Appendix C.1

Evaluation of Potential Human Exposure and Risks Related to Emissions From the Fifteen Mile Stream Mine Pit Project (Dust Deposition; Recreational Water Usage; Country Foods), Intrinsik Corp.

SCIENCE INTEGRITY KNOWLEDGE

EVALUATION OF POTENTIAL HUMAN EXPOSURES AND RISKS RELATED TO EMISSIONS FROM THE FIFTEEN MILE STREAM MINE PIT PROJECT (DUST DEPOSITION; RECREATIONAL WATER USAGE; COUNTRY FOODS)

Atlantic Mining NS Fifteen Mile Stream Mine Project

Technical Supporting Document
FINAL REPORT

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EXECUTIVE SUMMARY

The Fifteen Mile Stream (FMS) Mine Site Project will involve the construction, operation, closure and reclamation of a surface gold mine near Trafalgar, Nova Scotia, if this project is approved. This report assesses the potential for emissions from the mine, released via Project activities, to change the chemistry of air, water and soils in the area, and whether the predicted changes have the potential to result in metals accumulation in or on vegetation or other selected country foods that may be consumed by humans. In addition, this report also provides an assessment of other potential exposure pathways for land users, such as recreational swimming, inhalation and incidental ingestion of metals on dusts in air and soil. The focus of this assessment is on the FMS Mine Site, in areas outside of the property boundary which could be accessed by the general public during various activities.

The assessment approach used in this report follows a standard screening level risk assessment approach, wherein a Problem Formulation is conducted to determine the potential for open exposure pathways, the identification of Chemicals of Potential Concern (COPCs), and receptors, followed by an Exposure and Toxicity Assessment, and Risk Characterization. Methods outlined in Health Canada (2012; 2016a; 2016b; 2018) are followed in the assessment process, along with other guidance documents and approaches.

The Problem Formulation identified the following potential exposure pathways for people using the land in the area of the Mine site:

- Inhalation of air containing dusts;
- Incidental soil and dust ingestion, and/or vegetation ingestion;
- Consumption of game meats by humans;
- Exposure to surface water via incidental consumption and dermal contact through recreational activities (swimming);
- Consumption of fish by humans.

There are no residences near the proposed Mine site, and the nearest residence with a groundwater well is approximately 8.7 km away from the Mine. Therefore consumption of groundwater was not considered an open exposure pathway. Activities in the area could include traditional hunting and plant gathering, fishing, hiking, use of ATVs, and camping.
The assessment included a Baseline scenario, as well as a Project Increment scenario, and Baseline + Project Scenario.

Chemicals of Potential Concern (COPC) were identified through examination of the geochemistry of dusts which could be released by the mine, as well as through predicted future surface water concentrations in the water course which will receive direct effluent discharge (Anti Dam Flowage). Screening of these sources resulted in several metals/metalloids meriting further assessment (aluminium; arsenic; barium; chromium; cobalt; copper; lead; manganese; molybdenum; nickel; strontium; vanadium and zinc).

Dust deposition from mine site activities was predicted by Wood (2019), based on proposed operations and activities at the mine site, using standard methods. Predicted deposition rates were provided for the maximum point of impingement (MPOI) at the mine site property boundary, as well as a location approximately 1 km from the property boundary. These predictions were used to estimate potential future soil, vegetation and game meat concentrations in the Study area, using standard risk assessment equations provided by Health Canada and US EPA (e.g, US EPA OSW, 2005; US EPA, 1993). Metal concentrations on fine and coarse particulate matter were also estimated based on predicted concentrations of PM2.5 and PM10, provided by Wood (2019) at the MPOI. These predicted concentrations were used to assess potential inhalation exposures in areas outside the Property boundary, for either short term or chronic time frames. Effluent release into the nearby receiving environment (Anti Dam Flowage) and possible future receiving environment concentrations were predicted by Golder (2019). These data were used to evaluate potential exposures related to recreational swimming, and fish consumption.

Potential exposures to releases of the COPCs from the proposed FMS Mine for people who could spend time in areas near the FMS Mine site were estimated using standardized equations by Health Canada (2012) and US EPA (2003; 2004). Consumption rates for various foods which could be harvested from the area near the proposed mine, such as leafy vegetation, berries, fish and game meats (deer), were identified from the First Nations Food, Nutrition and Environment Study (FNFNES) for the Atlantic region (Chan et al, 2017). Soil ingestion, dust inhalation exposure rates were identified from Health Canada (2012). Exposure rates from swimming and incidental water ingestion were identified from both Health Canada (2012) and US EPA (2003; 2004). Chronic Toxicity Reference Values (TRVs), which are exposure levels of COPCs for a life-time below which adverse effects are not anticipated, or which are associated with negligible risk levels, were identified from Health Canada (2010), World Health Organization (2010), US EPA (1996; 1993) and other notable regulatory agencies. Potential risks were characterized by comparing the predicted exposure levels from all exposure pathways to the TRV, to predict a Risk Quotient (RQ) for non-carcinogens. RQs less than 0.2 for the Project scenario, or less than 1.0 for the Baseline + Project scenario, are considered to indicate that the intake of the COPC through the consumption of traditional foods and other Project-related pathways does not exceed the TRV and no adverse health effects are expected. For carcinogenic chemicals, an Incremental Lifetime Cancer Risk (ILCR) for all life stages is calculated. A benchmark cancer risk level of 1 in 100,000 (i.e., 1×10-5) is used to assess risk, and cancer risks are deemed negligible when the estimated ILCR is less than the benchmark value of 1 in 100,000 (i.e., ILCR $\leq$ 1.0).

Based on the assessment conducted, non-carcinogenic risks from soil and dust exposures, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use (i.e., swimming), as well as soil ingestion, are considered to be negligible, and hence, are not anticipated to result in adverse health effects. For arsenic, predicted ILCRs were below the benchmark ILCR of 1 in 100,000 in all scenarios and assessment cases. Therefore, the potential for adverse health effects from arsenic exposure are considered negligible.

Uncertainties and limitations and assumptions used in the assessment are discussed in the report.

EVALUTION OF POTENTIAL HUMAN EXPOSURES AND RISKS RELATED TO EMISSION FROM THE FIFTEEN MILE STREAM MINE PIT PROJECT (Dust Deposition; Recreational Water Usage; Country Foods)

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EVALUATION OF POTENTIAL HUMAN EXPOSURES AND RISKS RELATED TO EMISSIONS FROM THE FIFTEEN MILE STREAM MINE PIT PROJECT (DUST DEPOSITION; RECREATIONAL WATER USAGE; COUNTRY FOODS)

1 INTRODUCTION

The Fifteen Mile Stream (FMS) Mine Site Project will involve the construction, operation, closure and reclamation of a surface gold mine near Trafalgar, Nova Scotia, if this project is approved. The proposed mine will be a surface open pit mine and will include milling facilities (e.g. a primary crusher and concentrator), a Waste Rock Storage Facility (WRSF), a Tailings Management Facility (TMF), interior mine haul roads and associated mine infrastructure, including maintenance facilities, local supply systems, explosive storage, fuel storage and mine offices (Atlantic Mining Corp., 2018). Ore mined and milled at the FMS Mine Site will be transported as concentrate to the processing facilities at the Touquoy Mine, wherein gold dorée will be produced. Processing at Touquoy Mine will involve the deposition of concentrate tails at the Touquoy Mine TMF and the exhausted Touquoy Mine pit. The total development area of the FMS Mine Site is approximately 280 hectares (ha), which includes the ore extraction area (surface mine) (20 ha), materials storage (waste rock, overburden, low grade ore stockpile) (65 ha), crusher and concentrate facilities (10 ha) and site infrastructure (5 ha), TMF (165 ha), mine site haul roads (10 ha), access roads (5 ha) and Seloam Brook Diversion (1.3 km) (Atlantic Mining Corp. 2018).

Once closed, all facilities will be removed from the landscape, and disturbed lands will be rehabilitated and the property will be returned to a functional use according to the approved reclamation plans and accepted practices at time of closure.

The main elements of the FMS Mine Project are as follows, with additional details being provided in Atlantic Mining Corp. (2018):

- A surface mine from which 32.4 Mt of rock will be excavated, comprising 10.8 Mt of ore and 20.3 Mt of waste rock and 1.3 Mt of overburden;
- A 12 month pre-production period, followed by 5.5 years of production at an average extraction rate of 16,430 tpd, including ore production of 5,579 tpd;
- Construction of a 1.3 km diversion channel for Seloam Brook, to the north of the open pit. Surface and groundwater entering the open pit will be pumped to the TMF;
- Crushing and concentrate facilities to process 2.0 Mt/yr of ore, which will produce a gold concentrate which will be transported to the Touquoy facility for final processing;
- Waste rock storage with a capacity of 16.2 Mt of waste rock; over burden storage piles;
- A TMF with a design capacity of 8.3 Mm^3 of tailings solids;
- Administrative and maintenance buildings;
- Additional minor tailings storage at the Touquoy TMF facility, and the open pit once it is exhausted;

The hauling of concentrate from FMS Mine Site to Touquoy Mine Site will occur via two possible routes, mainly on public roads. The distance is approximately 60 - 76 km between the two sites. There are private dwellings along the haul route, in the community of Sheet Harbour,

with a lower density of dwellings between Sheet Harbour and Mooseland, Tangier and Marinette.

With respect to project stages, the following is the anticipated operations and closure timings:

- Site preparation and construction (year 1 - 2020)
- Operation (years 2-6; years 2021 to 2026)
    - Pre-production (12 months)
    - Full production (5 years)
- Decommissioning and reclamation (years 6 to 8 and beyond)

An Environmental Assessment commenced in July of 2018, and an Environmental Impact Statement (EIS) for the FMS Mine Project will be submitted for review to both the Canadian Environmental Assessment Agency (CEAA) and Nova Scotia Environment (NSE) in 2019. Guidelines were prepared for the EIS and were released in August of 2018. This technical report is prepared to support that EIS, particularly in the area of Mi'kmaq of Nova Scotia, under Health and socio-economic conditions. The guidelines indicated the following:

- *The assessment of impacts to human health will be based on effects of changes to the environment on Mi'kmaq of Nova Scotia's' human health, focusing on effects on health outcomes or risks in consideration of, but not limited to, potential changes in air quality, noise exposure and effects of vibration from blasting, current and future availability of country foods, and water quality (drinking, recreational and cultural uses).*
- *When risks to human health due to changes in one or more of these components are predicted, the proponent is expected to complete a Human Health Risk Assessment (HHRA) examining all exposure pathways for pollutants of concern to adequately characterize potential risks to human health.*
- *The proponent must provide a justification if it determines that an assessment of the potential for contamination of country foods (or other exposure pathways, such as inhalation) is not required or if some contaminants are excluded from the assessment.*
- *Consider effects to mental and social well-being of the Mi'kmaq of Nova Scotia. Where adverse health effects are predicted, any incidental effects such as effects on current use of lands and resources for traditional purposes should also be assessed.*
- *Consider and document how effects of changes to the environment could be different for particular sub-populations within the Mi'kmaq of Nova Scotia (for example, women, youth, elders, specific families).*

Therefore, the purpose of this report is to provide an assessment of potential human health impacts related to contaminants released via the FMS Mine Site, associated with the following:

- Potential changes in air quality, particularly associated with ore dust (Criteria Air Contaminants are assessed in a separate Technical Report; Wood, 2019; noise and vibration are also handled in a separate report);
- Potential impacts to soils and vegetation associated with dust deposition, in order to evaluate the potential for impacts to country foods;

- Potential impacts to water quality (drinking, recreational or cultural uses, as well as fish consumption)

This report assesses the potential for emissions from the FMS Mine Site, released via project activities, to change the chemistry of air, water and soils in the FMS Study Area, and whether the predicted changes have the potential to result in metals accumulation in or on vegetation or other selected country foods that may be consumed by humans. In addition, this report also provides an assessment of other exposure pathways, such as recreational swimming, inhalation and incidental ingestion of metals on dusts in air and soil. The focus of this report is on the FMS Study area, which could be influenced by mine site activities. In addition, some discussion is also provided related to potential implications of additional releases at the Touquoy Mine site area related to tailings generated due to processing of FMS concentrate, and potential release of water from the Touquoy Mine pit (once it fills naturally) via a spillway into Moose River.

The assessment approach used in this report follows a standard screening level risk assessment approach, wherein a Problem Formulation is conducted to determine the potential for open exposure pathways, the identification of Chemicals of Potential Concern (COPCs), and receptors. Methods outlined in Health Canada (2012; 2016a; 2016b; 2018) are followed in the assessment process, along with other guidance documents and approaches. The Problem Formulation is presented in Section 2. Section 3 identifies available baseline data for the assessment, whereas Section 4 provides a summary of the geochemistry data, as well as Chemicals of Potential Concern. Air dispersion of dusts from the FMS Mine Site is presented in Section 5, and an assessment of inhalation exposures to metals adhered to coarse and fine particulate matter is presented in Section 6. Potential changes to recreational water quality, and a screening assessment for this pathway is provided in Section 7; potential changes to soils and vegetation is provided in Section 8; and an assessment of country foods consumption, in conjunction with other identified exposure pathways, is provided in Section 9. Conclusions and Uncertainties (Section 10), and references cited are provided in Section 11.

This report focuses on exposures which could occur in areas outside the active operations of the FMS Mine Site (referred to as Potential Development Areas, or PDA), since these areas were assumed to most likely to be used for foraging activities by humans.

2 PROBLEM FORMULATION

2.1 Methodology

To conduct the Problem Formulation, the following steps were undertaken, as per Health Canada (2016a; 2016b and 2018):

- Define spatial and temporal boundaries
- Proximity of Project to receptors
- Identify open exposure pathways
- Identify human receptors
- Identify Contaminants of Potential Concern (COPCs)
- Develop Conceptual Model
- Develop assessment scenarios

2.2 Problem Formulation Outcomes

2.3 Spatial and Temporal Boundaries

The spatial boundaries of the Project will focus on areas outside of the active FMS mine site facility property boundary, where non-employees could incur exposures associated with emissions from the facility. Therefore, from an air dispersion perspective, either the maximum point of impingement (Max POI – highest predicted ground level air concentration outside the property boundary), and/or a more realistic amortized exposure point, were used to assess potential exposures to people (or receptors) in the area.

Based on the Project description (Atlantic Mining Corp., 2018), the Project will involve a number of stages, ranging from construction, pre-production, operations and decommissioning and reclamation. From a temporal boundary perspective, this assessment focuses on the operational time period, as this is the period associated with maximum emission releases. This same time period was used by Wood (2019) in the assessment of air quality.

2.4 Proximity to Residences and Reserves

The FMS Mine Property is unpopulated and the nearest village to the property is Sheet Harbour, 33 km to the south along Highway 374 (Atlantic Mining Corp. 2018). Sheet Harbour has a population of about 800 people and services a broader population of about 5000 people, mostly distributed in a string of small communities along the coastline. The two closest Mi'kmaq communities are the satellite communities to the Millbrook First Nation of Beaver Lake and Sheet Harbour. These two Indian Reserves (Beaver Lake IR 17, Sheet Harbour IR 36) are both located approximately 33km from the FMS Mine Site (Atlantic Mining Corp., 2018). There are no cottages visible in Google Earth in the vicinity of the FMS Mine Site area, and the nearest residence is over 4.9 km south of the Mine Site (no ground water wells are present at this property). The nearest domestic drinking water well is 8.7 kilometres away from the site, down-gradient in a southerly direction at a residence along Highway 374. Given the distance to the

nearest residence, it is highly improbable that any potable groundwater resources will be affected (Atlantic Mining Corp., 2018).

There are recreational activities in the vicinity of the FMS Mine site, including snowmobiling and ATV trails which are actively used (see Chapter 6.15 in the EIS; Atlantic Mining Corp, 2019). Other activities include camping which occurs sporadically near the southern end of Seloam Lake, as well as fishing and swimming in some water courses near the Mine Site area. Fishing does occur in Seloam Lake but it is infrequent, and fishing success is limited. Locals also fish in Anti Dam Flowage, but this appears to occur infrequently, and success rates are also low. East Lake, which is located near the TMF is infrequently fished as it is not readily accessible, and has poor habitat (and hence, low likelihood of catch). Further details can be found in the recreational chapter of the EIS. For the purposes of this assessment, Anti-Dam Flowage was assumed to represent a fishing location, as it will receive effluent from operational and post closure discharge, and hence, could be influenced by Project activities.

2.5 Potential Exposure Pathways

The types of activities at the FMS Mine Site are summarized in Wood (2019) and include the following:

- Blasting;
- Production Drilling;
- Bench Scale Exploration;
- Production Hauling.
- Material Handling in the open pit;
- Production Loading;
- Road transport (dust emissions of re-entrained dust); and
- Management of mine rock, ore, and overburden.

Atmospheric emissions from the mine could therefore include atmospheric dusts, particulate matter and gases, such as Nitrogen oxides (NO_x), Sulphur dioxide (SO_2), and carbon monoxide (CO). Other compounds, such as volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) from combustion of fuels may also be present. Effluent emissions and releases from the Tailings Management Facility (TMF) at the FMS Mine Site will be released into Anti-Dam flowage, and hence, some exposures could occur downstream of this point.

The potential exposure pathways for off-site receptors could therefore include the following:

- Inhalation of air containing dusts, particulate matter and gases;
- Ingestion of dusts;
- Deposition of dusts onto soils and vegetation, and subsequent (incidental) soil ingestion, and/or vegetation ingestion;
- Uptake of metals from soil or vegetation, uptake of metals in game species, and subsequent consumption by humans;
- Release of effluent into nearby watercourses, and exposure via direct consumption, or incidental consumption through recreational activities;

- Uptake of metals from surface water into fish and subsequent consumption by humans.

Note that there are no cottages downstream of effluent releases within the Fifteen Mile Stream or Anti Dam Flowage, and hence, direct consumption of surface waters containing mine effluent is not considered to be an open exposure pathway. Similarly, the distance from the FMS Mine Site to the nearest groundwater well is 8.7 km, and hence, this exposure pathway is also not considered to be open. Additional screening of various media will assist in determining which pathways require further assessment.

2.6 Potential Human Receptors

There are no homes in the vicinity of the FMS Mine Site, and the closest residence is approximately 4.9 km away from the FMS Mine site. Human receptors would therefore be those that travel in the area for hunting or gathering purposes, or recreational purposes, and could include any age group (infant to elderly). Exposures would likely be more of a transient nature, as no full-time dwellings are near the FMS Mine Site. Interactions between the Mi'kmaq and the Project are anticipated to be moderate (Section 6.13, Atlantic Mining NS Corp, 2019). The expected interaction with the Mi'kmaq relates to potential use of the land for traditional hunting, plant gathering, and fishing (Atlantic Mining Corp., 2018).

2.7 Identification of Chemicals of Potential Concern (COPCs)

Since the vast majority of dusts generated from the FMS Mine Site are expected to be related to the transportation along interior haul roads (i.e., haul roads within the property development area), the chemical composition of the dust considered in this report is specifically associated with source of metals in road construction, which is proposed to be waste rock related to mining activities at the FMS Mine Site. Other sources for the interior haul road construction may be used (such as rock from local quarry pits), but it was assumed that the geochemistry of waste rock would represent a reasonable base case characterization of metals dust levels, relative to other quarry sources. Based on the types of emissions that could be released, the following can be stated:

- Criteria air contaminants (TSP; PM10; PM2.5, NO_x; SO_2) are assessed in the air quality assessment (Wood, 2019), relative to provincial and federal air quality standards and objectives. These are not evaluated further in this report.
- Metals in dusts merit further evaluation, for both ambient air, soils, and vegetation in order to determine if changes to these media are anticipated to be large enough to merit more detailed evaluation. Specific COPCs were identified based on the relevant geochemistry of the dust sources, as discussed further in Section 4.2.
- VOCs and PAHs related to diesel combustion would be present at this site. The air quality assessment estimated concentrations of benzene and benzo(a)pyrene, which were chosen as surrogates to represent these chemical groups. Predicted concentrations at the property boundary were noticeably below air quality guidelines (see Table 5-3; Wood, 2019), and hence, further assessment of these contaminant groups was not considered of merit.

For metals from aqueous release of effluent into Anti Dam Flowage, predicted future concentrations in the receiving environment (provided by Golder, 2019) were screened against Canadian Drinking Water Quality Guidelines (CDWQG) to identify potential COPCs. Section 7 of the report provides further discussion and screening.

2.8 Development of a Conceptual Model

A conceptual model was developed to illustrate the potential sources of contaminants from the FMS Mine Site, and the exposure pathways by which media could be affected and by which people could be exposed. Figure 3-1 provides the Conceptual Model.

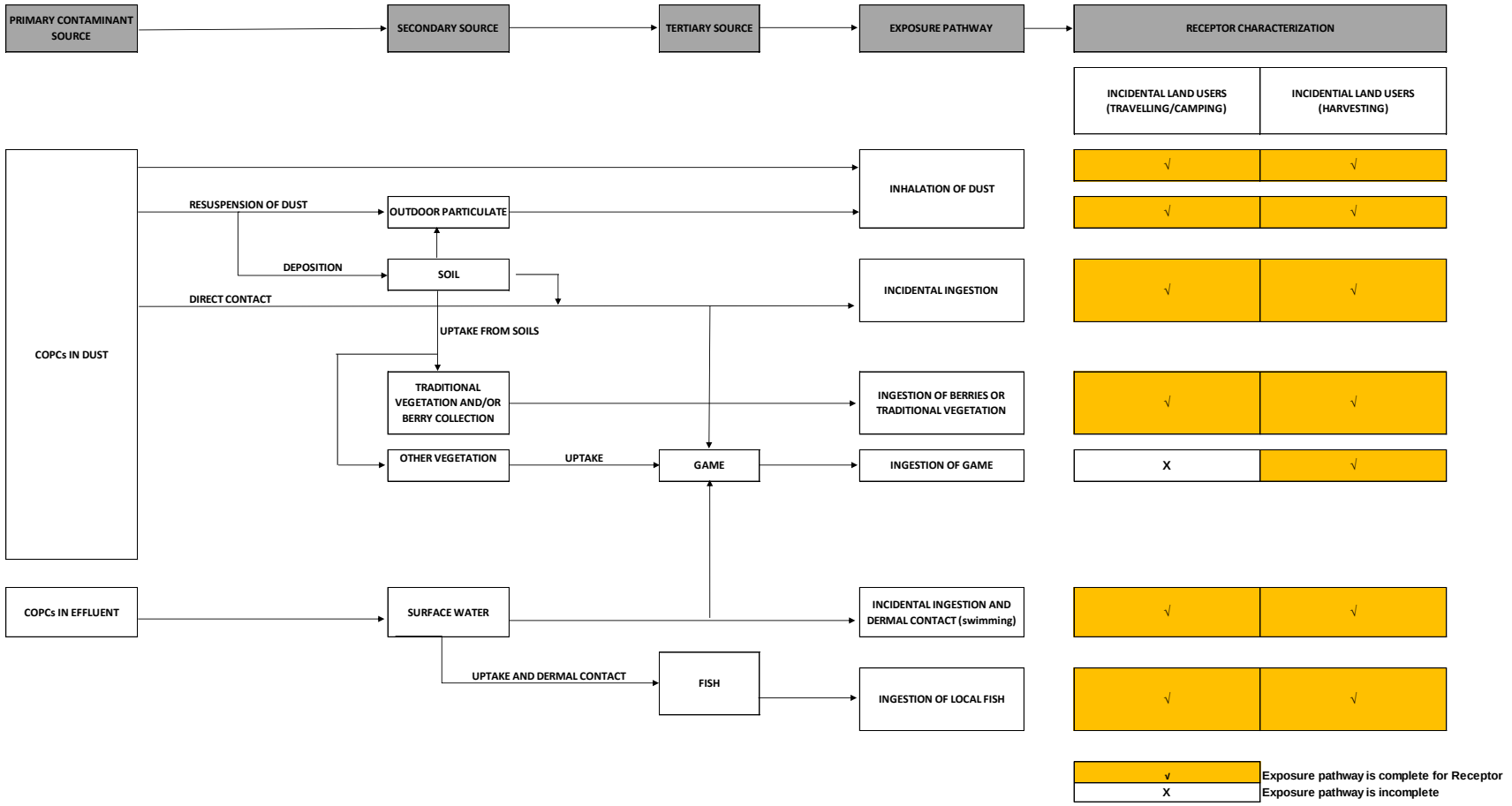

Figure 2-1 Human Health Conceptual Site Model

2.9 Assessment Scenarios

The focus of this assessment is on the operations phase of the Project, as this has been identified as the stage in the Project phases with the highest potential for impacts, due to the length of operations and the activities undertaken. When examining potential emissions from the 3 phases of a mine lifecycle (construction, operations, decommissioning), typically, the operations phase represents the highest predicted emissions scenarios, and hence, all predictions presented in this report are related to this phase.

