Report #12 Section 6.3 and Appendix F) or the environment (including aquatic life receptors and wildlife) are predicted due to surface water exposure pathways and requirement for further mitigation is not indicated.

The comparison of the predicted surface water concentrations and the surface water quality guidelines is presented in Table H.13.

Table H.13 Comparison of Maximum Predicted Surface Water Concentrations (mg/L) to Surface Water Quality Guidelines Protective of both Aquatic and Wildlife

COPC	Predicted Surface Water Concentration from Multimedia Model (mg/L)	Surface Water Quality Guideline (mg/L)	
	RSA-MPOI	Fresh Aquatic Life[a]	Wildlife Watering[b]
Acenaphthene	7.92E-09	0.0058	NGR
Acenaphthylene	2.27E-08	-	-
Aluminium	4.90E-08	0.05	5[C]
Anthracene	3.02E-09	0.000012	NGR
Antimony	1.41E-06	-	-
Arsenic	7.90E-06	0.005	0.025[C]
Barium	3.90E-02	-	-
Benz(a)anthracene	1.53E-09	0.000018	NGR
Benzo(a)pyrene	6.31E-10	0.000015	NGR
Benzo(b)fluoranthene	2.72E-09	-	-
Benzo(g,h,i)perylene	1.36E-09	-	-
Benzo(k)fluoranthene	5.35E-10	-	NGR
Beryllium	1.49E-05	0.1	0.1[C]
Cadmium	1.94E-05	0.00004	0.08[C]
Chromium	8.84E-05	0.0089	0.05[C]

Table H.13 Comparison of Maximum Predicted Surface Water Concentrations (mg/L) to Surface Water Quality Guidelines Protective of both Aquatic and Wildlife

COPC	Predicted Surface Water Concentration from Multimedia Model (mg/L)	Surface Water Quality Guideline (mg/L)	
	RSA-MPOI	Fresh Aquatic Life[a]	Wildlife Watering[b]
Chrysene	3.76E-09	-	-
Cobalt	1.06E-04	0.0025	1[C]
Copper	3.75E-04	0.007	0.5[C]
Dibenz(ah)anthracene	8.49E-10	-	-
Fluoranthene	9.89E-09	0.00004	NGR
Fluorene	3.14E-08	0.003	NGR
Formaldehyde	5.83E-07	-	-
Indeno(1,2,3-cd)pyrene	1.02E-09	-	-
Lead	1.64E-04	0.001	0.1[C]
Manganese	8.74E-08	0.2	-
Mercury	2.08E-06	0.000005	0.003[C]
Molybdenum	2.38E-05	0.073	0.5[C]
Nickel	3.68E-04	0.004	1[C]
Phenanthrene	1.00E-07	0.0004	NGR
Pyrene	6.28E-09	0.000025	NGR
Selenium	1.81E-05	0.001	0.05[C]
Thallium	7.47E-06	0.0008	-
Uranium	2.99E-05	0.015	0.2[C]
Vanadium	3.47E-04	0.1	0.1[C]
Zinc	1.93E-03	0.03	0.05[C]

a – Freshwater Aquatic Life Guidelines (FAL) obtained from Alberta Environment & Sustainable Resource Development (ESRD) Environmental Quality Guidelines for Alberta Surface Waters (ESRD 2014).

b – Wildlife Watering Guidelines obtained from Alberta Environment & Parks (AEP).Tier 1 Soil and Groundwater Remediation Guidelines – Appendix C Table C-11 (AEP 2016).

c – Livestock Watering Guidelines are presented in absence of an available Wildlife Watering Guideline and were obtained from ESRD (2014).

NGR – no guideline required as the calculated guideline value exceeds aqueous solubility (AEP 2016).

No surface water concentration exceeded their respective FAL or wildlife watering guideline; therefore, it was concluded that potential risks to wildlife from surface water would be negligible.

6.0 CONSERVATIVE ASSUMPTIONS

- Wildlife receptors were assumed to be exposed to maximum predicted air concentrations at the MPOI for the LSA and RSA for the entire exposure period considered (annual for chronic, 1 hour for acute with the exception of $PM_{2.5}$ that is 24-hour).
- For the chronic endpoints, wildlife receptors were assumed to spend their entire lifetime within the project area; however, most wildlife species will move within their home ranges that overlap the project area.
- Soil concentrations were calculated without accounting for transformation and loss processes like soil erosion and leaching.
- The operating life of the Project is expected to be 25 years, but 80 years of deposition was assumed to consider potential cumulative impacts.
- Instead of species-specific oral TRVs, generic soil and surface water quality guidelines protective of wildlife were used to assess potential risk from soil and surface water.
- Due to data limitations an inhalation TRV for $PM_{2.5}$ developed for humans was conservatively applied to wildlife.
- Chronic inhalation TRVs were developed using NOAELs selected for the most sensitive species and applied uncertainty factors where appropriate; established TRVs are therefore believed to be highly conservative.
- The chemical form that the test organism is exposed to in a laboratory is normally selected to maximize uptake into the blood stream. The use of highly bioaccessible forms often results in elevated exposures relative to uptake in the environment. In natural environments chemicals are often much less bioaccessible for a variety of reasons. For this reason the TRV are likely highly conservative.

7.0 UNCERTAINTY ASSESSMENT

In general, the uncertainties for the HHRA also apply for the screening-level wildlife health risk assessment. Uncertainties specific to the screening-level WRA are detailed below:

- The Grizzly Bear and Little Brown Bat have been identified as threatened or endangered species present in the study area. There is some uncertainty as to whether the inhalation TRVs applied for mammals would be protective of these receptors. While they are both mammals, little information is available on the nesting habitat for this bat species and how this species could be exposed to Project COPC is uncertain. Due to the large range of the Grizzly Bear, this

receptor's habitat is expected to overlap parts of the study area and actual exposure will therefore be lower than assumed in the screening-level WRA.

- The appropriateness of the use of toxicity data derived from laboratory animals to wildlife is uncertain due to differing physiology and potential uptake.
- A soil quality objective was not available for formaldehyde thus this COPC was not included in the ingestion exposure pathway assessment.
- An inhalation risk hazard quotient could not be established where no chronic inhalation TRV was available, including propylene, beryllium, lead, molybdenum, selenium, thallium and zinc.

8.0 CONCLUSIONS

The results of the screening-level WRA indicates that there are no expected population-level adverse effects associated with Project emissions on the health of wildlife in the study areas. The maximum predicted air concentrations associated with Project emission do no exceed either the acute or chronic TRVs protective of wildlife, with the exception of $PM_{2.5}$ in the acute inhalation assessment and nitrogen dioxide in the chronic inhalation assessment which were only slightly greater than 1.0. These results were not considered indicative of a risk of adverse wildlife health effects as they: conservatively used the TRV derived for human exposures and occurred only at the worst-case RSA-MPOI locations.

Maximum predicted long-term soil concentrations did not exceed the soil quality guidelines protective of wildlife, and predicted water concentrations did not exceed surface water guidelines protective of either freshwater aquatic life or wildlife watering.

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