The following scenarios are being assessed for the Project operations phase:

Baseline Scenario:

- This scenario predicts potential exposures, and risks, associated with the baseline environment;

Project Increment Scenario:

- The potential increment provided by the Project alone was assessed separately.

Baseline + Project Scenario:

- The two scenario results were summed to examine the potential incremental exposures or risks associated with the Project, when added to Baseline risks.

In addition, cumulative effects of the FMS project, in conjunction with other proposed Projects in the area (such as the Touquoy Mine and Beaver Dam Mine) are discussed qualitatively.

3 ENVIRONMENTAL BASELINE ENVIRONMENTAL MONITORING DATA (AIR, SOILS, BERRIES AND VEGETATION, SURFACE WATER)

3.1 Air

Baseline air data for the FMS Mine Site area are limited and are discussed in Wood (2019). Baseline TSP and PM_{10} were sampled at two locations in the FMS Mine Site area on November 21, 2017 over a 24-hour sampling period, as presented in Table 3-2. Baseline air data are also available from the Cochrane Hill mine site, located within 60km of the FMS Mine Site area and similar in respect to the remoteness of its location. Baseline PM_{10} data were sampled from two locations in this mine area in November 2017. These data were used to supplement the baseline data for the FMS Mine Site area. Baseline $PM_{2.5}$ data were not available for the FMS Mine Site area and therefore monitoring data collected from Seal Harbour, located approximately 60 km to the east of FMS were used to supplement the dataset. $PM_{2.5}$ was monitored for three 24-hour periods at Seal Harbour in each of July, August, and September of 2004. This location is similarly remote, and hence, has similar characteristics.

Table 3-1 Baseline 24-hour Air Concentrations Collected from and near to the Fifteen Mile Stream Mine Area [µg/m^3]

Chemical	*Location*	*Min*	*Max*	*24-hour Air Quality Criteria*
TSP	FMS mine area	9.6	14	120[a]
PM_{10}	FMS mine area	9.2	9.5	50[b]
	Cochrane Hill mine area	9.7	10.5	
$PM_{2.5}$	Seal Harbour	--	4.0	30[b]

Notes:
Baseline concentrations collected over 24-hour sampling period from two locations in the FMS Mine Site area on November 21, 2017 (Atlantic Gold, 2019; Air Quality)
[a] Nova Scotia Ambient Air Objective
[b] Ontario Ministry of Environment Ambient Air Quality Criteria

The average of all PM_{10} concentrations (n = 4; 9.7 µg/m^3) measured between the FMS and Cochrane Hill mine areas was selected for use in characterizing baseline PM_{10} concentrations at the FMS Mine Site area. Due to the lack of baseline $PM_{2.5}$ data from the FMS mine area, the maximum $PM_{2.5}$ concentration (4.0 µg/m^3) measured at Seal Harbour was used to characterize baseline $PM_{2.5}$ concentrations at the FMS Mine Site area.

3.2 Soils and Vegetation

No site-specific soils and vegetation were collected for the FMS Mine Site area, but baseline metals in soil and vegetation near the Beaver Dam Mine Project area were conducted in August of 2018 along the proposed Haul Road route by McCallum Environmental. These two Project sites are approximately 20 km apart, and hence the Beaver Dam Mine Project area baseline were assumed to be representative of soils and vegetation in the FMS Mine Site area. At soil sampling stations, berries and vegetation (leaves) were also collected. Leaves and berries were sent to an independent analytical laboratory (RPC Analytics) without any rinsing or washing. Figure 3-2 identifies the sampling stations, and Table 3-2 provides details on the samples collected. Other

baseline data were considered, such as data collected by Parsons and Little (2015) in the Goldenville area. The data included in Parsons and Little (2015) pertain only to arsenic and mercury, as opposed to other metals or metalloids, and are limited only to soils (as opposed to soils and vegetation). Goldenville is a similar distance away from the FMS Study Area as the Beaver Dam Project area, but the Beaver Dam area data were considered to be adequately representative and more complete, in that they included a full metals scan, and paired vegetation data. In addition, historic tailings have been identified in the FMS Mine Site area (Stantec, 2019), resulting in elevated levels of both arsenic and mercury, as well as lead in some areas. These occurrences are within the Mine site property area, and hence, exposures to these areas will be limited for the general public. These data were therefore not considered to represent baseline soils in the area.

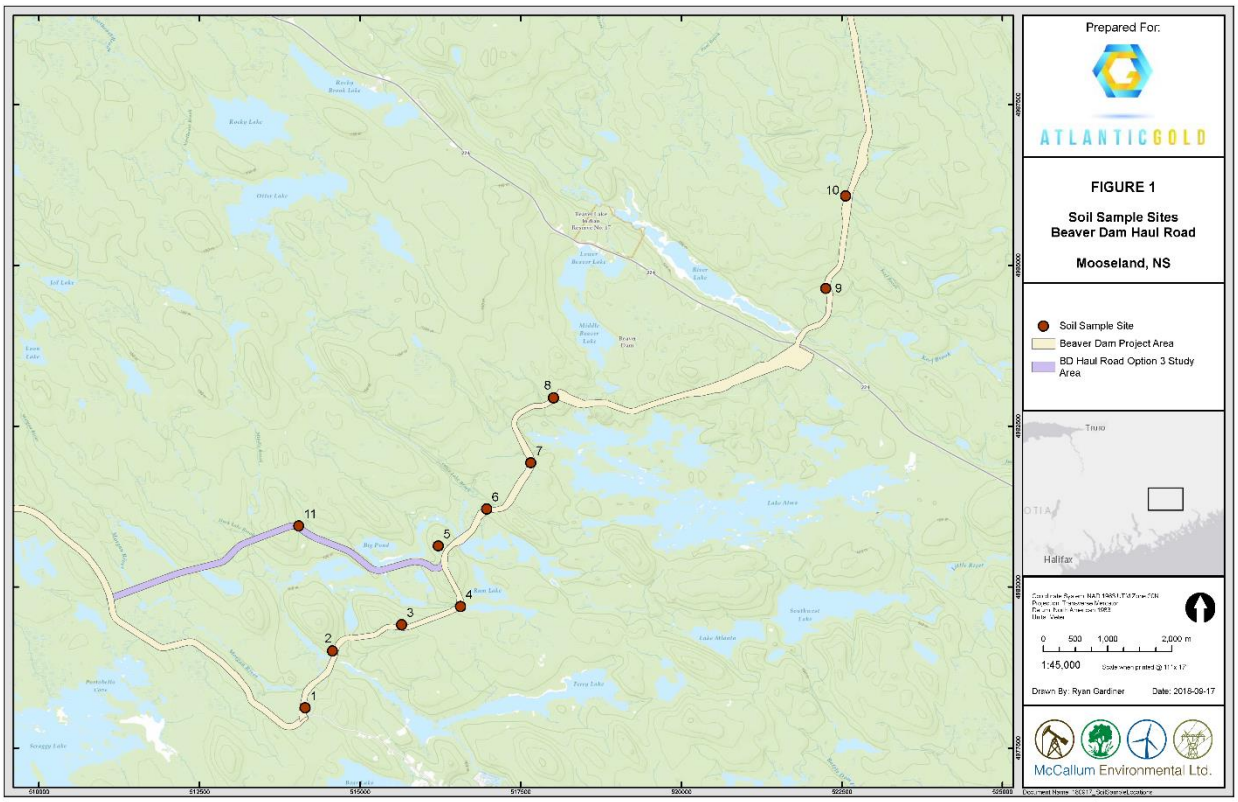

Figure 3-1 Soil, Berry and Vegetation Sampling Stations for Baseline Data Collection

Table 3-2 Sampling Locations, Distance from Beaver Dam Mine Haul Road, Berry and Vegetation Type, Sample Numbers and Depth

Site ID	Distance from Road (m)	Berry Type	# of Berries Collected	Vegetation Type	Soil Sample Depth Range (cm)
1	40	Blueberry	20	Blueberry Leaves	10 - 40
2	50	Raspberry	14	Raspberry Leaves	5 - 30
3	25	Blueberry	20	Blueberry Leaves	1 - 20
4	30	Cranberry	20	Sweet Gale Leaves	1 - 20
5	40	Raspberry	15	Raspberry Leaves	3 - 25
6	20	Blackberry	16	Blackberry Leaves	5 - 35
7	20	Bunch Berry	31	Bunch Berry Leaves	5 - 20
8	20	Black Huckle Berry	8	Black Huckle Berry Leaves	20 - 35
9	20	Raspberry	13	Raspberry Leaves	3 - 20
10	25	Blackberry	20	Blackberry Leaves	3 - 25
11	30	Blackberry	11	Blackberry Leaves	10 - 30

Notes:
All samples were collected on August 31, 2018, with the exception of Sample 11, which was collected on September 5, 2018.
Species names are as follows: Blackberry: *Rubus alleghaniensis*; Black Huckle Berry: *Gaylussacia baccata*; Blueberry: *Vaccinium myrtilloides*; Bunch Berry: *Cornus Canadensis*; Cranberry *Vaccinium macrocarpon*: Raspberry: *Rubus idaeus*; Sweet Gale:*Myrica gale*

The baseline soil, berry and vegetation samples were analyzed by RPC Laboratories in Fredericton, NB for available metals (see Appendix A for laboratory data sheets). Analytical results from these samples are provided in Tables 3-3 (soil), 3-4 (berry) and 3-5 (vegetation).

Table 3-3 Baseline Soil Metal Concentrations in mg/kg (dry weight)

Total Metals by ICPMS	# Detected (of 11)	Min	Max	Average	90th Percentile
Aluminum	11	2060	27400	9402	22400
Antimony	0	<0.1	<0.1	NC	NC
Arsenic	7	<1	14	4	10
Barium	11	6	49	21.8	35
Beryllium	5	<0.1	0.5	0.145	0.4
Bismuth	1	<1	1	0.545	0.5
Boron	6	<1	3	1.41	3
Cadmium	11	0.01	0.16	0.0673	0.11
Calcium	11	90	830	306	610
Chromium	11	2	26	10.2	21
Cobalt	11	0.3	20	4.36	10.2
Copper	10	<1	11	4.23	10
Iron	11	1340	44700	15571	32400
Lead	11	2.9	16.6	9.3	16.4
Lithium	11	1.2	53.9	11.6	29.6

Magnesium	11	210	4500	1532	2850
Manganese	11	27	3450	543	801
Mercury	11	0.01	0.16	0.0627	0.1
Molybdenum	4	<0.1	0.8	0.223	0.5
Nickel	10	<1	18	6.32	14
Potassium	11	120	1020	435	870
Rubidium	11	1.5	26.3	7.96	15
Selenium	3	<1	2	0.909	2
Silver	2	<0.1	0.3	0.0773	0.1
Sodium	2	<50	60	30.5	50
Strontium	11	2	10	6	9
Tellurium	0	<0.1	<0.1	NC	NC
Thallium	1	<0.1	0.2	0.0636	0.05
Tin	0	<1	<1	NC	NC
Uranium	11	0.2	1.2	0.509	0.9
Vanadium	11	3	40	18.6	35
Zinc	11	2	57	17.2	36
Carbon - Organic	11	0.83	9.58	4.07	7.11

Notes:
n = 11
Averages and 90th percentiles were calculated assuming chemicals which were not detected were present at ½ of the detection limit
< sign indicates chemical was not detected, value provided is the reportable detection limit
NC – indicates not calculated. Chemical was not detected in any samples.

Table 3-4 Baseline Berry Metal Concentrations in mg/kg (wet weight)

Total Metals by ICPMS	*# Detected (of 11)*	*Min*	*Max*	*Average*	*90th Percentile*
Aluminum	11	0.2	3.3	1.52	3.1
Antimony	0	<0.005	<0.005	NC	NC
Arsenic	0	<0.02	<0.02	NC	NC
Barium	11	0.52	2.93	1.50	2.55
Beryllium	0	<0.005	<0.005	NC	NC
Bismuth	0	<0.05	<0.05	NC	NC
Boron	11	0.64	3.24	1.85	3.05
Cadmium	9	<0.0005	0.0271	0.0124	0.0268
Calcium	11	136	648	281	424
Chromium	10	<0.02	0.11	0.0509	0.08
Cobalt	7	<0.002	0.052	0.0111	0.024
Copper	11	0.25	1.72	0.82	1.16
Iron	11	1	8	4.18	6
Lead	6	<0.002	0.013	0.00282	0.003

Lithium	7	<0.002	0.012	0.00318	0.006
Magnesium	11	70.8	412	220	350
Manganese	11	1.76	112	54.8	97.3
Mercury	0	<0.01	<0.01	NC	NC
Molybdenum	11	0.009	0.052	0.0287	0.046
Nickel	11	0.04	0.82	0.302	0.56
Potassium	11	752	2310	1533	2230
Rubidium	11	2.64	20.1	8.66	13.7
Selenium	0	<0.05	<0.05	NC	NC
Silver	0	<0.005	<0.005	NC	NC
Sodium	11	5	27	15.5	22
Strontium	11	0.87	8.68	2.33	3.72
Tellurium	0	<0.002	<0.002	NC	NC
Thallium	0	<0.002	<0.002	NC	NC
Tin	11	0.017	3.63	0.952	2.15
Uranium	0	<0.002	<0.002	NC	NC
Vanadium	0	<0.02	<0.02	NC	NC
Zinc	11	0.68	5.51	2.19	4.16
% Moisture	--	81.3	91.9	85.1	88.8

Notes:
n = 11
Averages and 90th percentiles were calculated assuming chemicals which were not detected were present at ½ of the detection limit
< sign indicates chemical was not detected, value provided is the reportable detection limit
NC – indicates not calculated. Chemical was not detected in any samples.

Table 3-5 Baseline Vegetation (Leaves) Metal Concentrations in mg/kg (wet weight)

Total Metals by ICPMS	*# Detected (of 11)*	*Min*	*Max*	*Average*	*90th Percentile*
Aluminium	11	7.6	208.0	46.2	70.6
Antimony	0	<0.005	<0.005	NC	NC
Arsenic	1	<0.02	0.04	0.013	0.010
Barium	11	8.5	46.5	24.3	37.4
Beryllium	0	<0.005	<0.005	NC	NC
Bismuth	0	<0.05	<0.05	NC	NC
Boron	11	8.4	25.1	13.3	19.0
Cadmium	11	0.0009	0.0765	0.0274	0.0593
Calcium	11	1150	8910	3196	4120
Chromium	11	0.03	0.14	0.059	0.08
Cobalt	11	0.005	0.069	0.0249	0.053
Copper	11	0.62	3.39	1.66	2.35
Iron	11	17	43	25.3	34.0
Lead	11	0.009	0.327	0.048	0.045
Lithium	11	0.006	0.149	0.027	0.036
Magnesium	11	570	2610	1217	1840
Manganese	11	30.5	1440	751	1430
Mercury	0	<0.01	<0.01	NC	NC
Molybdenum	11	0.01	0.119	0.0481	0.0870
Nickel	11	0.14	0.94	0.57	0.88
Potassium	11	980	3270	2232	3250
Rubidium	11	3.28	25.8	9.0	14.6
Selenium	1	<0.05	0.11	0.0327	0.0250
Silver	0	<0.005	<0.005	NC	NC
Sodium	11	6.0	365.0	44.4	23.0
Strontium	11	8.0	68.1	24.1	30.6
Tellurium	0	<0.002	<0.002	NC	NC
Thallium	4	<0.002	0.0220	0.0034	0.0040
Tin	11	0.006	0.062	0.023	0.055
Uranium	0	<0.002	<0.002	NC	NC
Vanadium	3	<0.02	0.05	0.02	0.04
Zinc	11	2.5	13.3	6.6	11.0
% Moisture	--	55.8	78.2	68.1	77.3

Notes:
n = 11
Averages and 90th percentiles were calculated assuming chemicals which were not detected were present at ½ of the detection limit

< sign indicates chemical was not detected, value provided is the reportable detection limit
NC – indicates not calculated. Chemical was not detected in any samples.

To characterize baseline soil, berry and vegetation concentrations, the 90th percentile value from Tables 3-3, 3-4 and 3-5 were used in the assessment, respectively. Where chemical concentrations were not detected in any soil samples, ½ of the detection limit was used in the assessment. Where chemical concentrations were not detected in any berry or leafy vegetation samples, baseline concentrations were predicted using literature-based bio concentration factors from the US EPA OSW (2005) and Baes et al. (1984).

3.3 Surface Water

Baseline surface water quality data is available from the FMS Mine Study area. The baseline surface water quality program was initiated in July 2017 and was later expanded in the following quarter. The program included the analysis of routine field parameters (temperature, pH, conductivity, total dissolved solids, turbidity, dissolved oxygen, and salinity), general chemistry, total metals, and total mercury, and now includes dissolved mercury. The monitoring program was revised in September 2018 to include a supplementary monitoring station (SW14) and more comprehensive list of analytical parameters applicable to baseline studies. Overall, the baseline surface water quality program comprised of a total of fifteen stations, thirteen of which were monitored per quarter, and two stations (SW13-S and SW13-D) that targeted water quality profiling in the deep water of the Anti-Dam Flowage (reservoir) (see Golder, 2019; and Figure 3-2). Although baseline water quality monitoring was conducted at multiple sites in the FMS study area, only baseline data for the FMS receiving environment of Anti Dam flowage (i.e., EMZ-2, and SW6) are discussed below, since these stations are most relevant for recreational water usage. Figure 3-3 presents the sampling stations (TMF pond effluent is station EMZ-2). Table 3-6 presents data for EMZ-2 (N=9), and Table 3-7 present data for SW6. Further discussion of the recreational water assessment is provided in Section 7.

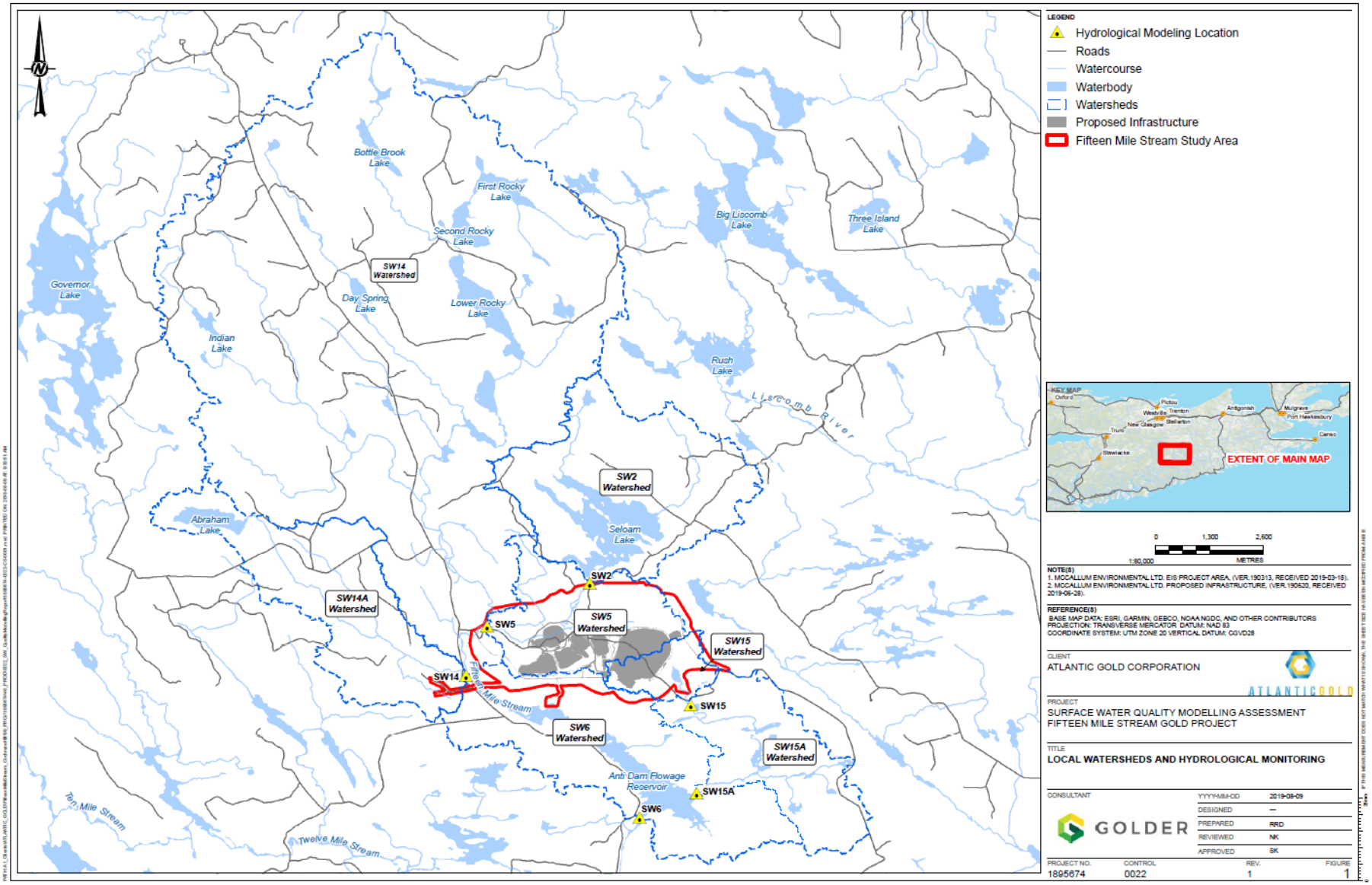

Figure 3-2 Local Watersheds and Hydrological Monitoring Locations

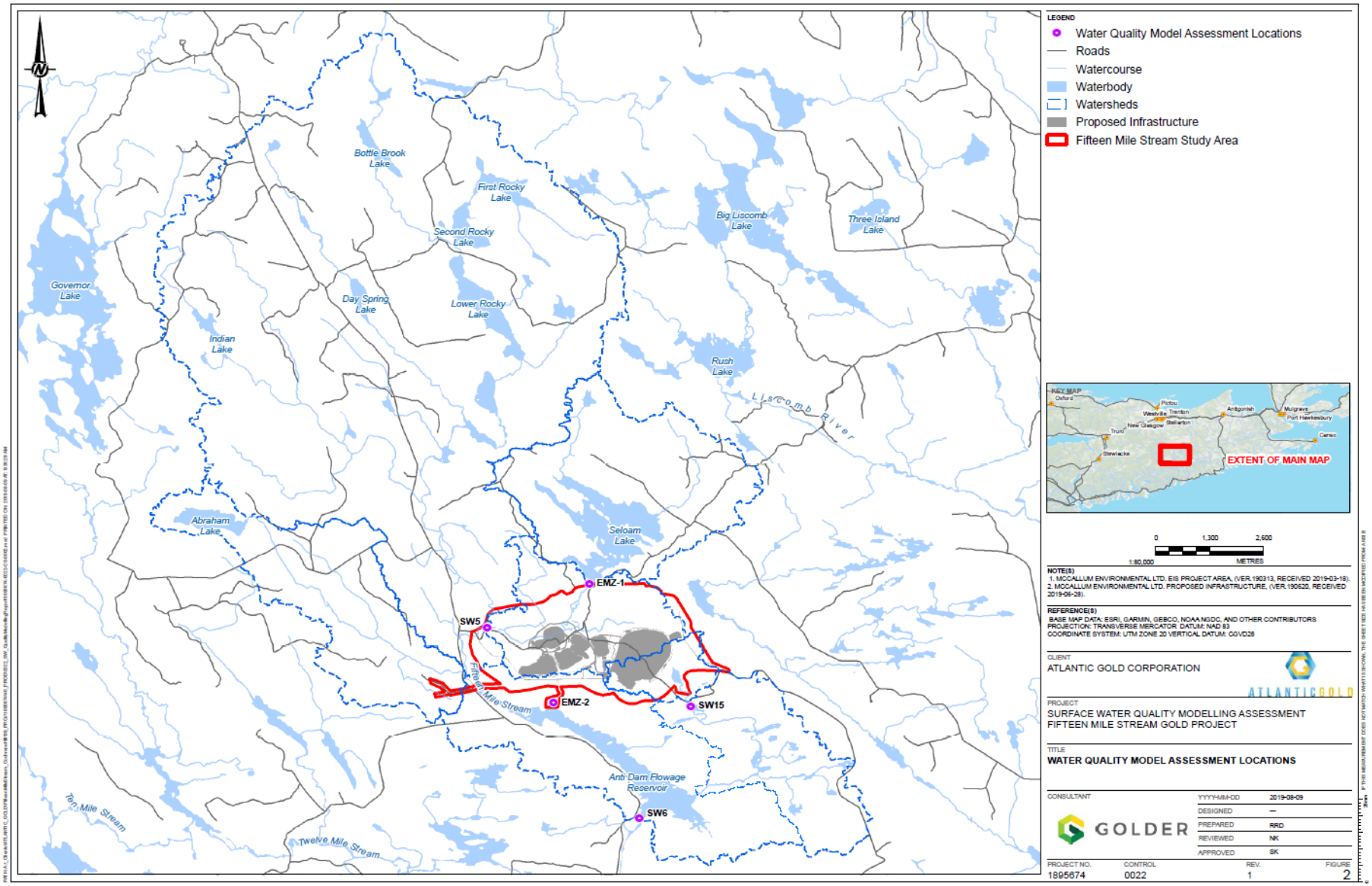

Figure 3-3 Water Quality Model Assessment Locations

Table 3-6 Baseline Surface Water Concentrations Collected from EMZ-2 (Total Metals mg/L; N = 13)[a]

Parameter	Min	Max	Mean	75th percentile	95th percentile	# of Non-Detects
Aluminium	0.1	0.3	0.21	0.25	0.29	0/13
Antimony	<0.001	<0.001	0.0005	0.00050	0.0005	13/13
Arsenic	<0.002	0.033	0.0062	0.0048	0.026	1/13
Boron	<0.05	<0.05	0.025	0.025	0.025	13/13
Cadmium	<0.00001	0.000026	0.000017	0.000022	0.000024	1/13
Chromium	<0.001	0.0012	0.00055	0.00050	0.00078	12/13
Cobalt	<0.0004	<0.0004	0.0002	0.00020	0.00020	13/13
Copper	<0.0005	<0.002	0.00077	0.0010	0.0010	13/13
Iron	0.15	1.3	0.36	0.33	0.87	0/13
Lead	<0.0005	0.00075	0.00029	0.00025	0.00045	12/13
Manganese	0.054	0.095	0.067	0.072	0.085	0/13
Mercury	<0.000013	<0.000013	0.0000065	0.0000065	0.0000065	13/13
Molybdenum	<0.002	<0.002	0.001	0.001	0.001	13/13
Nickel	<0.002	<0.002	0.001	0.001	0.001	13/13
Selenium	<0.001	<0.001	0.0005	0.0005	0.0005	13/13
Silver	<0.0001	<0.0001	0.00005	0.00005	0.00005	13/13
Thallium	<0.0001	<0.0001	0.00005	0.00005	0.00005	13/13
Uranium	<0.0001	<0.0001	0.00005	0.00005	0.00005	13/13
Zinc	<0.005	<0.005	0.0025	0.0025	0.0025	13/13

Notes:
[a] Summary statistics were calculated using half the detection limit value when a chemical was not detected in a sample.

Table 3-7 Baseline Surface Water Concentrations Collected from SW6 (Total Metals mg/L; N = 9)[a]

Parameter	Min	Max	Mean	75th percentile	95th percentile	# of Non-Detects
Aluminium	0.17	0.3	0.22	0.25	0.29	0/9
Antimony	<0.001	<0.001	0.0005	0.0005	0.0005	9/9
Arsenic	<0.002	0.021	0.0044	0.0045	0.015	1/9
Boron	<0.05	<0.05	0.025	0.025	0.025	9/9
Cadmium	0.000011	0.000026	0.000017	0.00002	0.000024	0/9
Chromium	<0.001	<0.001	0.0005	0.0005	0.0005	9/9
Cobalt	<0.0004	<0.0004	0.0002	0.0002	0.0002	9/9
Copper	<0.0005	<0.002	0.00083	0.001	0.001	9/9
Iron	0.15	1.3	0.40	0.33	1.0	0/9
Lead	<0.0005	0.00075	0.00031	0.00025	0.00055	8/9
Manganese	0.054	0.079	0.065	0.068	0.076	0/9
Mercury	<0.000013	<0.000013	0.0000065	0.0000065	0.0000065	9/9

Molybdenum	<0.002	<0.002	0.001	0.001	0.001	9/9
Nickel	<0.002	<0.002	0.001	0.001	0.001	9/9
Selenium	<0.001	<0.001	0.0005	0.0005	0.0005	9/9
Silver	<0.0001	<0.0001	0.00005	0.00005	0.00005	9/9
Thallium	<0.0001	<0.0001	0.00005	0.00005	0.00005	9/9
Uranium	<0.0001	<0.0001	0.00005	0.00005	0.00005	9/9
Zinc	<0.005	<0.005	0.0025	0.0025	0.0025	9/9

Notes:
[a] Summary statistics were calculated using half the detection limit value when a chemical was not detected in a sample.

4 GEOCHEMISTRY OF DUST AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

4.1 Geochemistry Characterization of Future Dust

The source material for mine site interior haul road construction could include either local quarry materials, or waste rock from the Fifteen Mile Stream Mine Site. Geochemistry data from waste rock at Fifteen Mile Stream Mine Site was used to characterize metals concentrations on dust.

Lorax (2018) conducted geochemistry analysis on 14 samples of waste rock. To characterize metals concentrations on dust, an average concentration (geometric mean) was calculated for each element, and this value was converted from a mg/kg (ppm) concentration to percent. Non-detected elements were assumed to be present at one-half of the detection limit for these calculations. Appendix B provides the raw geochemistry data, statistical analysis, and final percent concentrations calculated to represent elemental levels on dust.

4.2 Selection of Chemicals of Potential Concern (COPCs)

The selection of COPCs for the evaluation of particulate-based exposures and deposition onto soils and vegetation and potential uptake into country foods considers both the potential chemistry of the dust (based on waste rock chemistry), as well as the baseline chemistry of selected media, such as soil, berries, and leaves. Waste rock were analyzed for a suite of thirty-five (35) metals (see Appendix B); whereas, soil, berries, and leaves were analyzed for a suite of thirty-two (32) metals (see Section 2.0; Appendix A).

To identify COPCs for the assessment, both datasets were examined. Select metals were excluded as COPC in the assessment due to the following reasons:

- Several elements are essential nutrients, and hence are regulated by the body and unlikely to be associated with adverse health effects (*i.e.*, calcium, iron, magnesium, phosphorus, potassium, and sodium) (US EPA, 2014);
- Other elements were not detected in any of the waste rock samples or were only detected in one (1) of seventeen (17) waste rock samples (*i.e.*, beryllium, bismuth, boron, cadmium, mercury, silver, thallium, thorium, tungsten, and uranium). These circumstances were considered to not represent situations meriting further investigation, since the element is below detection limits within the source material of the dust. Likewise, antimony was only detected in two (2) of seventeen (17) samples and the percentage in ore is very low (0.00011%). Therefore, antimony was not considered for further assessment;
- Some elements are considered to be of low toxicity relative to human health (*i.e.*, sulfur and titanium); and therefore were not considered further. Titanium (in the form of titanium dioxide) is approved as a food additive by JECFA, SCF, and EFSA and reportedly there are no safety concerns associated with the use of this compound at concentrations ranging up to 3% (US EPA, 2005);
- Some elements were analyzed in environmental media but were not analyzed in waste rock samples (*i.e.*, lithium, rubidium, selenium, tellurium, and tin). These elements were

excluded due to the lack of data to predict future media concentrations from the deposition of dust. Although there is some uncertainty with this exclusion, these elements are unlikely to be dominant in the dust, and, were either not detected or detected at low levels in environmental media; and,

- Several elements were analyzed in the waste rock samples but have no environmental baseline data in either soils or berries. These elements include gallium, lanthanum, and scandium. The percent of these elements on dust is low (gallium: 0.0008%; lanthanum: 0.0023%; scandium: 0.00031%; see Appendix B), and hence, these elements were not considered to represent COPC as the incremental future concentrations would be very low.

The remaining elements were identified as COPCs and carried forward in the assessment to predict possible incremental changes to air, soil and vegetation (see Table 4-1). The percent composition of these elements within the waste rock is also presented in Table 4-1.

For COPCs in surface waters, predicted future water concentrations in Anti Dam Flowage provided by Golder (2019) were screened against CDWQG to identify possible COPCs associated with recreational water usage. This screening was conducted in Section 7 and did not identify COPCs associated with recreational water usage (see Section 7.1).

The COPC list presented in Table 4-1 identifies those substances identified through dust deposition as well as recreational swimming screening. Note that any COPC identified was assessed via all oral pathways (i.e., even though barium was only identified as a potential concern via dust pathways, potential contributions from recreational water usage were also included in the assessment).

Table 4-1 Chemicals Considered in the Screening Level Risk Assessment (Dust Sources and Recreational Water Usage)

Chemicals of Potential Concern	*COPC Pathway*	*Percent Composition in Waste Rock*
Aluminum	Dust	1.61E+00
Arsenic	Dust	1.73E-02
Barium	Dust	4.40E-03
Chromium	Dust	2.53E-03
Cobalt	Dust	1.24E-03
Copper	Dust	2.55E-03
Lead	Dust	8.19E-04
Manganese	Dust	6.82E-02
Molybdenum	Dust	5.80E-05
Nickel	Dust	2.69E-03
Strontium	Dust	2.36E-03
Vanadium	Dust	2.64E-03
Zinc	Dust	6.37E-03

5 AIR DISPERSION PREDICTIONS

5.1 Air Dispersion Analysis

The Project has the potential to generate dusts related to the surface mining operation at the FMS Mine Site, as well as the operations related to crushed ore transport via truck. The vast majority of these dusts are expected to be generated from the mining, transportation, and stockpiling of ore. Wood (2019) has conducted an air dispersion analysis of various emissions from the operations of the Project. The approach for modelling future emissions is outlined in detail in Wood (2019, and includes the use of the AERMOD model, in conjunction with 5 years of meteorological data from Halifax Airport (2007 – 2012). Emissions from activities at the Mine were estimated using standard sources from the US EPA. Dispersion modelling results for Criteria Air Contaminants and dust deposition were generated.

5.2 Selection of PM_{10} and $PM_{2.5}$ Concentrations for Metals Air Inhalation Assessment

To enable an assessment of potential exposures of metals adhered to particulate matter, 24 hour ground level air concentrations of PM_{10} and $PM_{2.5}$ were identified for assessment purposes from modelling conducted by Wood (2019). Maximum ground level air concentrations in areas outside of the Project Development Area (PDA) (also known as Max Point of Impingement or Max POI values) at the mine site boundary were identified as follows, and were used to characterize potential exposures associated with the FMS Mine Site (see Section 6):

- Max POI 24 hour PM_{10}: 98.8 µg/m^3 (see Figure 5-1)
- Max POI 24 hour $PM_{2.5}$: 10.1 µg/m^3 (see Figure 5-2)

Baseline PM10 and PM2.5 concentrations were identified from Table 3-1.

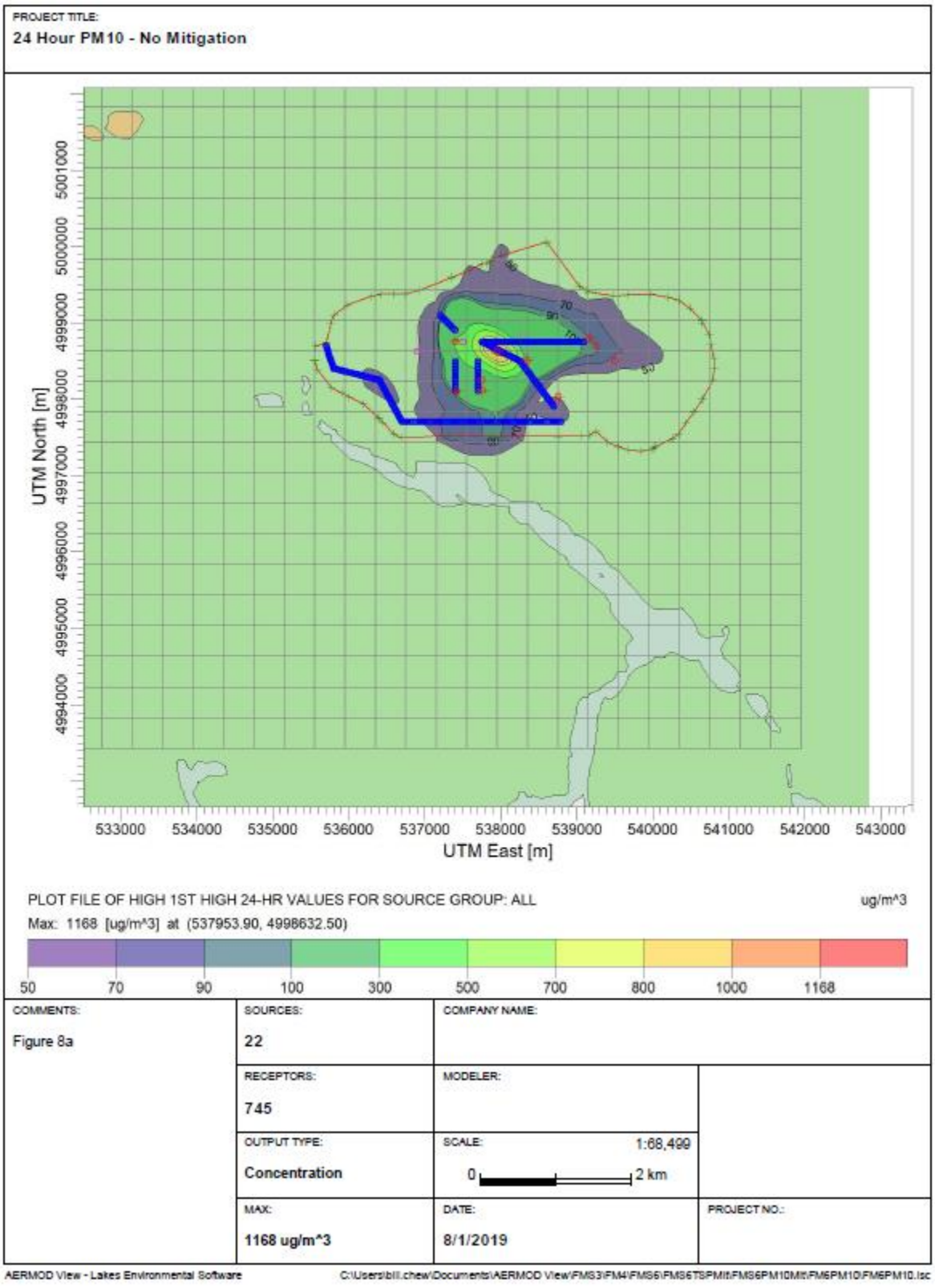

Figure 5-1 PM10 24 Hour Air Concentrations with No Mitigation

Note: Maximum identified on figure is the max PM10 within the mine property boundary

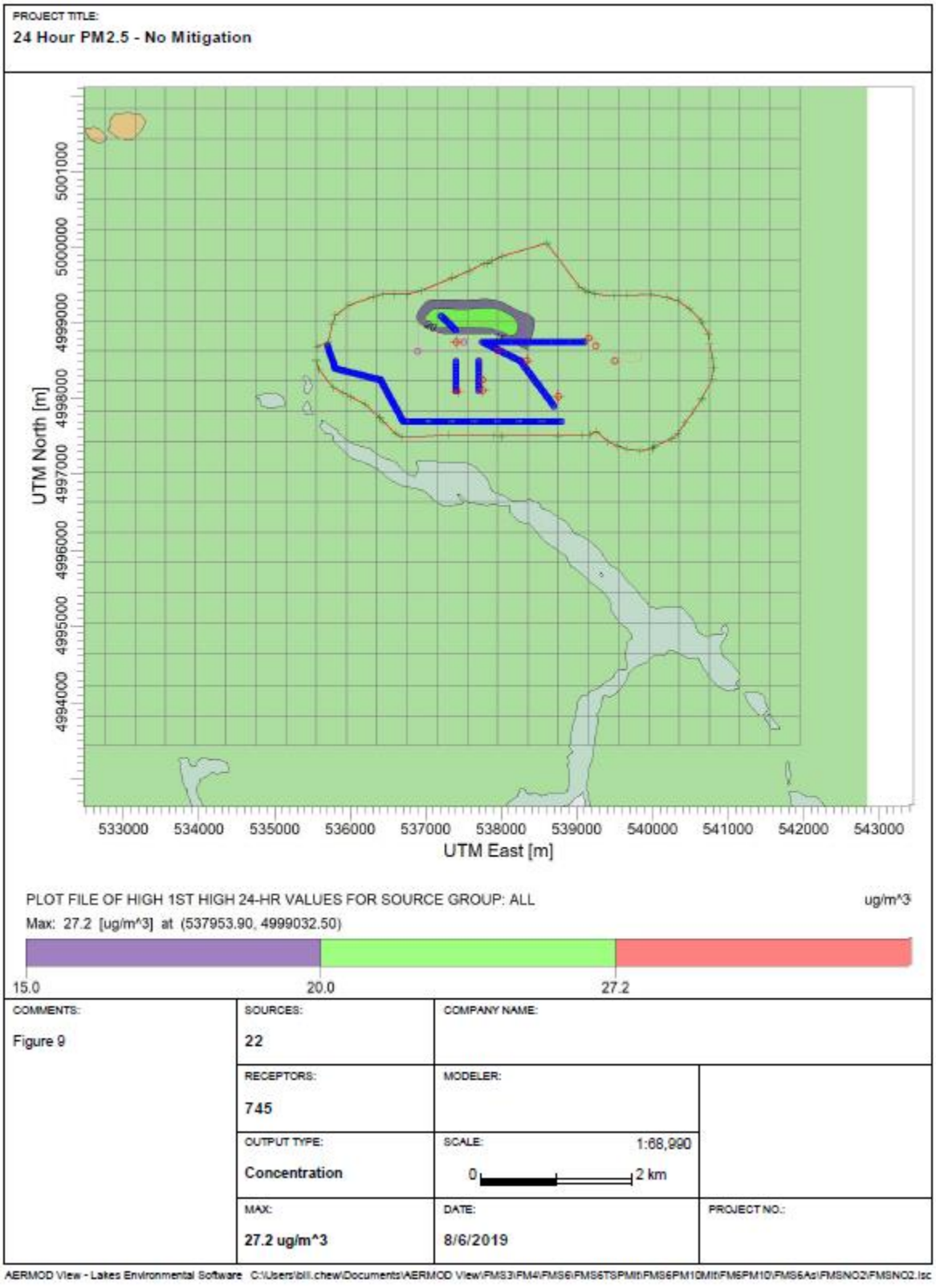

Figure 5-2 PM2.5 24 Hour Air Concentrations with No Mitigation

Note: Maximum identified on figure is the max PM2.5 within the mine property boundary

5.3 Selection of Dust Deposition Rates for Future Predictions

Based on the dust deposition predictions provided by Wood (2019) for the operational time frame, dusts are expected to settle in areas inside and outside of the PDA near the FMS area. Dusts released from operational activities will be transported by air and will deposit on local soils and vegetation. The metals present in the dust will add to naturally occurring metals in soils and have the potential of being taken up into vegetation through root uptake. In addition, dusts will also deposit directly on vegetation. Some foliar uptake may occur but this is likely limited. Direct ingestion of dusts on vegetation is possible for both humans and wildlife. Based on this, humans have a potential to be exposed to dusts via consumption of food sources within areas near the mine. Since the areas inside the PDA have restricted access in terms of foraging (due to safety reasons), upper bound estimates of dust deposition were selected for areas either at the PDA boundary, or close to the PDA boundary, for assessment purposes.

In order to predict possible future soil concentrations in areas near the Mine Site and transportation areas, dust deposition rates had to be identified for modelling purposes. As discussed in Section 5.1, Wood modelled dust deposition for the operational period. Therefore, for the assessment of potential impacts, two scenarios were considered, as follows, based on modelling conducted by Wood (2019; Table 5-4):

- For the mine site boundary, a dustfall rate of 1.4 g/m^2/year was selected. This rate represents the maximum annual TSP deposition at the mine site boundary over 6 years of mine operation, and hence represents a highly conservative exposure scenario (see Figure 5-3).
- A dustfall rate of 0.35 g/m^2/year was also selected, which represents the maximum annual dust deposition rate at 1 km from the mine site boundary over 6 years of mine operation.

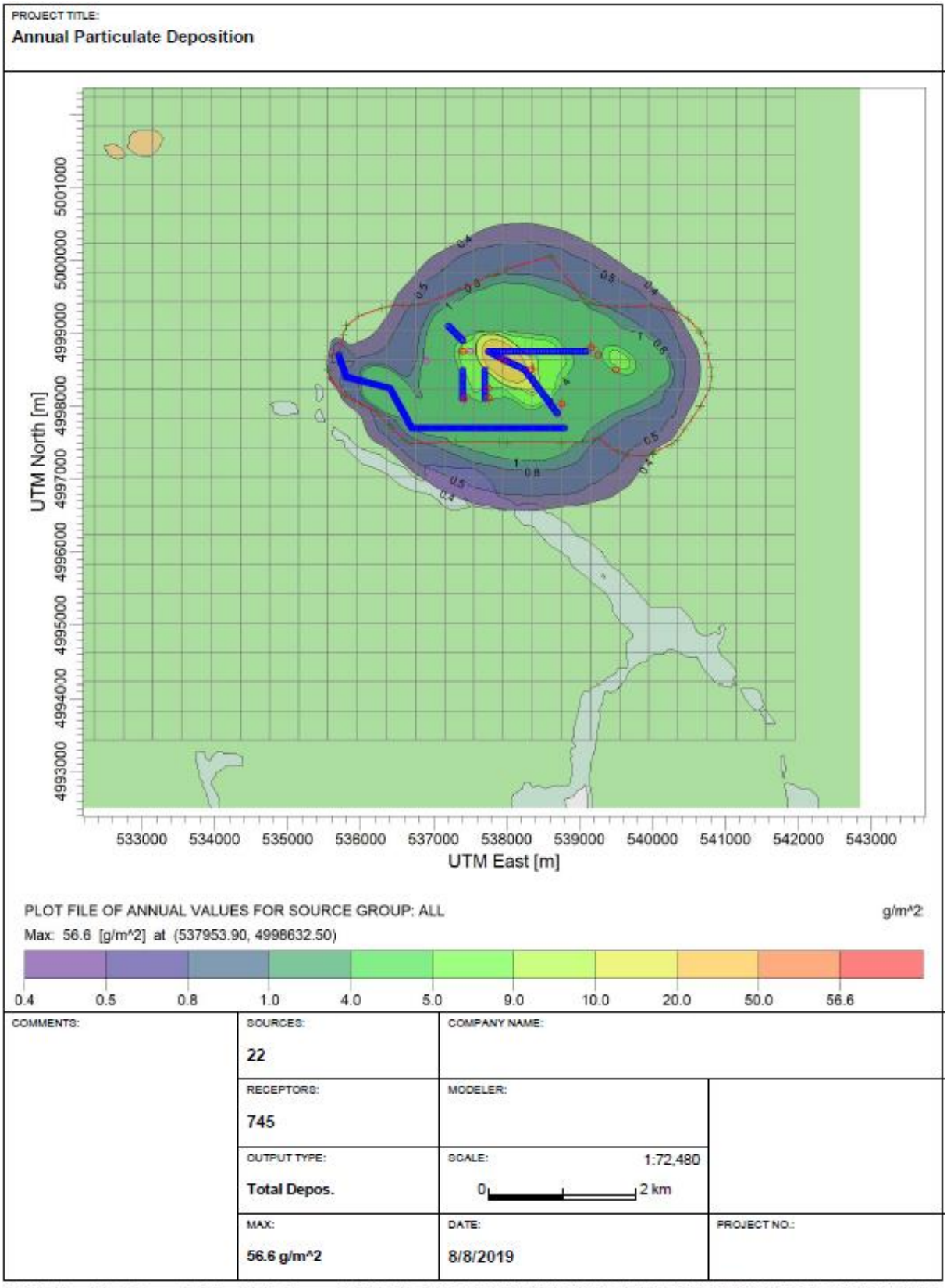

Figure 5-3 Annual TSP Deposition at Fifteen Mile Stream

Note: Maximum identified on figure is the max deposition within the mine property boundary

Table 5-1 provides the selected dust deposition rates, and assessment of potential future soils and vegetation are provided in Section 8.0.

Table 5-1 Deposition Rates at Various Receptor Locations

Location	*Statistic*	*Deposition Rate ($g/m^2/year$)*
Mine site boundary	Maximum annual deposition over 6 years (MPOI)	1.4
1 km from mine site boundary	Maximum annual deposition over 6 years	0.35

6 METALS INHALATION RISK ASSESSMENT

6.1 Methods

The assessment of potential exposures to metals on particulate matter involves calculation of baseline metals concentrations in ambient air (as measured metals on PM10 and PM2.5 are not available), as well as prediction of the incremental project concentration (Project Alone), and the Baseline + Project scenario. Health Canada guidance was considered in this assessment (Health Canada, 2016a). Each of these scenarios is discussed as follows:

- **Baseline:** Measured baseline concentrations of 24-hour PM10 are available from the study area. As such, the average measured PM10 value of 9.7 µg/m^3 from the Fifteen Mile Stream and Cochrane Hill areas was assumed as the baseline (Wood, 2019; Section 2.2). No measured baseline was available for PM2.5, and hence, PM2.5 was assumed to equal to the highest monitored PM2.5 value at Seal Harbour over three 24-hour periods in July, August, and September 2004 (4 µg/m^3), near to FMS (approximately 60 km to the east). As measured annual average baseline data is limited and is not available from the FMS area nor Seal Harbour, the annual average PM2.5 value was assumed to equal that monitored at Aylesford station (5.7 µg/m^3) (Wood, 2019). To predict baseline metals concentrations on the PM, the geochemistry of dustfall from the Mine area was used. The specific geochemistry fractions were developed and are provided in Appendix B. These fractions were applied to the baseline PM10 and PM2.5 data, to estimate metals-specific baseline air concentrations. It is recognized that the baseline metals composition on PM2.5 and PM10 may be different than that estimated in this project, but since the area is naturally enriched in metals, it is anticipated that this approach is a reasonable surrogate in the absence of site-specific data. Note there are no other Projects in the vicinity of this Project that would be anticipated to influence baseline concentrations (the Beaver Dam project is 20 km away, and hence, would not be expected to add to the exposures experienced from this mine pit).
- **Project Alone:** To calculate potential exposures to metals in areas near the PDA where local land users could spend time, Maximum predicted ground level air concentrations were used to characterize upper bound exposures (see Wood, 2019; Table 5-1). The site-specific geochemistry fractions for the Mine Site (from Section 4.0) were applied to these selected concentrations, to estimate possible Project Alone exposure concentrations to metals in ambient air. For PM2.5, a concentration of 10.1 µg/m^3 was selected at the Mine Site boundary for the 24 hr assessment (Max POI value for 24-hr PM2.5 at the Property boundary) and a concentration of 0.59 µg/m^3 was selected at the Mine site boundary for the long-term assessment (Max POI value for annual PM2.5 at the Property boundary). For PM10, a concentration of 98.8 µg/m^3 was selected for the 24-hr assessment (Max POI value for 24-hr PM10 at the Property boundary).
- **Project + Baseline:** The estimated baseline metals air concentrations were added to the estimated Project alone increment, to calculate an estimated total concentration for each metal in air.

- **Ambient Air Quality Guidelines (Short Term Exposure Assessment):** To assess the predicted concentrations from an acute or short-term perspective, 24 hour ambient air quality criteria were selected from Ontario.
- **Chronic TRVs**: To conduct the chronic air inhalation assessment, chronic inhalation toxicity reference values (TRV) that are defined as reference concentrations (RfC) for non-carcinogenic metals or risk-specific concentrations (RsC) for carcinogenic compounds, were identified from Health Canada (2010), or, in the absence of a TRV from Health Canada, other regulatory agency TRVs were sought, such as those from United States Environmental Protection Agency's Integrated Risk Information System (US EPA IRIS). If values were not available from Health Canada or US EPA, then the most defensible value from Agency for Toxic Substances & Disease Registry (ATSDR), National Institute of Public Health and the Environment (RIVM), California Office of Environmental Health Hazard Assessment (OEHHA) or World Health Organization (WHO) was selected. Lastly, if these agencies did not recommend a TRV for a metal then the Texas Commission on Environmental Quality (TCEQ) Effects Screening Levels (ESLs) were selected. Table 6-1 presents the chronic TRVs that were selected for the assessment.

Table 6-1 Chronic Inhalation TRVs Selected for the Inhalation Assessment

Metals	*Chronic TRV is an RfC / RsC [ug/m^3][(a)]*	*Endpoint*	*Reference / Comment*
Aluminum	5	Health (not specified)	TCEQ ESL 2016
Arsenic	0.0016	Lung cancer	Health Canada 2010
Barium	1	Hematological effects and cardiovascular effects	RIVM 2001
Chromium (III)	0.14	Respiratory irritation	TCEQ 2009
Cobalt	0.1	Respiratory irritation	ATSDR 2004
Copper	1	Respiratory and immunological effects	RIVM 2001
Lead	0.5	Haematological effects or neurological disturbances	RfC WHO 2000
Manganese	0.05	Impairment of neuro-behavioural function	USEPA 1993
Molybdenum	12	Changes in body weight	RIVM 2001
Nickel	0.0077	Lung cancer	Health Canada 2010
Strontium	2	Health (not specified)	TCEQ ESL 2016
Vanadium	0.1	Respiratory irritation	ATSDR 2012
Zinc	2	Health (not specified)	TCEQ ESL 2016

Notes: n/a = not available

(a) RsC based on 1 in 100,000 risk level (Health Canada 2010).

(b) Selected lowest TRV of available chemicals forms to be conservative.

6.2 Results

Tables 6-2 and 6-3 present the estimated exposures to ambient metals on PM10 and PM2.5, respectively, in the baseline, project, and baseline + project scenarios, based on Maximum POI

predicted concentrations at the Property boundary (24 hour, or daily exposures). These exposure concentrations are compared against Ontario 24-hour ambient air benchmark concentrations from the OMOE (2012). In addition, Table 6-4 presents the estimated exposure to long-term ambient metals on PM2.5 in the baseline, project, and baseline + project scenarios, based on Maximum POI predicted concentrations at the Property boundary (annual exposures).

The results of this assessment indicate that all estimated exposures based on ambient metals on PM10 and PM2.5 are orders of magnitude below Ontario 24-hour ambient air benchmark concentrations as well as chronic TRVs (assessed based on ambient metals on PM2.5). It should be noted that the chronic inhalation assessment, using annual average PM2.5 concentrations, is considered to be highly conservative as no one lives near the property boundary to which exposure was assumed. Therefore, given that no chemical exceedances were identified based on the Maximum POI predicted concentrations at the Property boundary, particulate concentrations resulting from emissions at the FMS Mine Site area are unlikely to present inhalation risks to receptors in the FMS study area.

Table 6-2 Estimated Short Term Exposures to Ambient Metals on Particulate (PM10) in Fifteen Mile Stream Mine Site Study Area – Max POI at Property Boundary

Metals	*Ontario 24 Hour Benchmark (µg/m³)*	*Baseline PM10[1] (µg/m³)*	*Mine outside PDA (PM10)*		
			% Metals on dust - Mine	*Project Increment PM10 (98.8 µg/m³)[2,3]*	*Baseline+Project (Column C+E) (µg/m³)*
Aluminum	12	0.156	1.61	1.59	1.75
Arsenic	0.3	0.001678	0.0173	0.0171	0.0188
Barium	10	0.000427	0.0044	0.00435	0.00477
Chromium (III)	0.5	0.000245	0.00253	0.00250	0.00275
Cobalt	0.1	0.000120	0.00124	0.00123	0.00135
Copper	50	0.000247	0.00255	0.00252	0.00277
Lead	0.5	0.0000794	0.000819	0.000809	0.000889
Manganese	0.2	0.00662	0.0682	0.0674	0.0740
Molybdenum	120	0.00000563	0.000058	0.0000573	0.0000629
Nickel	0.1	0.000261	0.00269	0.00266	0.00292
Strontium	120	0.000229	0.00236	0.00233	0.00256
Vanadium	2	0.000256	0.00264	0.00261	0.00286
Zinc	120	0.000618	0.00637	0.00629	0.00691

Notes:

** All Ontario guidelines were from 'Ontario's Ambient Air Quality Criteria' April 2012. The limiting effect for all metals were "Health", except for Aluminum and Zinc, which were "Particulate". For chemicals where multiple ambient air quality criteria (AAQC) are available from the OMOE (2012), the following AAQC were selected for use: the AAQC for manganese (Mn) is the AAQC for Mn in PM10; the AAQC for nickel (Ni) is the AAQC for Ni in PM10; and, the AAQC for uranium (U) is the AAQC for U in PM10.

[1] Baseline Value is based on the average measured baseline PM10 value of 9.7 µg/m³ from Fifteen Mile Stream and Cochrane Hill

[2] Percent composition of particulates based on site geochemistry data

[3] Project values selected from Wood (2019)

Bolded and shaded values indicate an exceedance of the OMOE (2012) air quality guidelines

Table 6-3 Estimated Short Term Exposures to Ambient Metals on Particulate (PM2.5) in Fifteen Mile Stream Mine Site Study Area – Max POI at Property Boundary

Metals	*Ontario 24 Hour Benchmark (µg/m³)*	*Baseline PM2.5[1] (µg/m³)*	*Mine outside PDA (PM2.5)*		
			% Metals on dust - Mine[2]	*Project Increment PM2.5 (10.1 µg/m³)[2, 3]*	*Baseline+Project (Column C+E) (µg/m³)*
Aluminum	12	0.0644	1.61	0.163	0.227
Arsenic	0.3	0.000692	0.0173	0.00175	0.00244
Barium	10	0.000176	0.0044	0.000444	0.000620
Chromium (III)	0.5	0.0001012	0.00253	0.000256	0.000357
Cobalt	0.1	0.0000496	0.00124	0.000125	0.000175
Copper	50	0.000102	0.00255	0.000258	0.000360
Lead	0.5	0.0000328	0.000819	0.0000827	0.000115
Manganese	0.1	0.00273	0.0682	0.00689	0.00962
Molybdenum	120	0.00000232	0.000058	0.00000586	0.00000818
Nickel	0.1	0.000108	0.00269	0.000272	0.000379
Strontium	120	0.0000944	0.00236	0.000238	0.000333
Vanadium	2	0.000106	0.00264	0.000267	0.000372
Zinc	120	0.000255	0.00637	0.000643	0.000898

Notes:

** All Ontario guidelines were from 'Ontario's Ambient Air Quality Criteria' April 2012. The limiting effect for all metals was "Health", except for Aluminum and Zinc, which were "Particulate". For chemicals where multiple ambient air quality criteria (AAQC) are available from the OMOE (2012), the following AAQC were selected for use: the AAQC for manganese (Mn) is the AAQC for Mn in PM2.5; the AAQC for nickel (Ni) is the AAQC for Ni in PM10; and, the AAQC for uranium (U) is the AAQC for U in PM10.

[1] Baseline PM2.5 values were estimated at 4 µg/m^3, based on the highest monitored PM2.5 value at Seal Harbour over three 24-hour periods in July, August, and September 2004. Baseline data from FMS are not available

[2] Percent composition of particulates based on site geochemistry data

[3] Project values selected from Wood (2019)

Bolded and shaded values indicate an exceedance of the OMOE (2012) air quality guidelines

Table 6-4 Estimated Exposures to Long-Term Ambient Metals on Particulate (PM2.5) in Fifteen Mile Stream Mine Site Study Area – Max POI at Property Boundary

Metals	*Chronic TRV (µg/m³)*	*Baseline PM2.5[1] - Mine (µg/m³)*	*% Metals on dust - Mine[2]*	*Mine outside PDA (PM2.5)*	
				Project Increment PM2.5 (0.59 µg/m³)[3]	*Baseline+Project (µg/m³)*
Aluminum	5	0.0966	1.61	0.00950	0.106
Arsenic	0.0016	0.00104	0.0173	0.000102	0.00114
Barium	1	0.000264	0.0044	0.0000260	0.000290
Chromium (III)	0.14	0.000152	0.00253	0.0000149	0.000167
Cobalt	0.1	0.0000744	0.00124	0.00000732	0.0000817
Copper	1	0.000153	0.00255	0.0000150	0.000168
Lead	0.5	0.0000491	0.000819	0.00000483	0.0000540
Manganese	0.05	0.00409	0.0682	0.000402	0.00449
Molybdenum	12	0.00000348	0.000058	0.000000342	0.00000382
Nickel	0.0077	0.000161	0.00269	0.0000159	0.000177
Strontium	2	0.000142	0.00236	0.0000139	0.000156
Vanadium	0.1	0.000158	0.00264	0.0000156	0.000174
Zinc	2	0.000382	0.00637	0.0000376	0.000420

Notes:

[1] Baseline PM2.5 value is based on the annual average measured baseline PM2.5 value of 6 µg/m³ at Aylesford station in 2016. Baseline data from FMS are not available

[2] Percent composition of particulates based on site geochemistry data

[3] Project value is the maximum at site boundary from Wood (2019)

Bolded and shaded values indicate an exceedance of the chronic TRV

7 RECREATIONAL WATER QUALITY ASSESSMENT

7.1 Methods

The recreational water quality assessment was conducted based on guidance from Health Canada (2016b). Recreational waters are defined as natural and artificial waterbodies that people may use for leisure (Health Canada 2016b). The FMS Mine Site is located in a remote area and therefore, it is unlikely that receptors would often frequent the waterbodies near to the project for recreational use. However, for the purposes of the assessment, it was assumed that people may swim in nearby waterbodies and thus be exposed to water that has the potential to be impacted by the FMS Mine Project. The assessment involved identifying waterbody locations that people may use for swimming near to the project area to which surface water monitoring data was available, as well as assessing the potential risks from exposure to possible changes in water quality due to predicted impacts from the project. Nodes EMZ-2 and SW6 in the Anti Dam flowage, which is in the receiving environment of the Project (i.e., Anti Dam Flowage will receive effluent discharge from the Project), were identified to be deep enough for swimming and were used in the assessment to assess exposure via recreational water use (see Figure 3-2 and 3-3). With respect to the Touquoy area, and potential future water releases from Touquoy Mine Pit into the Moose River via a spillway, Moose River was not considered deep enough to represent an area that would be frequently used for swimming, and hence, this area was not included in the recreational swimming assessment. Water quality data for EMZ-2 and SW6 in Anti Dam flowage at the FMS Mine Site area, including predicted concentrations during operations and post closure, were obtained from Golder (2019). These concentrations were compared to Health Canada's Guidelines for Canadian Drinking Water Quality (CDWQG) (Health Canada 2017). Health Canada (2016b) states that, "*if the project will not result in any exceedance of applicable water quality guidelines or standards at the point of human consumption or exposure, it is reasonable to conclude that negative impacts on human health are not expected from exposure to drinking or recreational water*." Therefore, only chemicals with predicted concentrations that exceed the CDWQG were retained for further assessment. Metals that were identified as Chemicals of Potential Concern (COPCs) in Section 4.2, were carried forward such that potential additive exposures from recreational swimming could be considered in the oral multi pathway risk assessment model. It is worthwhile to note that comparison of water concentrations to the CDWQG in this assessment is considered to be highly conservative, as the CDWQG are chronic guidelines developed for the protection of long-term consumption of drinking water, whereas, exposures to recreational water is considered to be at a more infrequent basis to which any exposure via ingestion would be incidental.

7.2 Results

Table 7-1 presents a comparison of predicted upper case water concentrations at nodes EMZ-2 and SW6 during operations (from Golder, 2019 Table B-2) and post closure (from Golder, 2019; Table B-4) to the CDWQG. In addition, predicted water concentrations are also compared to baseline water concentrations at each of the nodes for perspective. Overall, all water quality parameters were predicted to be below CDWQG.

To further assess the potential for health risks from exposure to COPC concentrations in surface water during recreational water use (i.e., swimming), COPC identified in the selection of COPC (Section 4.2) were included in the multiple pathway exposure assessment in Section 9 and will be assessed in terms of total estimated exposure from multiple pathways (i.e., recreational water, country foods, soil and dust exposure).

Table 7-1 Comparison of Predicted Recreational Water Concentrations during Operations and Post Closure to CDWQG (Golder, 2019; upper case predictions Table B-2 and B-4)

Parameter	CDWQG [1] (MAC) mg/L	OPERATIONS						POST CLOSURE			
		95th Percentile Baseline Concentrations (mg/L)		Predicted Concentration (mg/L)				Predicted Concentration (mg/L)			
		EMZ-2	SW6	EMZ-2		SW6		EMZ-2		SW6	
				mean	95th percentile	mean	95th percentile	mean	95th percentile	mean	95th percentile
Nitrite	3	0.0050	0.0050	0.010	0.015	0.0090	0.012	0.0055	0.0060	0.0054	0.0057
Nitrate	45	0.059	0.048	0.22	0.40	0.16	0.28	0.033	0.056	0.026	0.041
Ammonia (total)	NR	0.079	0.025	0.071	0.10	0.061	0.081	0.038	0.040	0.036	0.04
Ammonia (un-ionized)	NA	0.000016	0.000013	0.0000016	0.0000022	0.0000014	0.0000018	0.00000084	0.00000089	0.00000081	0.00000085
Sulphate	NA [2]	2.1	2.6	14	25	11	18	8.9	15	6.8	11
Aluminium	NA [2]	0.29	0.29	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21
Antimony	0.006	0.00050	0.00050	0.00049	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Arsenic	0.0100	0.026	0.015	0.0063	0.0065	0.0057	0.0059	0.0065	0.0067	0.0058	0.0060
Boron	5	0.025	0.025	0.027	0.028	0.026	0.027	0.026	0.026	0.026	0.026
Cadmium	0.005	0.000024	0.000024	0.000017	0.000018	0.000017	0.000017	0.000027	0.000035	0.000024	0.000030
Chromium	0.05	0.00078	0.00050	0.00055	0.00055	0.00054	0.00054	0.00057	0.00058	0.00056	0.00057
Cobalt	NA	0.00020	0.00020	0.00023	0.00026	0.00024	0.00025	0.00052	0.00079	0.00045	0.00062
Copper	NA [2]	0.0010	0.0010	0.00077	0.00078	0.00078	0.00079	0.0010	0.0012	0.00094	0.0011
Iron	NA [2]	0.87	1.0	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.41
Lead	0.005	0.00045	0.00055	0.0002904	0.0002921	0.00030	0.00030	0.00050	0.00067	0.00045	0.00056
Manganese	NA [2]	0.085	0.076	0.069	0.071	0.068	0.069	0.078	0.087	0.074	0.080
Molybdenum	NA	0.0010	0.0010	0.0014	0.0017	0.0013	0.0015	0.0012	0.0014	0.0012	0.0013

Nickel	NA	0.0010	0.0010	0.0015	0.0020	0.0014	0.0017	0.0029	0.0045	0.0024	0.0034
Selenium	0.0500	0.00050	0.00050	0.00051	0.00052	0.00051	0.00051	0.00051	0.00052	0.00051	0.00051
Silver	NR	0.00005	0.00005	0.000049	0.000050	0.000049	0.000050	0.000050	0.000050	0.000050	0.000050
Thallium	NA	0.00005	0.00005	0.000049	0.000050	0.000050	0.000050	0.000052	0.000053	0.000051	0.000052
Uranium	0.02	0.00005	0.00005	0.00018	0.00028	0.00014	0.00021	0.00012	0.00019	0.00010	0.000144
Zinc	NA[2]	0.0025	0.0025	0.0027	0.0028	0.0027	0.0028	0.0041	0.0055	0.0037	0.0046
Mercury	0.001	0.000010	0.000010	0.0000070	0.0000070	0.0000070	0.0000070	0.0000074	0.0000077	0.0000073	0.0000075

Notes: Predictions were provided by Golder (2019)

[1] Health Canada (2017). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Note the lead guideline was updated to 0.005 mg/L in March of 2019, and hence the new guideline is presented.

[2] MAC value was not available, however "other guideline" was presented for non-health based guidelines including aesthetic objectives and operational guidelines

NA indicates not available

NR indicates not required

MAC – maximum acceptable concentration

Bolded values indicate a guideline exceedance

Shaded values indicate an exceedance of the baseline concentration

8 METHODS FOR PREDICTING FUTURE SOIL, VEGETATION AND COUNTRY FOODS

8.1 Approach to Predicting Future Soil Concentrations

The approach taken to estimate future incremental soil concentrations of metals utilized the following:

- Geochemistry "fingerprint" ratios for road dust (see Section 4 and Appendix B);
- Deposition rates for the FMS mine area based on modelled estimates (see Table 4-1; Note that only the maximum annual scenario and average scenario were modelled);
- Standardized equations from US EPA OSW (2005) used to predict changes to soils from atmospheric depositional sources. These equations are used in the vast majority of Environmental Impact Assessments to predict future impacts to soils, and associated media (such as vegetation) related to dust deposition.

The predicted increments resulting from these dust deposition rates for areas outside the PDA were subsequently added to the 90th percentile of the measured baseline soil concentrations (see Table 3-3), to calculate the potential future soil concentration.

Incremental increase in soil metal concentrations were calculated using the equations below, as suggested by the US EPA OSW (2005):

$$D_S = \left(\frac{D}{Zs \times BD}\right)$$

Where,

D_S = Annual deposition to soil over exposure duration (mg COPC/kg soil-year)
D = Yearly deposition rate of contaminant (mg/m^2-year)
Z_s = Soil mixing zone depth (assumed two depths, a shallow depth of 5 cm to represent the public health layer of soils, as per Health Canada, and a 20 cm mixing zone for root uptake, as per US EPA, 2005)
BD = Soil bulk density (Default 1.5 g/cm^3; US EPA OSW, 2005)

Soil concentrations were calculated on a mass per mass basis (mg/kg) based on the following equation, as suggested by the US EPA OSW (2005):

$$C_s = \frac{D_s \times [1 - \exp(-kt \times tD)]}{kt}$$

Where,

Cs = average soil concentration over deposition duration (mg/kg soil)
Ds = deposition to soil (mg COPC/kg-soil/year)
kt = chemical soil loss constant due to all processes (degradation or loss due to erosion) (yrs-1)
tD = time period over which deposition occurs (yrs)

It was conservatively assumed that metal losses from soil were limited (e.g., degradation, erosion, runoff), assumed low soil loss constant or half-life of 27 years, and therefore the equation for the average soil concentration over exposure duration was reduced to the following equation:

$$C_s = D_s \times tD$$

The following periods of deposition were assumed for the project:

- Project Pre-production: 12 months
- Project Operations: 5 years
- Total operational period assumed in model: 6 years

The calculated incremental metal soil concentrations were then added to the 90th percentile[1] of the measured baseline soil metals concentrations data (see Table 3-3), for each metal of interest identified in Section 4, Table 4-1.

Table 8-1 and 8-2 present the baseline, project increment alone, and the accumulated Project incremental and final total (baseline + increment) soil metals concentrations following the 6 year operational period for the FMS mine area (maximum point of impingement outside the PDA Table 8-1; maximum annual deposition rate at 1 km from the site boundary; Table 8-2). Appendix C provides the supporting model worksheets for predicted future concentrations.

[1] A number of regulatory agencies prefer or endorse the use of the 90th percentile for soil background or baseline concentration statistics. This would be a conservative (biased high) estimate of baseline soil concentrations in the area.

Table 8-1 Baseline and Predicted Future Soil Concentrations (based on MPOI Annual Average Deposition rate at Site Boundary over 6 years of Operations)

Metal/COPC	*Baseline Surface Soil Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (1.4 g/m2/year) over 6 years of operations*			
		5 cm Soil Depth		*20 cm Soil Depth*	
		Project	*Project + Baseline*	*Project*	*Project + Baseline*
Aluminium	22400	1.80	22402	0.451	22400
Arsenic	10	0.0194	10.0	0.00484	10.0
Barium	35	0.00493	35.0	0.00123	35.0
Chromium	21	0.00283	21.0	0.0007084	21.0
Cobalt	10.2	0.00139	10.2	0.0003472	10.2
Copper	10	0.00286	10.0	0.000714	10.0
Lead	16.4	0.000917	16.4	0.00022932	16.4
Manganese	801	0.0764	801	0.0191	801
Molybdenum	0.5	0.0000650	0.500	0.0000162	0.500
Nickel	14	0.00301	14.0	0.000753	14.0
Strontium	9	0.00264	9.00	0.000661	9.00
Vanadium	35	0.00296	35.0	0.000739	35.0
Zinc	36	0.00713	36.0	0.00178	36.0

Table 8-2 Baseline and Predicted Future Soil Concentrations (based on the Maximum Annual Deposition Rate at 1.0 km from Property Boundary)

Metal/COPC	*Baseline Surface Soil Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (0.35 g/m2/year) over 6 years of operations*			
		5 cm Soil Depth		*20 cm Soil Depth*	
		Project	*Project + Baseline*	*Project*	*Project + Baseline*
Aluminium	22400	0.451	22400	0.113	22400
Arsenic	10	0.00484	10.0	0.00121	10
Barium	35	0.00123	35.0	0.000308	35.0
Chromium	21	0.000708	21.0	0.000177	21.0
Cobalt	10.2	0.000347	10.2	0.0000868	10.2
Copper	10	0.000714	10.0	0.000179	10.0
Lead	16.4	0.000229	16.4	0.0000573	16.4
Manganese	801	0.0191	801	0.00477	801
Molybdenum	0.5	0.0000162	0.5	0.00000406	0.500
Nickel	14	0.000753	14.0	0.000188	14.0

Strontium	9	0.000661	9.0	0.000165	9.00
Vanadium	35	0.000739	35.0	0.000185	35.0
Zinc	36	0.00178	36.0	0.000446	36.0

8.2 Approach to Predicting Future Surface Water Concentrations

The Anti Dam Flowage will receive effluent discharge from the FMS Mine Site and therefore is the focus for assessing potential surface water impacts from the Project. As discussed in the Recreational Water Quality Assessment (Section 7) water quality data predicted for EMZ-2 and SW6 in the Anti Dam Flowage were obtained from Golder (2019). For the purposes of assessing the surface water exposure pathways, water quality data from EMZ-2 is used, as measured baseline concentrations from EMZ-2 are based on the average of available data from nodes SW14 and SW6. The predicted 95th percentile water concentrations represent an assimilated Baseline + Project scenario; therefore, it was necessary to remove the contribution from the Baseline scenario, in order to assess the incremental impact of the Project. As such, the mean measured baseline concentrations at EMZ-2, which were used by Golder (2019) to represent the conditions before effluent was added to the water quality predictions, were subtracted from the predicted 95th percentile (Baseline + Project) upper case source terms water concentrations in order to determine Project Case water concentrations (see Table 8-3). The calculated Project concentrations and the measured baseline concentrations from EMZ-2 were used in the assessment for the prediction of exposures resulting from recreational water use and the consumption of fish captured from the Anti Dam Flowage.

Table 8-3 Baseline and Predicted Future Surface Water Concentrations at EMZ-2 during Post Closure (upper case predictions)

Parameter	*Baseline[1]*	*Surface Water Concentrations (mg/L)*	
		95th Percentile (Baseline + Project)	*Project (calculated)[2]*
Aluminum	0.210	0.210	0
Arsenic	0.0062	0.00670	0.000500
Chromium	0.000550	0.000580	0.0000300
Cobalt	0.0002	0.000790	0.000590
Copper	0.00077	0.00120	0.000430
Lead	0.00029	0.000670	0.000380
Manganese	0.0670	0.0870	0.0200
Molybdenum	0.001	0.00140	0.000400
Nickel	0.001	0.00450	0.00350
Zinc	0.0025	0.00550	0.00300

Notes:
NA indicates not applicable
[1] mean baseline value used to represent the condition before effluent was added during the prediction of water quality concentrations. For EMZ-2, the average of available data from SW14 and SW6 was used
[2] Project water concentrations were calculated by subtracting the mean Baseline concentration from the 95th percentile Baseline + Project concentration during post closure (Golder, 2019; upper case predictions Table B-2)
Results for barium, strontium and vanadium are not available as they were not modelled by Golder (2019)

8.3 Approach to Predicting Future Berry and Leafy Vegetation Concentrations

The approach to predicting future berry and leafy vegetation concentrations was based on the following:

- Measured baseline berry and leafy vegetation concentrations from the Beaver Dam Mine project (2018) were used as surrogates for baseline concentrations for the FMS Mine Site area and the concentrations are presented in Tables 3-4 and 3-5 for berries and leafy vegetation, respectively;
- Deposition rates for the area outside of the PDA near the FMS area based on modelled estimates (see Section 5.3); and
- Standardized equations from US EPA OSW (2005) used to predict changes to berries and leafy vegetation from atmospheric depositional sources. These equations are used in the vast majority of Environmental Impact Assessments to predict future impacts to vegetation related to dust deposition.

The predicted increments resulting from these dust deposition rates for the MPOI at the mine site boundary and the maximum at 1 km from the mine site boundary were subsequently added to the 90th percentile of the measured baseline berry (see Table 8-4) and leaves (see Table 8-5) concentrations, to calculate the potential future concentration.

The measured baseline vegetation concentration was correlated with the measured baseline soil concentration with a site-specific bio-concentration factor (BCF) where applicable; therefore, if soil concentrations increased then berry and leafy vegetation concentrations increased accordingly. BCF values were calculated based on the following equation:

$$BCF = \frac{C_L}{C_S}$$

Where,

BCF = Site-specific berry or leaf bio-concentration factor (kg-soil / kg-plant)
C_L = 90th percentile concentration in berry or leaf (mg-COPC / kg-plant)
C_S = 90th percentile concentration in soil (mg-COPC / kg-soil)

Site-specific BCFs could not be calculated where chemical concentrations were not detected in any of the baseline berry or leafy vegetation samples. Therefore, in these cases, literature-based BCFs from the US EPA OSW (2005) and Baes *et al*. (1984) were used instead in the assessment.

In addition to uptake of metals via soil, the future concentrations also included uptake via atmospheric deposition. The following equation was used to predict plant concentrations based on deposition (US EPA OSW 2005):

$$Pd = \frac{D \times Rp \times \left[1.0 - \exp\left(-kp \times Tp\right)\right]}{Yp \times kp}$$

Where,

Pd	=	plant concentration as a result of direct deposition (mg/kg DW)
D	=	deposition (mg/m²/yr)
Rp	=	intercept fraction of edible portions of plant (unitless)
kp	=	plant surface loss coefficient (yr-1)
Tp	=	length of plant exposure to deposition (yr)
Yp	=	yield or productivity (kg DW/m²)

The US EPA OSW (2005) recommends values for the intercept fraction of edible portions of plants (Rp) (unitless) based on two aboveground produce classes, exposed fruits and exposed vegetables. The Rp value of 0.053 for exposed fruits and the Rp value of 0.982 for exposed vegetables were assumed for the prediction of berry concentrations and leafy vegetable concentrations, respectively. The kp value is a measure of the amount of chemical lost as a result of removal by wind and water and growth dilution. The length of plant exposure was assumed to be 0.164 years or 60 days (US EPA OSW 2005). The US EPA OSW (2005) recommends a default kp value of 18 yr^{-1}, which corresponds to a 14-day half-life. Finally, the US EPA OSW (2005) recommends using a Yp value of 0.25 kg DW/m² for exposed fruits and 5.66 kg DW/m² for exposed vegetables. These values were assumed for the prediction of berry concentrations and leafy vegetable concentrations, respectively.

Predicted berry and leaf concentrations are provided in Tables 8-3 and 8-4, and include both root uptake and deposition. Note that baseline berry and leaf data were converted from wet weight (as presented in Table 3-4 and 3-5) to dry weight for calculations in the assessment, based on the average moisture content of the samples using the following equation:

$$C_{DW} = \frac{C_{WW}}{(1 - MC)}$$

Where,

C_{DW}	=	Concentration in berry or leaf in dry weight (mg/kg DW)
C_{WW}	=	Concentration in berry or leaf in wet weight (mg/kg WW)
MC	=	Moisture content in berry or leaf (% / 100%)

Appendix C provides supporting model worksheets for berry and vegetation predictions.

Table 8-4 Baseline and Predicted Future Berry Concentrations (mg/kg WW)

Metal/COPC	*Baseline Berry Concentration (90th %ile)*	*Incremental Contribution of Dust Deposition Outside of PDA (1.4 g/m2/year) over 6 years of operations – Max POI*		*Incremental Contribution of Dust Deposition Outside of PDA (0.35 g/m2/year) over 6 years of operations – Max 1 km*	
		Project	*Project + Baseline*	*Project*	*Project + Baseline*
Aluminum	3.1	0.0376	3.14	0.00941	3.11
Arsenic	0.00579 [a]	0.000249	0.00604	0.0000623	0.00585
Barium	2.55	0.000192	2.55	0.0000481	2.55
Chromium	0.08	0.0000618	0.0800	0.0000154	0.0800
Cobalt	0.024	0.0000298	0.0240	0.00000744	0.0240
Copper	1.16	0.000142	1.16	0.0000356	1.16
Lead	0.003	0.0000192	0.00302	0.00000479	0.00300
Manganese	97.3	0.00391	97.3	0.000978	97.3
Molybdenum	0.0461	0.00000285	0.0461	0.000000712	0.0461
Nickel	0.56	0.0000929	0.5596	0.0000232	0.560
Strontium	3.72	0.000328	3.72	0.0000821	3.72
Vanadium	0.0289 [a]	0.0000622	0.0289	0.0000156	0.0289
Zinc	4.16	0.000355	4.16	0.0000887	4.16

Notes:
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

Table 8-5 Baseline and Predicted Future Leafy Vegetation Concentrations (mg/kg WW)

Metal/COPC	*Baseline Leaf Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (1.4 g/m²/year) over 6 years of operations – MAX POI*		*Incremental Contribution of Dust Deposition Outside of PDA (0.35 g/m²/year) over 6 years of operations – Max 1 km*	
		Project	*Project + Baseline*	*Project*	*Project + Baseline*
Aluminum	70.6	0.0670	70.7	0.0168	70.6
Arsenic	0.0078	0.000554	0.00835	0.000138	0.00794
Barium	37.4	0.00150	37.4	0.000374	37.4
Chromium	0.08	0.000106	0.0801	0.0000265	0.0800
Cobalt	0.0531	0.0000523	0.0532	0.0000131	0.0531
Copper	2.35	0.000272	2.35	0.0000679	2.35
Lead	0.045	0.0000340	0.0450	0.00000850	0.0450
Manganese	1430	0.0369	1430	0.00922	1430
Molybdenum	0.087	0.00000519	0.0870	0.00000130	0.0870
Nickel	0.88	0.000157	0.880	0.0000392	0.880
Strontium	30.6	0.00234	30.6	0.000586	30.6
Vanadium	0.04	0.000108	0.0401	0.0000271	0.0400
Zinc	11	0.000805	11.0	0.0002013	11.0

Notes:
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

8.4 Approach to Predicting Fish Tissue Concentrations

The following equation was used to predict the chemical concentration in fish from the Anti Dam Flowage:

$$C_{fish} = C_{sw} \times BCF$$

Where:

C_{fish} = chemical concentration in fish (mg/kg WW)
C_{sw} = chemical concentration in surface water (mg/L)
BCF = surface water-to-fish bioconcentration factor (L water/kg fish WW)

Bioconcentration factors (BCFs) for fish were calculated based on surrogate surface water and fish tissue data from Scraggy Lake, as fish samples were not available from the Anti Dam

Flowage. BCF values were calculated using yellow perch samples (n = 10) and water concentrations specific to the location of fish capture in Scraggy Lake. Scraggy Lake is the receiving environment for the Touquoy Mine pit, and this data set includes baseline fish tissue concentrations and surface water concentrations. The mean BCF value for each chemical parameter was selected for use as the BCF for this assessment. The following equation was used to calculate the BCFs used to predict chemical concentrations in fish:

$$BCF = \frac{C_{fish}}{C_{sw}}$$

Where:

C_{fish} = chemical concentration in fish (mg/kg WW)
C_{sw} = chemical concentration in surface water (mg/L)

Appendix C provides supporting worksheets for the BCF calculations.

8.5 Approach to Predicting Deer Concentrations

8.5.1 Estimated Daily Intake of Chemicals in Wildlife via all Media

Soil Ingestion

The estimated daily intake of a chemical through incidental ingestion of soil by wildlife was calculated by applying the soil ingestion rate to the chemical concentration in the soil. The soil ingestion rate for deer was obtained from GoC (2012).

$$EDI_{soil} = C_s \times SIR$$

Where:

EDI_{soil} = estimated daily intake of chemical in soil (mg/d)
C_s = chemical concentration in surface soil (mg/kg)
SIR = soil ingestion rate (kg/d)

Food Ingestion

The estimated daily intake of a chemical through food ingestion by wildlife was calculated by applying food ingestion rates obtained from GoC (2012) to the concentration within each media. Deer were assumed to consume a diet of browse (i.e., leafy vegetation) and berries.

$$EDI_{food} = C_i \times FIR_i$$

Where:

EDI_{food} = estimated daily intake of chemical in food item (mg/d)
C_i = chemical concentration in food item (mg/kg-DW)
FIR_i = food ingestion rate for food item (kg/d)

Water Ingestion

The estimated daily intake of a chemical through ingestion of surface water by wildlife was calculated by applying the water ingestion rate to the maximum predicted surface water concentration.

$$EDI_{water} = C_{sw} \times WIR$$

Where:

EDI_{water} = estimated daily intake of chemical in surface water (mg/d)
C_{sw} = chemical concentration in surface water (mg/L)
WIR = water ingestion rate (L/d) obtained from GoC 2012

Air and Dust Ingestion

The air inhalation rate for deer was predicted using an allometric equation for mammals, as provided by the US EPA (1993).

Inhalation rate for mammals: $AIR = 0.5458 \times BW^{0.80}$

Where:

AIR = predicted air inhalation rate (m^3/d)
BW = body weight (kg) obtained from GoC (2012)

The estimated daily intake of a chemical through inhalation of predicted ground-level air concentrations by deer was calculated by applying the air inhalation rate to the predicted air and dust concentration.

$$EDI_{inh} = C_{dust} \times AIR \times CF$$

Where:

EDI_{inh} = estimated daily intake of chemical via inhalation (mg/d)
C_{dust} = chemical concentration in dust ($\mu g/m^3$)
AIR = air inhalation rate (m^3/d)
CF = conversion factor from µg to mg (0.001 mg/µg)

Estimated Total Daily Intake

The estimated daily intake for deer from all potential pathways of exposure was calculated as follows:

$$EDI_{total} = EDI_{soil} + EDI_{browse} + EDI_{berries} + EDI_{water} + EDI_{inh}$$

Where:

EDI_{total} = total estimated daily intake of chemical via all routes of exposure (mg/d)
EDI_{soil} = estimated daily intake of chemical from ingestion of soil (mg/d)
EDI_{browse} = estimated daily intake of chemical from consumption of browse (i.e., leafy vegetation) (mg/d)
$EDI_{berries}$ = estimated daily intake of chemical from consumption of berries (mg/d)
EDI_{water} = estimated daily intake of chemical from ingestion of water (mg/d)
EDI_{inh} = estimated daily intake of chemical from inhalation of dust (mg/d)

8.5.2 Wildlife Tissue Concentrations

Biotransfer Factors

Biotransfer factors (BTFs) are used to translate an estimated dose of a chemical to a tissue concentration. BTFs were taken from US EPA OSW (2005) when available, followed by Baes et al. 1984.

Tissue Concentrations

Chemical concentrations in deer meat were predicted based on the following equation (US EPA OSW 2005):

$$C_{Deer} = BTF \times EDI_{total}$$

Where:

C_{deer} = chemical concentration in deer meat (mg/kg WW)
BTF = biotransfer factor ([mg/kg tissue] / [mg/d])
EDI_{total} = total estimated daily intake of chemical via all routes of exposure (mg/d)

Appendix C provides the supporting worksheets for predicted deer meat concentrations.

8.6 Assessment of Predicted Change in Trace Metals due to Dust deposition on Soils and Vegetation

8.6.1 Assessment Approach

A screening level assessment of predicted changes to area soils, berries and vegetation is presented in Section 8.6.2. The approach presents comparisons of predicted future soil concentrations to health-based soil quality guidelines (Section 8.6.2.1); and an evaluation of potential future berry and leafy vegetation concentrations, relative to baseline berry and leafy vegetation concentrations (as there are no berry and leafy vegetation guidelines for the protection of humans via consumption) (Section 8.6.2.2).

8.6.2 Screening Level Assessment

8.6.2.1 Comparison of Predicted Soil Concentrations to Health-Based Soil Quality Guidelines

Total future soil concentrations (predicted increment for the operational time period of 6 years + 90th percentile baseline) for the 2 scenarios [MPOI annual deposition at the site boundary, and the maximum annual deposition at 1 km from the site boundary] were compared to CCME soil quality guidelines (*e.g.*, CCME, 2018). In addition, predicted future soil concentrations were also compared to Nova Scotia contaminated sites pathway specific soil quality guidelines (NSE, 2014) and the maximum measured baseline soil concentrations. These comparisons were undertaken to gather perspective on whether the incremental soil concentrations, once added to baseline, will exceed soil quality guidelines or indicate a noticeable increase over maximum baseline soil concentrations.

The soil quality guidelines used in these comparisons are derived by Canadian regulatory agencies and are widely used across Canada for determining whether or not chemicals present in soils merit further study. The soil quality guidelines used in the screening level assessment are for an agricultural land use classification (agricultural land use guidelines are the most conservative, relative to guidelines derived for all other land uses). These guidelines are suitable for rural areas. CCME soil quality guidelines were used preferentially and represent the lower of the human and ecologically-based guidelines. In addition, guidelines from Nova Scotia were also used, which are a compilation of guidelines from several jurisdictions, including the CCME. Guidelines presented from Nova Scotia were based on the soil contact/ingestion pathway protective of human health.

In addition to soil quality guideline comparisons, it is also important to consider the naturally occurring metals levels in the existing environment (*i.e.*, baseline conditions). The available baseline dataset for metals levels in soils is small (N = 11 for most elements), but this baseline data provides an indication of existing natural metals soil concentration ranges within the area of the FMS Mine Site based on surrogate data from the nearby Beaver Dam Mine project (2018) (see Table 2-2). The baseline soil chemistry data provides an additional benchmark of comparison to identify which metals could become noticeably elevated in local soils as a result of ore dust deposition.

Where predicted future metals soil concentrations (baseline + project increment, accumulated over the 6 year operational period considered in the assessment) are below the applicable agricultural land use soil quality guidelines, and within the range of measured baseline soil concentrations (which is the same as being less than the maximum baseline soil concentrations), there is a reasonably high degree of confidence that human health will not be adversely affected. If predicted future metals soil concentrations (baseline + project increment) are greater than both the applicable soil quality guideline and the maximum baseline soil concentration, humans are not necessarily at risk, but, further evaluation would be appropriate. Manganese lacked a soil quality guideline, and therefore comparisons could only be made to maximum baseline soil concentrations. Exceedances of future soil concentrations above the baseline maxima were considered to require further discussion/evaluation.

Table 8-6 presents a comparison of the maximum baseline and predicted future concentrations to soil quality guidelines for the 1.4 g/m^2/year dust deposition scenario (based on the MPOI annual average deposition at the site boundary) and Table 8-7 presents the comparison for the 0.35 g/m^2/year dust deposition scenario (based on the maximum annual deposition at 1 km from the site boundary).

Table 8-6 Comparison of Baseline and Predicted Future Soil Concentrations (based on the MPOI annual average deposition rate at the site boundary) to Provincial and Federal Soil Quality Guidelines (mg/kg)

Metal/COPC	*Baseline Surface Soil Concentration (90th %ile)*	*Incremental Contribution of Dust Deposition Outside of PDA (1.4 g/m2/year) over 6 years of operations*				*Soil Quality Guidelines*		*Max Baseline Surface Soil Concentration*
		5 cm Soil Depth		*20 cm Soil Depth*				
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	*NSE*	*CCME*	
Aluminum	22400	1.80	22402	0.451	22400	15400	n/a	27400
Arsenic	10	0.0194	10.0	0.00484	10.0	31	12	14
Barium	35	0.00493	35.0	0.00123	35.0	10000	750	49
Chromium	21	0.00283	21.0	0.0007084	21.0	220	64	26
Cobalt	10.2	0.00139	10.2	0.0003472	10.2	22	40	20
Copper	10	0.00286	10.0	0.000714	10.0	1100	63	11
Lead	16.4	0.000917	16.4	0.00022932	16.4	140	70	16.6
Manganese	801	0.0764	801	0.0191	801	n/a	n/a	3450
Molybdenum	0.5	0.0000650	0.500	0.0000162	0.500	110	5	0.8
Nickel	14	0.00301	14.0	0.000753	14.0	330	45	18
Strontium	9	0.00264	9.00	0.000661	9.00	9400	n/a	10
Vanadium	35	0.00296	35.0	0.000739	35.0	39	130	40

Zinc	36	0.00713	36.0	0.00178	36.0	5600	250	57

Notes:
Shaded values indicate an exceedance of soil quality guidelines
[a] Nova Scotia Environmental Quality Standards (EQS) are the soil contact/ingestion values for coarse/fine-textured soil in an agricultural land use from Nova Scotia Environment (2014)
[b] CCME Soil Quality Guidelines (SQG) are the SQG for the Protection of Environmental and Human Health for the agricultural land use from CCME (2018)

Table 8-7 Comparison of Baseline and Predicted Future Soil Concentrations (based on the maximum annual deposition rate at 1 km from the site boundary) to Provincial and Federal Soil Quality Guidelines (mg/kg)

Metal/COPC	*Baseline Surface Soil Concentration (90th %ile)*	*Incremental Contribution of Dust Deposition Outside of PDA (0.35 g/m2/year) over 6 years of operations*				*Soil Quality Guidelines*		*Max Baseline Surface Soil Concentration*
		5 cm Soil Depth		*20 cm Soil Depth*				
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	*NSE*	*CCME*	
Aluminum	22400	0.451	22400	0.113	22400	15400	n/a	27400
Arsenic	10	0.00484	10.0	0.00121	10	31	12	14
Barium	35	0.00123	35.0	0.000308	35.0	10000	750	49
Chromium	21	0.000708	21.0	0.000177	21.0	220	64	26
Cobalt	10.2	0.000347	10.2	0.0000868	10.2	22	40	20
Copper	10	0.000714	10.0	0.000179	10.0	1100	63	11
Lead	16.4	0.000229	16.4	0.0000573	16.4	140	70	16.6
Manganese	801	0.0191	801	0.00477	801	n/a	n/a	3450
Molybdenum	0.5	0.0000162	0.5	0.00000406	0.500	110	5	0.8
Nickel	14	0.000753	14.0	0.000188	14.0	330	45	18
Strontium	9	0.000661	9.0	0.000165	9.00	9400	n/a	10
Vanadium	35	0.000739	35.0	0.000185	35.0	39	130	40
Zinc	36	0.00178	36.0	0.000446	36.0	5600	250	57

Notes:
Shaded values indicate an exceedance of soil quality guidelines
[a] Nova Scotia Environmental Quality Standards (EQS) are the soil contact/ingestion values for coarse/fine-textured soil in an agricultural land use from Nova Scotia Environment (2014)
[b] CCME Soil Quality Guidelines (SQG) are the SQG for the Protection of Environmental and Human Health for the agricultural land use from CCME (2018)

Based on the comparisons presented in Table 8-6 (MPOI annual average deposition rate at the site boundary) and Table 8-7 (maximum annual deposition rate at 1 km from the site boundary), none of the COPC predicted project + baseline concentrations exceed relevant soil quality guidelines, with the exception of aluminum, which exceeds the NSE (2014) soil quality guideline in the two dust deposition scenarios. In both cases, baseline concentrations exceed the guideline, and contribute to the majority of the project + baseline soil concentrations, with the project

adding very little to the total. The predicted future + baseline concentrations of aluminium do not exceed the maximum baseline soil concentration of aluminum, and hence, are well within the soil concentration range. The only inorganic which lacks a guideline is manganese, and the predicted future + baseline concentrations are also well within the baseline soil range. Based on the predicted soil concentrations, dust deposition is not estimated to have a substantial effect on soil quality relative to the existing baseline metals concentration in soil.

8.6.2.2 Comparison of Predicted Berry and Leafy Vegetation Concentrations to Maximum Baseline Concentrations

In order to evaluate the potential for accumulation of metals in berries and leafy vegetation, predictions of possible future berry and leafy vegetation concentrations were undertaken, relative to the MPOI annual dustfall in the FMS mine area (1.4 g/m^2/year) and the maximum annual dustfall at 1 km from the site boundary (0.35 g/m^2/year) over 6 years. These predictions involved the use of site-specific soil to berry and leafy vegetation uptake factors from the existing baseline data, as well as atmospheric deposition onto the plants. Since there are no regulatory benchmarks available related to berry or vegetation metals uptake, the predicted incremental concentrations are added to the 90th percentile of baseline concentrations, and compared to maximum baseline concentrations, for perspective.

Table 8-8 Comparison of Baseline and Predicted Future Berry Concentrations (mg/kg WW)

Metal/COPC	*Baseline Berry Concentration (90th %ile)*	*Incremental Contribution of Dust Deposition Outside of PDA (1.4 g/m2/year) over 6 years of operations*		*Incremental Contribution of Dust Deposition Outside of PDA (0.35 g/m2/year) over 6 years of operations*		*Max Baseline Berry Concentration*
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	
Aluminum	3.1	0.0376	3.14	0.00941	3.11	3.3
Arsenic	0.00579 [a]	0.000249	0.00604	0.0000623	0.00585	<0.02
Barium	2.55	0.000192	2.55	0.0000481	2.55	2.93
Chromium	0.08	0.0000618	0.0800	0.0000154	0.0800	0.11
Cobalt	0.024	0.0000298	0.0240	0.00000744	0.0240	0.052
Copper	1.16	0.000142	1.16	0.0000356	1.16	1.72
Lead	0.003	0.0000192	0.00302	0.00000479	0.00300	0.013
Manganese	97.3	0.00391	97.3	0.000978	97.3	112
Molybdenum	0.0461	0.00000285	0.0461	0.000000712	0.0461	0.052
Nickel	0.56	0.0000929	0.5596	0.0000232	0.560	0.82
Strontium	3.72	0.000328	3.72	0.0000821	3.72	8.68

Vanadium	0.0289 [a]	0.0000622	0.0289	0.0000156	0.0289	<0.02
Zinc	4.16	0.000355	4.16	0.0000887	4.16	5.51

Notes:
Shaded values indicate an exceedance of the maximum measured berry concentration
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

Table 8-9 Comparison of Baseline and Predicted Future Leafy Vegetation Concentrations (mg/kg WW)

Metal/COPC	*Baseline Leaf Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (1.4 g/m²/year) over 6 years of operations*		*Incremental Contribution of Dust Deposition Outside of PDA (0.35 g/m²/year) over 6 years of operations*		*Max Baseline Leaf Concentration*
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	
Aluminum	70.6	0.0670	70.7	0.0168	70.6	208
Arsenic	0.0078	0.000554	0.00835	0.000138	0.00794	0.04
Barium	37.4	0.00150	37.4	0.000374	37.4	46.5
Chromium	0.08	0.000106	0.0801	0.0000265	0.0800	0.14
Cobalt	0.0531	0.0000523	0.0532	0.0000131	0.0531	0.069
Copper	2.35	0.000272	2.35	0.0000679	2.35	3.39
Lead	0.045	0.0000340	0.0450	0.00000850	0.0450	0.327
Manganese	1430	0.0369	1430	0.00922	1430	1440
Molybdenum	0.087	0.00000519	0.0870	0.00000130	0.0870	0.119
Nickel	0.88	0.000157	0.880	0.0000392	0.880	0.94
Strontium	30.6	0.00234	30.6	0.000586	30.6	68.1
Vanadium	0.04	0.000108	0.0401	0.0000271	0.0400	0.05
Zinc	11	0.000805	11.0	0.0002013	11.0	13.3

Notes:
Shaded values indicate an exceedance of the maximum measured leaf concentration
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

Based on the predicted berry concentrations (Table 8-8), all project + baseline berry concentrations were within the range of baseline with the exception of vanadium, which was estimated to exceed the maximum baseline concentration (Table 8-8; 1.4 g/m^2/year and 0.35 g/m^2/year deposition rates). However, the increase in concentration is attributed to the use of a literature-based BCF to calculate a predicted baseline concentration, as vanadium was not detected in any berry samples. Vanadium contributions from the Project are predicted to be

minimal when compared to the contribution from the predicted baseline concentration to the overall project + baseline berry concentrations

Based on the predicted leafy vegetation concentrations (Table 8-9), all project + baseline leafy vegetation concentrations were within the range of baseline concentrations. In general, the use of MPOI and maximum annual average dust deposition rates are considered to be conservative assumptions when predicting chemical concentrations in environmental media.

9 ASSESSMENT OF HUMAN EXPOSURES FROM CONSUMPTION OF COUNTRY FOODS, RECREATIONAL WATER USAGE AND SOIL AND DUST EXPOSURES

9.1 Methods

The approach to predicting human exposure from soil and dust exposures, recreational water use (i.e., swimming) and consumption of country foods (i.e., berries, leafy vegetation, fish, and deer) was based on and/or considered Health Canada (2012; 2018) guidance as detailed in the sections below. Appendix C provides supporting worksheets for receptor characteristics and other exposure and media variables, as well as predicted exposure levels.

Consumption rates for berries are based on the First Nations Food, Nutrition and Environment Study (FNFNES) for Atlantic Canada by Chan et al. (2017). The daily intake rate of berries/plants by adult (>18 years) heavy consumers (95th percentile) from First Nations in Atlantic Canada was used as a starting point to estimate the consumption rate for berries. This consumption rate was adjusted for the other lifestages using consumption ratios from Health Canada (1994). For leafy vegetation, an adult consumption rate for mint and Labrador tea of 3 g/day was obtained from Wein (1989) and Alberta Health and Wellness (AHW) (2007). This value was corroborated in a recent study examining the consumption of traditional plants, such as mint and Labrador tea, in two First Nations communities in northern Alberta (McAuley *et al*. 2016). The study estimated that 1-2 sprigs of mint and 3-4 dried leaves of Labrador tea were consumed by community elders on a daily basis. According to the study authors, these estimates are "within the same range as past studies completed in the Regional Municipality of Wood Buffalo, which estimated the consumption of traditional tea vegetation by adults at approximately 3 g/day" (McAuley *et al*. 2016). In the absence of site specific data, it was assumed that First Nations near the FMS Mine Site would consume comparable amounts of dried vegetation in the form of tea; therefore, these consumption rates were used to estimate exposure via the consumption of leafy vegetation, on a daily basis (as tea). The consumption rates were also adjusted based on the assumption that not all of a person's berry and leafy vegetation would come from the MPOI area. It is highly probable that harvesting from this area would be occasional and therefore, a factor of 0.5 was applied to the consumption rates to account for this site use pattern, indicating that half of all berry and leafy vegetation would be harvested from this specific area. In addition, to provide a more realistic scenario, metal concentrations in berry and leafy vegetation at 1 km from the site boundary were predicted and it was assumed that all of a person's berry and leafy vegetation would come from this area.

Consumption rates for fish and deer are also based on the FNFNES for Atlantic Canada by Chan et al. (2017). For fish, the average adult consumer rate for all fish consumption (9 g/day) was selected for use and adjusted for the other lifestages using consumption ratios from Health Canada (2007). The average consumer rate was selected as opposed to the heavy consumer rate (95^{th} percentile) as limited fishing occurs in the Anti Dam Flowage and minimal fish are typically caught from the waterbody, based on knowledge from a local fisherman (Atlantic Mining NS Corp., 2019). Deer consumption was used as a surrogate for all game meat consumption, therefore, the adult heavy consumer rate (95^{th} percentile) for consumption of all game meat (68.4 g/day) was selected for use. This value was adjusted for the other lifestages using consumption ratios in Health Canada (2012). Table 9-1 presents the consumption rates for

berries, leafy vegetation, fish, and deer for each lifestage. Incidental ingestion of soil and inhalation of re-suspended dust, as well as recreational water exposures via swimming activity (i.e., incidental ingestion of water and dermal contact) were also considered in the exposure assessment.

Table 9-1 Consumption Rates for Country Foods

Dust Deposition Scenario	*Environmental Media*	*Consumption Rate (g/day)*				
		Infant	*Toddler*	*Child*	*Adolescent*	*Adult*
Maximum annual deposition at site boundary[a]	Berries	0	3.4	8.0	6.4	9.1
	Leafy vegetation	0	0.5	0.5	1.5	1.5
Maximum annual deposition at 1 km from site boundary	Berries	0	6.9	16	12.9	18.2
	Leafy vegetation	0	1.0	1.0	3.0	3.0
All scenarios	Fish	0	4.5	7.4	9.0	9.0
All scenarios	Deer	0	21.5	31.7	44.3	68.4

Notes:

[a] For the MPOI scenario, it was assumed that half of all harvested media (i.e., berries and leafy vegetation) would be collected from this area and therefore, a factor of 0.5 was applied to the consumption rates.

Berries

The following equation was used to estimate human exposure via consumption of wild berries (Health Canada, 2012). Consumption rates used to predict berry exposures were obtained from Chan et al. (2017) and adjusted as explained previously.

$$EDI_{berry} = P_b \times IR_{berry}$$

Where:

EDI_{berry} = estimated daily intake of chemical via consumption of berries (µg/d)
Pb = chemical concentration in berries from root uptake (mg/kg or ug/g WW)
IR_{berry} = berry ingestion rate (g/d)

Note, bio-accessibility of chemical in plant was assumed to be 100%.

Leafy Vegetation

The following equation was used to estimate human exposure via consumption of leafy vegetation (Health Canada, 2012). Consumption rates and equations used to predict exposures were obtained from Chan et al. (2017) and adjusted as explained previously.

$$EDI_{leaves} = C_{leaves} \times IR_{leaves}$$

Where:

EDI_{leaves} = estimated daily intake of chemical via consumption of leafy vegetation (µg/d)

C_{leaves} = total chemical concentration in leafy vegetation (mg/kg or ug/g WW)
IR_{leaves} = leafy vegetation ingestion rate (g/d)

Ingestion of Wild Game (Deer) and Fish

The following equation was used to estimate human exposure via consumption of wild game (i.e., deer) and fish (Health Canada 2012).

$$EDI_{animal} = C_{animal} \times IR_{animal}$$

Where:

EDI_{animal} = estimated daily intake of chemical via consumption of wild game or fish (µg/d)
C_{animal} = chemical concentration in animal tissue (mg/kg or ug/g WW)
IR_{animal} = fish or wild game ingestion rate (g/d)

Ingestion of Soil (Incidental)

The following equation was used to estimate human exposure via incidental ingestion of soil. Soil ingestion rates and equations used to predict exposures were based on recommendations from Health Canada (2012).

$$EDI_{soil} = C_s \times SIR$$

Where:

EDI_{soil} = estimated daily intake of chemical via ingestion of soil (µg/d)
C_s = chemical concentration in surface soil (mg/kg or ug/g)
SIR = incidental soil ingestion rate (g/d)

Inhalation of Dust

The following equation was used to estimate human exposure via inhalation of dust. Air inhalation rates and equations used to predict exposures were based on recommendations from Health Canada (2012).

$$EDI_{dust} = C_s \times DL \times AIR \times CF$$

Where:

EDI_{dust} = estimated daily intake of chemical via inhalation of dust (µg/d)
C_s = chemical concentration in surface soil (mg/kg)
DL = dust level (kg/m³)
AIR = air inhalation rate (m³/d)
CF = conversion factor from mg to µg (1000 µg/mg)

Exposures While Swimming

Receptors were assumed to swim in the Anti Dam Flowage and would be exposed via incidental ingestion of water and dermal contact. Receptor exposure parameters were obtained from the US EPA and Health Canada and were tailored to the site and are presented in Table 9-2.

Table 9-2 Receptor Parameters for Swim Exposure Pathway

Parameter	*Adult*	*Adolescent*	*Child*	*Toddler*	*Infant*	*Units*	*Comment*
Swim Exposure Frequency (SEF)	2.55E-01	2.55E-01	2.55E-01	2.55E-01	0.00E+00	hr/day	Assumed: 1hr/day for 12 days/month; 3 months/year; swim exposure factor
Swim Ingestion Rate (SWIR)	2.50E-02	2.50E-02	5.00E-02	5.00E-02	0.00E+00	L/day	US EPA 2003; Assumed 1hr / day; swim ingestion rate
Surface Area Total (SAT)	1.76E+04	1.55E+04	1.01E+04	6.13E+03	3.62E+03	cm2	Health Canada (2012); surface area total
Dermal Permeability Coefficient (Kp)	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	cm/hr	US EPA 2004; used all inorganics value

The following sections describe the methods used to estimate exposures while swimming.

Dermal Exposure to Surface Water

The following equation was used to estimate dermal exposure from swimming based on recommendations from US EPA (2004) and Health Canada (2012). The predicted surface water concentration was selected for estimating dermal exposure from swimming.

$$EDI_{derm+swim} = C_{sw} \times Kp \times SEF \times SAT \times CF1 \times CF2$$

Where:

$EDI_{derm+swim}$ = estimated daily intake of chemical from dermal contact with surface water (µg/d)
C_{sw} = chemical concentration in surface water (mg/L)
Kp = dermal permeability coefficient in water (cm/hr)
SEF = swim exposure factor (hr/d: 1hr/day x 12 days / month x 3 months / year x 1 year/365 days)
SAT = surface area total (cm^2)
CF1 = conversion factor from mg to µg (1,000 µg/mg)
CF2 = conversion factor from L to cm^3 (0.001 L/cm^3)

Surface Water Ingestion (Incidental)

The following equation was used to estimate ingestion exposure from swimming based on recommendations from US EPA (2004) and Health Canada (2012). The predicted surface water concentration was selected for estimating ingestion exposure from swimming.

$$EDI_{ing+swim} = C_{sw} \times SEF \times SWIR \times CF1$$

Where:

$EDI_{ing+swim}$ = estimated daily intake of chemical from ingestion of surface water during swimming (µg/d)
C_{sw} = chemical concentration in surface water (mg/L)
SEF = swim exposure factor (hr/d: 1hr/day x 12 days / month x 3 months / year x 1 year/365 days)
SWIR = swimming ingestion rate (L/hr)
CF1 = conversion factor from mg to µg (1,000 µg/mg)

Total Exposure While Swimming

The following equation was used to estimate total ingestion and dermal exposure from swimming.

$$EDI_{tot\_swim} = EDI_{derm+swim} + EDI_{ing+swim}$$

Where:

EDI_{tot_swim} = estimated daily intake of chemical from ingestion of and dermal contact with surface water during swimming (µg/d)
$EDI_{derm+swim}$ = estimated daily intake of chemical from dermal contact with surface water during swimming (µg/d)
$EDI_{ing+swim}$ = estimated daily intake of chemical from ingestion of surface water during swimming (µg/d)

Total Human Exposure

Total exposure was calculated by summing the individual exposures from each medium (*i.e.*, berry and leafy vegetable intake) for all relevant exposure pathways on a per chemical and per life stage basis (Health Canada, 2012):

$$EDI_{total} = EDI_{berries} + EDI_{leaves} + EDI_{deer} + EDI_{fish} + EDI_{soil} + EDI_{dust} + EDI_{tot\_swim}$$

Where:

EDI_{total} = total estimated daily intake of chemical via all routes (µg/d)
$EDI_{berries}$ = estimated daily intake of chemical from consumption of berries (µg/d)
EDI_{leaves} = estimated daily intake of chemical from consumption of leaves (µg/d)
EDI_{deer} = estimated daily intake of chemical via consumption of deer (µg/d)
EDI_{fish} = estimated daily intake of chemical via consumption of fish (µg/d)
EDI_{soil} = estimated daily intake of chemical via ingestion of soil (µg/d)
EDI_{dust} = estimated daily intake of chemical via inhalation of dust (µg/d)
EDI_{tot_swim} = estimated daily intake of chemical from ingestion of and dermal contact with surface water during swimming (µg/d)

The total estimated daily intake was normalized to body weight as follows:

$$EDI_{total\_BW} = \frac{EDI_{total}}{BW}$$

Where:

EDI_{total_BW} = total estimated daily intake of chemical via all routes adjusted to body weight (µg/kg bw/d)
EDI_{total} = total estimated daily intake of chemical via all routes (µg/d)
BW = body weight (kg)

Toxicity Reference Values

In the selection of exposure limits, preference was generally given to Health Canada. Where exposure limits were not available from Health Canada, they were obtained from a number of other leading scientific and regulatory authorities, including the following:

- United States Environmental Protection Agency (US EPA);
- World Health Organization (WHO);
- Health Institute of the Netherlands (RIVM); and
- JECFA (Joint FAO/WHO Expert Committee on Food Additives).

To ensure that the most defensible and appropriate exposure limit was selected for each chemical, consideration was given only to exposure limits meeting the following criteria:

- Established or recommended by leading scientific and regulatory authorities.
- Protective of the health of the general public based on the current scientific understanding of the health effects known to be associated with exposures to the COPC.

- Protective of sensitive individuals, typically through the use of appropriate uncertainty factors.

- Supported by adequate and available documentation.

All supporting documents were critically evaluated to identify the most appropriate and defensible limits for use in the assessment. In the case that the above criteria were supported by more than one standard, guideline or objective, the most scientifically defensible limit was selected. Table 9-3 presents the toxicity reference values (TRVs) selected for use in the assessment of risks from exposure to the COPC.

Table 9-3 Toxicity Reference Values used in the Assessment

Chemical of Potential Concern	*Chronic Oral Exposure Limits*				
	Averaging Time	*Type*	*Value (µg/kg bw/day)*	*Critical Effect*	*Agency*
Aluminum (Al)	Annual	RfD	143	Developmental, kidney, liver, nervous system and reproductive effects	WHO 2010a,b
Arsenic (As)	Annual	RfD	0.3	Hyperpigmentation and keratosis	US EPA 1993b
Arsenic (As)_cancer	Annual	RsD	0.006	Bladder, liver and lung cancer	Health Canada 2010
Barium (Ba)	Annual	RfD	200	Renal effects	Health Canada 2010
Chromium (Cr)	Annual	RfD	1	Hepatotoxicity	Health Canada 2010
Cobalt (Co)	Annual	RfD	1.4	Cardiovascular effects	RIVM 2001
Copper (Cu) (Adult)	Annual	RfD	141	Hepatotoxicity and gastrointestinal effects	Health Canada 2010
Copper (Cu) (Toddler)	Annual	RfD	91	Hepatotoxicity and gastrointestinal effects	Health Canada 2010
Lead (Pb) (Adult)	Annual	RfD	1.3	Increased blood pressure	JECFA 2011
Lead (Pb) (Toddler)	Annual	RfD	0.6	Neurodevelopmental effects	JECFA 2011
Manganese (Mn) (Adult)	Annual	RfD	156	Neurotoxicity	Health Canada 2010
Manganese (Mn) (Toddler)	Annual	RfD	136	Neurotoxicity	Health Canada 2010
Molybdenum (Mo) (Adult)	Annual	RfD	28	Reproductive effects	Health Canada 2010
Molybdenum (Mo) (Toddler)	Annual	RfD	23	Reproductive effects	Health Canada 2010
Nickel (Ni)	Annual	RfD	11	Perinatal lethality	Health Canada 2010
Strontium (Sr)	Annual	RfD	600	Developmental effects, skeletal changes	US EPA 1996
Vanadium (V)	Annual	RfD	2.1	Developmental effects	RIVM 2009
Zinc (Zn) (Adult)	Annual	RfD	570	Reduced iron and copper status	Health Canada 2010

Zinc (Zn) (Toddler)	Annual	RfD	480	Developmental effects	Health Canada 2010

Human Risk Calculations

Risk quotient (RQ) values for non-carcinogens and incremental lifetime cancer risks (ILCRs) for carcinogens (per 100,000) were estimated using the following equations and the calculated exposure estimates.

Non-Carcinogens

The following equation was used to calculate the risk quotients for non–carcinogens (Health Canada, 2012):

$$RQ_i = \frac{EDI_{total\_BW}}{RfD}$$

Where:

RQ_i = risk quotient of chemical for the 'i' life stage of the Indigenous peoples (unitless)
EDI_{total_BW} = total estimated daily intake of chemical via all routes adjusted to body weight for the 'i' life stage (µg/kg bw/d)
RfD = chemical-specific reference dose (µg/kg bw/d)

The maximum RQ of all the life stages (i.e., infant, toddler, child, adolescent, and adult) was presented in the report for non-carcinogens. The toddler life stage had the highest RQ of all the life stages.

This project included both oral and dermal exposure pathways. An HQ of 0.2 was used as a benchmark to assess the risk level for non-carcinogenic exposures for the Project scenario, whereas the baseline scenario and Baseline + Project scenarios were compared to a HQ of 1.0. An HQ of 0.2 assumes an exposure of 20% of the allowable level to come from the Project related sources (e.g., traditional foods, swimming, soils and dust) and 80% to come from other sources. If the calculated HQ in the Project scenario is greater than the benchmark of 0.2, then further assessment may be required, but because this Project scenario includes a multitude of exposure pathways, a higher HQ apportionment would be considered. An HQ less than the benchmark of 0.2 indicates that the intake of the COPC through the consumption of traditional foods and other Project-related pathways does not exceed the TRV and no adverse health effects are expected. It is noted that the assessment does not include all traditional foods that could be consumed from the area, but through the inclusion of game meats, fish, as well as berries, the representation is considered reasonable.

Carcinogens

The following equation was used to calculate the ILCRs (per 100,000) for carcinogens (Health Canada, 2012):

$$ILCR = \frac{EDI_{total\_BW-inf}}{RsD} \times LAF_{-inf} + \frac{EDI_{total\_BW-tod}}{RsD} \times LAF_{-tod} + \frac{EDI_{total\_BW-child}}{RsD} \times LAF_{-child} + \frac{EDI_{total\_BW-adol}}{RsD} \times LAF_{-adol} + \frac{EDI_{total\_BW-adult}}{RsD} \times LAF_{-adult}$$

Where:

ILCR = ILCR of chemical for the sum of the life stages of the Indigenous peoples (unitless)
EDI_{total_BW-i} = total estimated daily intake of chemical via all routes adjusted to body weight for the 'i' life stage (µg/kg bw/d)
RsD = chemical-specific risk-specific dose (µg/kg bw/d)
LAF_{-i} = Lifetime adjustment factor for the 'i' life stage for general population (yr-life stage/yr-total)

The sum of the ILCR values of all the life stages (*i.e.*, infant, toddler, child, adolescent, and adult) was presented in the report for carcinogens. For the purposes of assessing carcinogenic substances, a benchmark cancer risk level of 1 in 100,000 (i.e., 1×10^{-5}) is used; cancer risks are deemed negligible when the estimated ILCR is ≤ 1 in 100,000. An ILCR greater than 1 in 100,000 does not necessarily imply that an actual risk exists; rather, an exceedance is an indication that there may be the potential for adverse health effects and further assessment may be required.

9.2 Screening Level Assessment

Predicted Exposure and Risk

The predicted maximum RQ values (i.e., infant to adult) for the non-carcinogenic COPC are presented in Table 9-4. The predicted RQ values for all COPC based on the MPOI annual deposition rate at the site boundary and the maximum annual average deposition rate at 1 km from the site boundary are below the benchmark RQ value of 1.0 for Baseline + Project, and below 0.2 for the Project case alone. This indicates that adverse health effects from soil and dust exposure, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use (i.e., swimming), are not anticipated.

Table 9-4 Chronic Non-Carcinogenic Risk Quotients for the Indigenous Group

Metal/COPC	*Risk Quotients*					
	MPOI annual deposition rate at site boundary			*Maximum annual deposition rate at 1 km from site boundary*		
	Baseline	*Project*	*Project + Baseline*	*Baseline*	*Project*	*Project + Baseline*
Aluminum	8.2E-01	1.4E-04	8.2E-01	8.4E-01	5.2E-05	8.4E-01
Arsenic	1.9E-01	1.9E-03	1.9E-01	1.9E-01	1.5E-03	1.9E-01
Barium	9.4E-03	5.6E-07	9.4E-03	1.8E-02	2.5E-07	1.8E-02
Chromium	1.4E-01	2.3E-04	1.4E-01	1.6E-01	2.1E-04	1.6E-01
Cobalt	5.8E-02	3.7E-03	6.1E-02	6.2E-02	3.7E-03	6.6E-02
Copper	6.9E-03	2.9E-04	7.2E-03	1.0E-02	2.9E-04	1.1E-02
Lead	1.4E-01	3.9E-03	1.5E-01	1.5E-01	3.9E-03	1.5E-01
Manganese	5.3E-01	5.8E-04	5.3E-01	1.0E+00	5.7E-04	1.0E+00
Molybdenum	9.3E-04	3.0E-05	9.6E-04	1.5E-03	3.0E-05	1.5E-03
Nickel	2.5E-02	5.6E-04	2.5E-02	3.8E-02	5.5E-04	3.8E-02
Strontium	3.0E-03	2.6E-07	3.0E-03	5.9E-03	1.2E-07	5.9E-03
Vanadium	8.9E-02	1.6E-05	8.9E-02	9.3E-02	6.0E-06	9.3E-02
Zinc	5.1E-03	2.7E-03	7.8E-03	7.6E-03	2.7E-03	1.0E-02

Notes:
Shaded values indicate an exceedance of the RQ benchmark of 0.2

The predicted ILCRs for the carcinogenic COPC (*i.e.*, arsenic) are presented in Table 9-5. The predicted ILCRs based on the MPOI annual deposition rate at the site boundary and the maximum annual average deposition rate at 1 km from the site boundary are all below the benchmark value of 1 in 100,000. Therefore, the cancer risk from soil and dust exposure, the consumption of country foods collected from the vicinity of the Mine Site, and recreational water use, is considered to be negligible and adverse health effects are not expected.

Table 9-5 Chronic Incremental Lifetime Cancer Risks for the Indigenous Group

Metal/COPC	*Incremental Lifetime Cancer Risks (per 100,000)*	
	MPOI annual deposition rate at site boundary	*Maximum annual deposition rate at 1km from site boundary*
	Project	*Project*
Arsenic	3.7E-02	3.2E-03

9.3 Summary

Non-carcinogenic risks from soil and dust exposures, the consumption of country foods harvested from the vicinity of the Mine Site, and recreational water use (i.e., swimming), as well as soil ingestion and dermal contact, are considered to be negligible, and hence, are not anticipated to result in adverse health effects. For arsenic, predicted ILCRs were below the benchmark ILCR of 1 in 100,000 in all scenarios and assessment cases. Therefore, the potential for carcinogenic adverse health effects from arsenic exposure are considered negligible.

10 CONCLUSIONS

Based on the assessment conducted, the following can be concluded:

- Metals are naturally occurring in the environment and are present within existing soils and vegetation in the region. Mine activities will result in increased deposition of dust in the vicinity of the Mine Site outside the PDA;
- Dustfall predictions indicate that the areas outside the PDA that will potentially receive higher dustfall rates are small in size (see Figure 5-3), which limits the exposure potential for people in the area;
- The bioavailability of ore dust is unknown at this time, but is likely low in that the mineral types and forms of metals present in the ore may serve to limit the potential for uptake into terrestrial vegetation;
- Based on the estimated future soil concentrations of all metals considered, some accumulation within vegetation is anticipated to occur, but would likely be localized to areas most affected by dust loadings which are generally limited in size and closer to the mine site boundary;
- Based on the assessment conducted, it is considered unlikely that ore dust deposition and effluent releases from the FMS Mine Site at the rates considered in this assessment would result in levels of metals in country foods, soils and dust, and surface water (*via* recreational water use) that would be harmful to human health, based on the risk assessment conducted; and,
- Cumulative effects of the FMS project, in conjunction with other proposed Projects in the area (such as the Touquoy Mine and Beaver Dam Mine) are not expected as these mines are located some distance from the FMS Mine Site, and the air quality impacts are unlikely to overlap.

Uncertainties, Conservative Assumptions and Limitations:

As inherent in any risk assessment study, there are limitations, uncertainties and conservative assumptions applicable to this screening level risk assessment, as follows:

- Geochemistry from waste rock obtained from the Fifteen Mile Stream Mine Site was used in the assessment to predict the composition of dust fall and the potential exposures related to country foods harvested from the vicinity of the Mine Site. The use of waste rock in the estimation of potential interior haul road dust levels is considered to represent a reasonable assumption, based on the expectation that the haul road inside the mine will be constructed of waste rock.
- The use of literature-based BCFs to predict baseline berry and leafy vegetation concentrations is considered standard practice where site-specific BCFs cannot be calculated. Although this represents a source of uncertainty, predictions in the assessment using the literature-based BCF tended to result in conservative estimations, given that concentrations for those chemicals were not detected in any of the samples.
- The use of fish tissue concentrations and surface water concentrations from samples collected from Scraggy Lake (as opposed to the Anti Dam Flowage) to calculate site-specific fish BCFs represents a source of uncertainty. However, due to the lack of

available fish tissue data from the Anti Dam Flowage, data from Scraggy Lake are considered to represent an appropriate surrogate for use in predicting fish BCFs for the Anti Dam Flowage.

- For the purposes of calculating summary statistics to represent baseline soil, berry, and leafy vegetation concentrations (*e.g.*, 90th percentile), where a chemical concentration was not detected in a sample, ½ of the detection limit was used for the sample in the calculations. This is a standard approach, however, it represents an area of uncertainty due to the absence of an actual detected concentration.
- Indigenous peoples were assumed to harvest and consume 50% of all berries, leafy vegetation, and 100% of wild game (i.e., deer) from the Mine Site boundary for their entire lifespan in the MPOI deposition rate scenario and all of their berry, leafy vegetation, and wild game harvest at 1 km from the Mine Site boundary for their entire lifespan in the alternate maximum scenario. In the absence of site specific consumption information, these assumptions are considered to represent conservative assumptions as it is unlikely that people would continually harvest and consume berries, leafy vegetation, and wild game at such rates in the vicinity of the Mine Site for their entire lifetimes. In addition, dusting events associated with the Mine Site are estimated to only occur over a 6 year period, and hence, lifetime exposure to these levels is not plausible.
- Indigenous peoples were assumed to harvest all fish from the Anti Dam Flowage. Limited fish appear to inhabit the Anti Dam Flowage and fishing is infrequent in this waterbody. Therefore, the assumption that all fish consumed over an entire lifetime would be harvested from the Anti Dam Flowage is likely highly conservative.
- Indigenous peoples were assumed to swim in the Anti Dam Flowage every day for 1 hour for 12 days during 3 months of each year (representative of the entirety of the summer months). The Anti Dam Flowage is located in a remote area with limited access and no residents are known to live nearby. Therefore, this assumption is likely highly conservative.
- Bio-accessibility of metals in consumed vegetation was assumed to be 100%.
- Vegetation was assumed to be unwashed prior to consumption.
- TRV incorporate several layers of uncertainty factors often ranging from 100 to 1000 and points of departure typically based on NOAELs.

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Appendix A – Baseline Analytical Results

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-11	288107-12	288107-13
Client Sample ID:			Berry 1	Berry 2	Berry 3
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	86.0	91.9	86.4

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit

Ross Kean
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-14	288107-15	288107-16
Client Sample ID:			Berry 4	Berry 5	Berry 6
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	88.4	82.4	85.1

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-17	288107-18	288107-19
Client Sample ID:			Berry 7	Berry 8	Berry 9
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	83.2	81.3	84.3

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for

Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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Tel: 506.452.1212
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www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-20
Client Sample ID:			Berry 10
Date Sampled:			31-Aug-18
Analytes	**Units**	**RL**	
Moisture	%	0.1	82.2

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-11	288107-12	288107-13
Client Sample ID:			Berry 1	Berry 2	Berry 3
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	2.2	0.4	3.1
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	2.55	1.88	1.14
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	1.28	2.52	0.67
Cadmium	mg/kg	0.0005	0.0005	0.0161	< 0.0005
Calcium	mg/kg	2	240	305	197
Chromium	mg/kg	0.02	0.08	0.05	0.05
Cobalt	mg/kg	0.002	< 0.002	0.024	0.003
Copper	mg/kg	0.02	0.79	0.78	0.25
Iron	mg/kg	1	4	5	2
Lead	mg/kg	0.002	0.002	0.003	0.003
Lithium	mg/kg	0.002	0.002	0.004	< 0.002
Magnesium	mg/kg	0.5	91.6	225.	74.7
Manganese	mg/kg	0.02	52.5	75.3	97.3
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.021	0.030	0.009
Nickel	mg/kg	0.02	0.12	0.56	0.13
Potassium	mg/kg	1	975	1530	861
Rubidium	mg/kg	0.002	9.63	10.3	3.62
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	15	27	12
Strontium	mg/kg	0.02	1.55	2.32	2.03
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.481	3.63	0.122
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	0.94	3.10	0.68

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-14	288107-14 Dup	288107-15
Client Sample ID:			Berry 4	Lab Duplicate	Berry 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	0.2	0.3	0.3
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	1.63	1.70	1.23
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	0.64	0.64	3.05
Cadmium	mg/kg	0.0005	0.0096	0.0094	0.0231
Calcium	mg/kg	2	138	128	359
Chromium	mg/kg	0.02	< 0.02	< 0.02	0.11
Cobalt	mg/kg	0.002	< 0.002	< 0.002	0.010
Copper	mg/kg	0.02	0.49	0.41	1.03
Iron	mg/kg	1	1	2	8
Lead	mg/kg	0.002	< 0.002	< 0.002	0.003
Lithium	mg/kg	0.002	0.012	0.020	< 0.002
Magnesium	mg/kg	0.5	70.8	66.5	350.
Manganese	mg/kg	0.02	6.02	3.21	88.9
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.010	0.011	0.046
Nickel	mg/kg	0.02	0.04	0.06	0.50
Potassium	mg/kg	1	752	640	2230
Rubidium	mg/kg	0.002	2.64	2.13	6.35
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	5	6	15
Strontium	mg/kg	0.02	0.99	1.42	1.85
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.017	0.013	2.15
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	0.79	0.96	5.51

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-16	288107-17	288107-18
Client Sample ID:			Berry 6	Berry 7	Berry 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	0.3	2.7	2.6
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	0.52	1.61	0.96
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	1.86	1.32	0.65
Cadmium	mg/kg	0.0005	0.0203	0.0012	< 0.0005
Calcium	mg/kg	2	136	648	154
Chromium	mg/kg	0.02	0.05	0.03	0.08
Cobalt	mg/kg	0.002	0.010	< 0.002	< 0.002
Copper	mg/kg	0.02	0.83	0.30	0.72
Iron	mg/kg	1	3	2	3
Lead	mg/kg	0.002	< 0.002	0.013	< 0.002
Lithium	mg/kg	0.002	< 0.002	0.002	< 0.002
Magnesium	mg/kg	0.5	287.	268.	77.5
Manganese	mg/kg	0.02	112.	1.76	2.21
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.042	0.025	0.013
Nickel	mg/kg	0.02	0.20	0.19	0.12
Potassium	mg/kg	1	1520	1900	1210
Rubidium	mg/kg	0.002	12.5	20.1	5.22
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	9	19	22
Strontium	mg/kg	0.02	0.90	8.68	1.11
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.622	0.392	0.153
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	1.36	0.85	0.76

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-19	288107-20
Client Sample ID:			Berry 9	Berry 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	1.2	0.4
Antimony	mg/kg	0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	1.53	2.93
Beryllium	mg/kg	0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	3.24	2.64
Cadmium	mg/kg	0.0005	0.0271	0.0268
Calcium	mg/kg	2	424	353
Chromium	mg/kg	0.02	0.04	0.03
Cobalt	mg/kg	0.002	0.005	0.052
Copper	mg/kg	0.02	0.95	1.72
Iron	mg/kg	1	6	6
Lead	mg/kg	0.002	0.002	< 0.002
Lithium	mg/kg	0.002	0.003	0.002
Magnesium	mg/kg	0.5	250.	412.
Manganese	mg/kg	0.02	82.3	18.8
Mercury	mg/kg	0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.035	0.052
Nickel	mg/kg	0.02	0.45	0.82
Potassium	mg/kg	1	1900	1680
Rubidium	mg/kg	0.002	6.03	13.7
Selenium	mg/kg	0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005
Sodium	mg/kg	2	15	13
Strontium	mg/kg	0.02	1.63	3.72
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	1.96	0.231
Uranium	mg/kg	0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	4.16	4.16

Report ID: 288107-IAS
Report Date: 24-Sep-18
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-01	288107-01 Dup	288107-02
Client Sample ID:			Soil 1	Lab Duplicate	Soil 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Carbon - Organic	mg/kg	0.01	2.19	2.21	5.34

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-03	288107-04	288107-05
Client Sample ID:			Soil 3	Soil 4	Soil 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Carbon - Organic	mg/kg	0.01	0.83	7.11	5.46

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-06	288107-07	288107-08
Client Sample ID:			Soil 6	Soil 7	Soil 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Carbon - Organic	mg/kg	0.01	1.18	9.58	1.17

Report ID: 288107-IAS
Report Date: 24-Sep-18
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-09	288107-10
Client Sample ID:			Soil 9	Soil 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Carbon - Organic	mg/kg	0.01	2.79	5.78

Report ID: 288107-IAS
Report Date: 24-Sep-18
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-01	288107-01 Dup	288107-02
Client Sample ID:			Soil 1	Lab Duplicate	Soil 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	1	6870	7150	12800
Antimony	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	1	1	14
Barium	mg/kg	1	12	13	14
Beryllium	mg/kg	0.1	< 0.1	< 0.1	0.2
Bismuth	mg/kg	1	< 1	< 1	< 1
Boron	mg/kg	1	3	3	2
Cadmium	mg/kg	0.01	0.04	0.04	0.09
Calcium	mg/kg	50	260	240	150
Chromium	mg/kg	1	10	10	15
Cobalt	mg/kg	0.1	1.4	1.4	2.7
Copper	mg/kg	1	4	4	6
Iron	mg/kg	20	17500	18000	44700
Lead	mg/kg	0.1	6.8	6.9	13.8
Lithium	mg/kg	0.1	3.2	3.5	9.1
Magnesium	mg/kg	10	1060	1130	1690
Manganese	mg/kg	1	67	73	254
Mercury	mg/kg	0.01	0.03	0.03	0.10
Molybdenum	mg/kg	0.1	< 0.1	< 0.1	0.5
Nickel	mg/kg	1	4	4	7
Potassium	mg/kg	20	350	410	250
Rubidium	mg/kg	0.1	7.0	7.2	5.0
Selenium	mg/kg	1	< 1	< 1	2
Silver	mg/kg	0.1	< 0.1	< 0.1	0.3
Sodium	mg/kg	50	< 50	< 50	< 50
Strontium	mg/kg	1	9	8	4
Tellurium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1	< 1
Uranium	mg/kg	0.1	0.3	0.3	0.5
Vanadium	mg/kg	1	40	40	28
Zinc	mg/kg	1	10	11	18

Report ID: 288107-IAS
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-03	288107-04	288107-05
Client Sample ID:			Soil 3	Soil 4	Soil 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	1	5070	2260	22400
Antimony	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	2	< 1	10
Barium	mg/kg	1	12	23	35
Beryllium	mg/kg	0.1	< 0.1	< 0.1	0.4
Bismuth	mg/kg	1	< 1	1	< 1
Boron	mg/kg	1	< 1	2	3
Cadmium	mg/kg	0.01	0.01	0.11	0.08
Calcium	mg/kg	50	90	450	260
Chromium	mg/kg	1	4	3	21
Cobalt	mg/kg	0.1	1.3	0.9	10.2
Copper	mg/kg	1	2	3	11
Iron	mg/kg	20	4780	3200	32400
Lead	mg/kg	0.1	4.2	9.5	16.4
Lithium	mg/kg	0.1	8.3	1.8	29.6
Magnesium	mg/kg	10	680	470	2850
Manganese	mg/kg	1	160	72	801
Mercury	mg/kg	0.01	0.02	0.07	0.16
Molybdenum	mg/kg	0.1	< 0.1	< 0.1	0.8
Nickel	mg/kg	1	3	2	14
Potassium	mg/kg	20	280	210	870
Rubidium	mg/kg	0.1	8.1	2.1	15.0
Selenium	mg/kg	1	< 1	< 1	2
Silver	mg/kg	0.1	< 0.1	0.1	< 0.1
Sodium	mg/kg	50	< 50	< 50	< 50
Strontium	mg/kg	1	3	8	7
Tellurium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1	< 1
Uranium	mg/kg	0.1	0.3	0.2	0.9
Vanadium	mg/kg	1	6	7	26
Zinc	mg/kg	1	7	7	36

Report ID: 288107-IAS
Report Date: 24-Sep-18
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CERTIFICATE OF ANALYSIS

for
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-06	288107-07	288107-08
Client Sample ID:			Soil 6	Soil 7	Soil 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	1	7700	5760	2060
Antimony	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	5	< 1	< 1
Barium	mg/kg	1	12	24	6
Beryllium	mg/kg	0.1	0.1	< 0.1	< 0.1
Bismuth	mg/kg	1	< 1	< 1	< 1
Boron	mg/kg	1	< 1	2	< 1
Cadmium	mg/kg	0.01	0.02	0.16	0.02
Calcium	mg/kg	50	140	300	100
Chromium	mg/kg	1	11	4	2
Cobalt	mg/kg	0.1	2.7	0.9	0.3
Copper	mg/kg	1	3	3	< 1
Iron	mg/kg	20	14300	3570	1340
Lead	mg/kg	0.1	5.4	11.0	2.9
Lithium	mg/kg	0.1	11.1	1.7	1.2
Magnesium	mg/kg	10	2240	500	210
Manganese	mg/kg	1	200	54	27
Mercury	mg/kg	0.01	0.02	0.07	0.01
Molybdenum	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Nickel	mg/kg	1	7	2	< 1
Potassium	mg/kg	20	400	360	120
Rubidium	mg/kg	0.1	6.3	6.0	1.5
Selenium	mg/kg	1	< 1	< 1	< 1
Silver	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Sodium	mg/kg	50	< 50	< 50	< 50
Strontium	mg/kg	1	3	7	2
Tellurium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1	< 1
Uranium	mg/kg	0.1	0.4	0.7	0.4
Vanadium	mg/kg	1	17	12	3
Zinc	mg/kg	1	16	11	2

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-09	288107-10
Client Sample ID:			Soil 9	Soil 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	1	3130	7970
Antimony	mg/kg	0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	< 1	2
Barium	mg/kg	1	26	27
Beryllium	mg/kg	0.1	< 0.1	0.1
Bismuth	mg/kg	1	< 1	< 1
Boron	mg/kg	1	< 1	1
Cadmium	mg/kg	0.01	0.06	0.08
Calcium	mg/kg	50	610	830
Chromium	mg/kg	1	4	12
Cobalt	mg/kg	0.1	4.9	2.7
Copper	mg/kg	1	1	3
Iron	mg/kg	20	4190	16100
Lead	mg/kg	0.1	6.4	9.3
Lithium	mg/kg	0.1	2.0	6.0
Magnesium	mg/kg	10	500	2150
Manganese	mg/kg	1	792	95
Mercury	mg/kg	0.01	0.04	0.07
Molybdenum	mg/kg	0.1	< 0.1	0.3
Nickel	mg/kg	1	4	8
Potassium	mg/kg	20	380	550
Rubidium	mg/kg	0.1	5.3	5.0
Selenium	mg/kg	1	< 1	< 1
Silver	mg/kg	0.1	< 0.1	< 0.1
Sodium	mg/kg	50	< 50	50
Strontium	mg/kg	1	6	10
Tellurium	mg/kg	0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1
Uranium	mg/kg	0.1	0.3	0.4
Vanadium	mg/kg	1	7	35
Zinc	mg/kg	1	7	18

CERTIFICATE OF ANALYSIS
for
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Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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General Report Comments

288107-1 to 288107-10
Samples were air dried and sieved at 2 mm. A portion of each was digested according to EPA Method 3050B.
The resulting solutions were analyzed for trace elements by ICP-MS.
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
A portion of each sample was dried and sieved at 2 mm. Total and Inorganic Carbon were determined using combustion/acid evolution infrared methods. Total Organic Carbon is calculated as the difference.

288107-11 to 288107-20
The samples were homogenized and portions were prepared by Microwave Assisted Digestion in nitric acid (SOP 4.M26).
The resulting solutions were analyzed for trace elements by ICP-MS (SOP 4.M01).
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
Results are reported on an "as received" (wet weight) basis.
† Arsenic could not be reported due to a matrix based interference.

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			CRM088027	RB052177
Type:			CRM NIST1573a	Blank
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	494.	< 0.1
Antimony	mg/kg	0.005	0.026	< 0.005
Arsenic	mg/kg	0.02	†	< 0.02
Barium	mg/kg	0.05	63.9	< 0.05
Beryllium	mg/kg	0.005	0.019	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	32.5	< 0.05
Cadmium	mg/kg	0.0005	1.53	< 0.0005
Calcium	mg/kg	2	57300	< 2
Chromium	mg/kg	0.02	1.91	< 0.02
Cobalt	mg/kg	0.002	0.551	< 0.002
Copper	mg/kg	0.02	4.36	< 0.02
Iron	mg/kg	1	362	< 1
Lead	mg/kg	0.002	0.585	< 0.002
Lithium	mg/kg	0.002	0.622	< 0.002
Magnesium	mg/kg	0.5	11400	< 0.5
Manganese	mg/kg	0.02	260.	< 0.02
Mercury	mg/kg	0.01	0.03	< 0.01
Molybdenum	mg/kg	0.002	0.559	< 0.002
Nickel	mg/kg	0.02	1.54	< 0.02
Potassium	mg/kg	1	29700	< 1
Rubidium	mg/kg	0.002	16.5	< 0.002
Selenium	mg/kg	0.05	0.10	< 0.05
Silver	mg/kg	0.005	0.012	< 0.005
Sodium	mg/kg	2	136	< 2
Strontium	mg/kg	0.02	102.	< 0.02
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	0.042	< 0.002
Tin	mg/kg	0.002	0.034	0.011
Uranium	mg/kg	0.002	0.025	< 0.002
Vanadium	mg/kg	0.02	0.80	< 0.02
Zinc	mg/kg	0.02	30.5	< 0.02

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			CRM087844	RB052079
Type:			CRM NIST2709a	Blank
Analytes	**Units**	**RL**		
Aluminum	mg/kg	1	26900	2
Antimony	mg/kg	0.1	0.1	< 0.1
Arsenic	mg/kg	1	8	< 1
Barium	mg/kg	1	437	< 1
Beryllium	mg/kg	0.1	0.8	< 0.1
Bismuth	mg/kg	1	< 1	< 1
Boron	mg/kg	1	37	< 1
Cadmium	mg/kg	0.01	0.35	< 0.01
Calcium	mg/kg	50	14800	< 50
Chromium	mg/kg	1	77	< 1
Cobalt	mg/kg	0.1	12.1	< 0.1
Copper	mg/kg	1	31	< 1
Iron	mg/kg	20	31900	< 20
Lead	mg/kg	0.1	11.6	< 0.1
Lithium	mg/kg	0.1	37.0	< 0.1
Magnesium	mg/kg	10	12400	< 10
Manganese	mg/kg	1	475	< 1
Mercury	mg/kg	0.01	0.89	< 0.01
Molybdenum	mg/kg	0.1	0.9	0.1
Nickel	mg/kg	1	77	< 1
Potassium	mg/kg	20	3740	< 20
Rubidium	mg/kg	0.1	33.7	< 0.1
Selenium	mg/kg	1	1	< 1
Silver	mg/kg	0.1	0.1	< 0.1
Sodium	mg/kg	50	560	< 50
Strontium	mg/kg	1	109	< 1
Tellurium	mg/kg	0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	0.2	0.2
Tin	mg/kg	1	< 1	5
Uranium	mg/kg	0.1	1.8	< 0.1
Vanadium	mg/kg	1	71	< 1
Zinc	mg/kg	1	97	< 1

CERTIFICATE OF ANALYSIS
for
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Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
EPA 3050B Digestion	4.M19	EPA 3050B	Nitric Acid/Hydrogen Peroxide Digestion
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES
Mercury	4.M53	EPA 245.5	Cold Vapor AAS

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental
Sciences Inc
5121 Sackville Street, Suite 506
Halifax, NS B3J 1K1

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921 College Hill Rd
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-01	290705-01 Dup	290705-02
Client Sample ID:			Veg 1	Lab Duplicate	Veg 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	56.8	57.9	62.2

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit

Ross Kean
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for

Intrinsik Environmental Sciences Inc
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Tel: 506.452.1212
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Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-03	290705-04	290705-05
Client Sample ID:			Veg 3	Veg 4	Veg 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	77.3	55.8	71.5

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for

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Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-06	290705-07	290705-08
Client Sample ID:			Veg 6	Veg 7	Veg 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	†	72.5	61.8

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for

Intrinsik Environmental Sciences Inc
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Tel: 506.452.1212
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www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-09	290705-10
Client Sample ID:			Veg 9	Veg 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Moisture	%	0.1	76.9	78.2

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
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5121 Sackville Street, Suite 506
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-01	290705-01 Dup	290705-02
Client Sample ID:			Veg 1	Lab Duplicate	Veg 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	47.8	51.0	12.6
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	46.5	49.2	22.1
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	19.0	19.6	15.7
Cadmium	mg/kg	0.0005	0.0019	0.0018	0.0423
Calcium	mg/kg	2	3610	3680	2580
Chromium	mg/kg	0.02	0.08	0.08	0.04
Cobalt	mg/kg	0.002	0.017	0.012	0.037
Copper	mg/kg	0.02	2.28	2.14	2.35
Iron	mg/kg	1	34	32	25
Lead	mg/kg	0.002	0.027	0.028	0.023
Lithium	mg/kg	0.002	0.036	0.030	0.008
Magnesium	mg/kg	0.5	1250	1270	1210
Manganese	mg/kg	0.02	803.	692.	1110
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.026	0.025	0.055
Nickel	mg/kg	0.02	0.62	0.62	0.94
Potassium	mg/kg	1	2150	2150	3230
Rubidium	mg/kg	0.002	14.6	14.7	25.8
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	20	21	7
Strontium	mg/kg	0.02	27.4	27.3	19.8
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	0.002
Tin	mg/kg	0.002	0.055	0.020	0.015
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	0.04	0.03	< 0.02
Zinc	mg/kg	0.02	5.53	5.41	4.72

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-03	290705-04	290705-05
Client Sample ID:			Veg 3	Veg 4	Veg 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	49.6	7.6	10.0
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	17.2	18.4	10.3
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	8.36	9.09	10.7
Cadmium	mg/kg	0.0005	0.0009	0.0012	0.0422
Calcium	mg/kg	2	1870	2730	2030
Chromium	mg/kg	0.02	0.03	0.05	0.04
Cobalt	mg/kg	0.002	0.028	0.069	0.005
Copper	mg/kg	0.02	0.67	1.82	1.40
Iron	mg/kg	1	19	43	21
Lead	mg/kg	0.002	0.011	0.031	0.011
Lithium	mg/kg	0.002	0.018	0.149	0.006
Magnesium	mg/kg	0.5	570.	1110	1110
Manganese	mg/kg	0.02	1440	554.	921.
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.013	0.119	0.045
Nickel	mg/kg	0.02	0.77	0.88	0.23
Potassium	mg/kg	1	980	1900	1740
Rubidium	mg/kg	0.002	3.28	5.96	5.13
Selenium	mg/kg	0.05	0.11	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	23	365	11
Strontium	mg/kg	0.02	19.0	19.2	10.7
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	0.002	< 0.002
Tin	mg/kg	0.002	0.020	0.007	0.015
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	2.51	11.0	5.23

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-06	290705-07	290705-08
Client Sample ID:			Veg 6	Veg 7	Veg 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	24.6	208.	34.9
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	8.51	23.7	37.4
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	8.73	12.8	9.36
Cadmium	mg/kg	0.0005	0.0254	0.0043	0.0019
Calcium	mg/kg	2	1150	8910	4120
Chromium	mg/kg	0.02	0.07	0.05	0.06
Cobalt	mg/kg	0.002	0.017	0.005	0.011
Copper	mg/kg	0.02	1.56	0.62	1.29
Iron	mg/kg	1	24	23	17
Lead	mg/kg	0.002	0.009	0.327	0.015
Lithium	mg/kg	0.002	0.012	0.020	0.011
Magnesium	mg/kg	0.5	709.	2610	1130
Manganese	mg/kg	0.02	751.	30.5	140.
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.023	0.032	0.010
Nickel	mg/kg	0.02	0.20	0.14	0.71
Potassium	mg/kg	1	1040	3270	2250
Rubidium	mg/kg	0.002	5.26	12.5	6.45
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	13	6	14
Strontium	mg/kg	0.02	7.97	68.1	28.7
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.036	0.017	0.013
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	0.05	< 0.02
Zinc	mg/kg	0.02	3.47	5.18	3.23

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-09	290705-10
Client Sample ID:			Veg 9	Veg 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	12.2	30.5
Antimony	mg/kg	0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	0.04	< 0.02
Barium	mg/kg	0.05	15.4	32.5
Beryllium	mg/kg	0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	11.9	15.3
Cadmium	mg/kg	0.0005	0.0765	0.0593
Calcium	mg/kg	2	2640	2260
Chromium	mg/kg	0.02	0.04	0.05
Cobalt	mg/kg	0.002	0.009	0.053
Copper	mg/kg	0.02	1.14	1.79
Iron	mg/kg	1	22	21
Lead	mg/kg	0.002	0.011	0.045
Lithium	mg/kg	0.002	0.015	0.013
Magnesium	mg/kg	0.5	804.	1840
Manganese	mg/kg	0.02	968.	113.
Mercury	mg/kg	0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.073	0.087
Nickel	mg/kg	0.02	0.54	0.53
Potassium	mg/kg	1	3250	1540
Rubidium	mg/kg	0.002	6.44	8.31
Selenium	mg/kg	0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005
Sodium	mg/kg	2	14	9
Strontium	mg/kg	0.02	12.5	30.6
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	0.022	0.004
Tin	mg/kg	0.002	0.008	0.062
Uranium	mg/kg	0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	0.04
Zinc	mg/kg	0.02	7.73	10.4

CERTIFICATE OF ANALYSIS

for

Intrinsik Environmental Sciences Inc
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General Report Comments

The samples were homogenized and portions were prepared by Microwave Assisted Digestion in nitric acid (SOP 4.M26).
The resulting solutions were analyzed for trace elements by ICP-MS (SOP 4.M01).
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
Results are reported on an "as received" (wet weight) basis.
† The sample was mis-placed prior to sub-sampling for Moisture analysis.

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

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*** Revised Report ***

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			289142-2	289142-3
Client Sample ID:			Berry II	Vegetation II
Date Sampled:			5-Sep-18	5-Sep-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	3.3	70.6
Antimony	mg/kg	0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	0.57	35.4
Beryllium	mg/kg	0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	2.47	25.1
Cadmium	mg/kg	0.0005	0.0109	0.0455
Calcium	mg/kg	2	140	3260
Chromium	mg/kg	0.02	0.03	0.14
Cobalt	mg/kg	0.002	0.014	0.023
Copper	mg/kg	0.02	1.16	3.39
Iron	mg/kg	1	6	29
Lead	mg/kg	0.002	< 0.002	0.016
Lithium	mg/kg	0.002	0.006	0.013
Magnesium	mg/kg	0.5	310.	1040
Manganese	mg/kg	0.02	65.7	1430
Mercury	mg/kg	0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.033	0.046
Nickel	mg/kg	0.02	0.19	0.66
Potassium	mg/kg	1	2310	3200
Rubidium	mg/kg	0.002	5.14	5.24
Selenium	mg/kg	0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005
Sodium	mg/kg	2	19	6
Strontium	mg/kg	0.02	0.87	20.9
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.710	0.006
Uranium	mg/kg	0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	1.78	13.3

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit

Ross Kean
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

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for
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*** Revised Report ***

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			289142-1	289142-1 Dup
Client Sample ID:			Soil II	Lab Duplicate
Date Sampled:			5-Sep-18	5-Sep-18
Analytes	**Units**	**RL**		
Carbon - Organic	mg/kg	0.01	3.35	3.54

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

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for
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Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

*** Revised Report ***

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			289142-1
Client Sample ID:			Soil II
Date Sampled:			5-Sep-18
Analytes	**Units**	**RL**	
Aluminum	mg/kg	1	27400
Antimony	mg/kg	0.1	< 0.1
Arsenic	mg/kg	1	8
Barium	mg/kg	1	49
Beryllium	mg/kg	0.1	0.5
Bismuth	mg/kg	1	< 1
Boron	mg/kg	1	< 1
Cadmium	mg/kg	0.01	0.07
Calcium	mg/kg	50	180
Chromium	mg/kg	1	26
Cobalt	mg/kg	0.1	20.0
Copper	mg/kg	1	10
Iron	mg/kg	20	29200
Lead	mg/kg	0.1	16.6
Lithium	mg/kg	0.1	53.9
Magnesium	mg/kg	10	4500
Manganese	mg/kg	1	3450
Mercury	mg/kg	0.01	0.10
Molybdenum	mg/kg	0.1	0.5
Nickel	mg/kg	1	18
Potassium	mg/kg	20	1020
Rubidium	mg/kg	0.1	26.3
Selenium	mg/kg	1	2
Silver	mg/kg	0.1	< 0.1
Sodium	mg/kg	50	60
Strontium	mg/kg	1	7
Tellurium	mg/kg	0.1	< 0.1
Thallium	mg/kg	0.1	0.2
Tin	mg/kg	1	< 1
Uranium	mg/kg	0.1	1.2
Vanadium	mg/kg	1	24
Zinc	mg/kg	1	57

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General Report Comments

289142-1
Sample was air dried and sieved at 2 mm. A portion was digested according to EPA Method 3050B.
The resulting solution was analyzed for trace elements by ICP-MS.
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
A portion of the sample was dried and sieved at 2 mm. Total and Inorganic Carbon were determined using combustion/acid evolution infrared methods. Total Organic Carbon is calculated as the difference.

289142-2 & 289142-3
The samples were homogenized and portions were prepared by Microwave Assisted Digestion in nitric acid (SOP 4.M26).
The resulting solutions were analyzed for trace elements by ICP-MS (SOP 4.M01).
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
Results are reported on an "as received" (wet weight) basis.

Revision Comments

Incorrect results were reported due to a calculation error.
Results have been revised.

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

CERTIFICATE OF ANALYSIS

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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			RB052179
Type:			Blank
Analytes	**Units**	**RL**	
Aluminum	mg/kg	0.1	< 0.1
Antimony	mg/kg	0.005	0.005
Arsenic	mg/kg	0.02	< 0.02
Barium	mg/kg	0.05	< 0.05
Beryllium	mg/kg	0.005	< 0.005
Bismuth	mg/kg	0.05	0.10
Boron	mg/kg	0.05	< 0.05
Cadmium	mg/kg	0.0005	< 0.0005
Calcium	mg/kg	2	< 2
Chromium	mg/kg	0.02	< 0.02
Cobalt	mg/kg	0.002	< 0.002
Copper	mg/kg	0.02	< 0.02
Iron	mg/kg	1	< 1
Lead	mg/kg	0.002	< 0.002
Lithium	mg/kg	0.002	< 0.002
Magnesium	mg/kg	0.5	< 0.5
Manganese	mg/kg	0.02	< 0.02
Mercury	mg/kg	0.01	< 0.01
Molybdenum	mg/kg	0.002	0.004
Nickel	mg/kg	0.02	< 0.02
Potassium	mg/kg	1	< 1
Rubidium	mg/kg	0.002	< 0.002
Selenium	mg/kg	0.05	< 0.05
Silver	mg/kg	0.005	< 0.005
Sodium	mg/kg	2	< 2
Strontium	mg/kg	0.02	< 0.02
Tellurium	mg/kg	0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002
Tin	mg/kg	0.002	0.003
Uranium	mg/kg	0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02
Zinc	mg/kg	0.02	0.02

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
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Atlantic Gold
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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			CRM088117	RB052223
Type:			CRM NIST2709a	Blank
Analytes	**Units**	**RL**		
Aluminum	mg/kg	1	26400	< 1
Antimony	mg/kg	0.1	0.1	< 0.1
Arsenic	mg/kg	1	8	< 1
Barium	mg/kg	1	429	< 1
Beryllium	mg/kg	0.1	0.8	< 0.1
Bismuth	mg/kg	1	< 1	< 1
Boron	mg/kg	1	35	11
Cadmium	mg/kg	0.01	0.36	< 0.01
Calcium	mg/kg	50	13200	< 50
Chromium	mg/kg	1	72	< 1
Cobalt	mg/kg	0.1	11.7	< 0.1
Copper	mg/kg	1	30	< 1
Iron	mg/kg	20	30900	< 20
Lead	mg/kg	0.1	11.4	< 0.1
Lithium	mg/kg	0.1	35.6	< 0.1
Magnesium	mg/kg	10	12500	< 10
Manganese	mg/kg	1	465	< 1
Mercury	mg/kg	0.01	0.81	< 0.01
Molybdenum	mg/kg	0.1	0.4	0.7
Nickel	mg/kg	1	75	< 1
Potassium	mg/kg	20	3710	70
Rubidium	mg/kg	0.1	32.5	< 0.1
Selenium	mg/kg	1	< 1	< 1
Silver	mg/kg	0.1	0.2	< 0.1
Sodium	mg/kg	50	560	< 50
Strontium	mg/kg	1	107	< 1
Tellurium	mg/kg	0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	0.2	< 0.1
Tin	mg/kg	1	< 1	5
Uranium	mg/kg	0.1	1.8	< 0.1
Vanadium	mg/kg	1	65	< 1
Zinc	mg/kg	1	96	< 1

Report ID: 289142-IAS Rev01
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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
EPA 3050B Digestion	4.M19	EPA 3050B	Nitric Acid/Hydrogen Peroxide Digestion
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES
Mercury	4.M53	EPA 245.5	Cold Vapor AAS

Appendix B – Geochemistry Data for Waste Rock and Calculations of Metals Ratios for Dust Characterization

Geochemistry Data for Waste Rock and Calculations of Metals Ratios for Dust Characterization

The chemical composition of dust deposition used in the evaluation of potential exposures related to soil, berries and leafy vegetation harvested from the vicinity of the Project was based on the geochemistry of waste rock from the Fifteen Mile Stream Mine. The use of waste rock in the estimation of potential haul road dust levels is considered to represent a reasonable assumption for construction materials. A total of 14 waste rock samples were obtained from Atlantic Gold and analyzed for a suite of metals. The laboratory results were examined and statistical calculations were conducted. Where a chemical concentration was not detected in a sample, half of the detection limit was substituted in place of the non-detect value for statistical calculations. The geometric mean was selected to represent the metal concentrations of the waste rock dust. These geometric means were converted to percent values and applied to the dust deposition rates in the assessment to characterize dust composition.

Hole ID	Grade	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La
	per S. Goodman	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm
FMS-17-199	Waste	0.1	2.51	1560	5	70	0.25	1	0.66	0.25	14	39	25	4.49	10	0.0025	0.6	20
FMS-17-055	Waste	0.1	1.79	50	5	70	0.25	2	2.63	0.25	12	29	52	3.78	10	0.0025	0.58	30
FMS-17-055	Waste	0.1	2.64	429	5	50	0.9	1	0.71	0.25	20	30	47	4.88	10	0.0025	0.42	30
FMS-17-124	Waste	0.1	1.82	3850	5	60	0.25	1	1.77	0.25	15	27	13	3.51	10	0.0025	0.5	20
FMS-17-165	Waste	0.1	1.98	41	5	40	0.25	1	0.53	0.25	15	31	32	3.96	10	0.0025	0.34	30
FMS-17-165	Waste	0.1	1.99	424	5	40	0.25	1	0.86	0.25	18	26	45	4.08	10	0.0025	0.32	20
FMS-17-073	Waste	0.1	2.14	50	5	60	0.25	1	0.96	0.25	19	38	25	3.63	10	0.0025	0.5	30
FMS-17-073	Waste	0.1	2.11	71	5	60	0.25	1	0.31	0.25	15	35	14	3.65	10	0.0025	0.59	30
FMS-17-124	Waste	0.1	1.33	57	5	50	0.25	1	2.07	0.25	10	20	34	2.72	5	0.0025	0.36	20
FMS-17-165	Waste	0.1	0.7	16	5	20	0.25	1	4.03	0.25	7	11	18	1.64	5	0.0025	0.12	20
FMS-17-165	Waste	0.1	1.79	60	5	100	0.25	1	0.51	0.25	15	36	16	3.14	10	0.0025	0.7	20
FMS-17-199	Waste	0.1	0.88	165	5	20	0.25	1	4.85	0.25	7	14	24	1.91	5	0.0025	0.16	20
FMS-17-199	Waste	0.1	1.39	1070	5	30	0.25	1	1.05	0.25	10	22	24	2.72	5	0.0025	0.2	20
FMS-17-199	Waste	0.1	1.02	270	5	20	0.25	1	5.03	0.25	7	18	22	2.07	5	0.0025	0.13	20

red font indicates non-detect sample, at half of the detection limit

average	0.1	1.72071429	579.5	5	49.2857143	0.29642857	1.07142857	1.855	0.25	13.1428571	26.8571429	27.9285714	3.29857143	8.21428571	0.0025	0.39428571	23.5714286
geomean	0.1	1.61178961	172.54883	5	43.9897511	0.2739529	1.05075664	1.28158907	0.25	12.3839416	25.2625587	25.5191702	3.14771463	7.80709182	0.0025	0.3416379	23.116375
75th percentile	0.1	2.08	427.75	5	60	0.25	1	2.49	0.25	15	34	33.5	3.915	10	0.0025	0.56	30
95th percentile	0.1	2.5555	2361.5	5	80.5	0.4775	1.35	4.913	0.25	19.35	38.35	48.75	4.6265	10	0.0025	0.635	30

geomean percent	1.00E-05	1.61E+00	1.73E-02	5.00E-04	4.40E-03	2.74E-05	1.05E-04	1.28E+00	2.50E-05	1.24E-03	2.53E-03	2.55E-03	3.15E+00	7.81E-04	2.50E-07	3.42E-01	2.31E-03

Hole ID	Grade	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th	Ti	Tl	U	V	W	Zn
	per S. Goodman	%	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
FMS-17-199	Waste	1.53	779	1	0.02	41	750	28	0.3	1	4	15	10	0.08	5	5	36	5	94
FMS-17-055	Waste	0.85	882	0.5	0.02	30	500	6	0.45	1	4	21	10	0.1	5	5	29	5	67
FMS-17-055	Waste	1.34	664	1	0.02	42	470	13	0.29	1	3	17	10	0.04	5	5	27	5	96
FMS-17-124	Waste	0.94	675	0.5	0.03	28	460	8	0.31	2	4	34	10	0.06	5	5	30	5	74
FMS-17-165	Waste	0.95	494	1	0.03	28	440	10	0.26	1	4	13	10	0.06	5	5	33	5	82
FMS-17-165	Waste	0.99	585	0.5	0.02	38	410	18	0.37	1	3	14	10	0.04	5	5	26	5	81
FMS-17-073	Waste	1.16	653	0.5	0.03	35	700	4	0.05	1	5	20	10	0.09	5	5	41	5	79
FMS-17-073	Waste	1.14	463	0.5	0.03	34	700	3	0.11	1	4	11	10	0.09	5	5	36	5	84
FMS-17-124	Waste	0.65	765	0.5	0.03	22	300	8	0.28	1	3	27	10	0.07	5	5	22	5	53
FMS-17-165	Waste	0.33	1105	0.5	0.03	12	280	9	0.26	1	1	79	10	0.02	5	5	11	5	27
FMS-17-165	Waste	0.89	462	0.5	0.04	25	410	4	0.15	1	6	19	10	0.13	5	5	49	5	68
FMS-17-199	Waste	0.55	1080	0.5	0.03	17	540	8	0.23	1	2	83	10	0.03	5	5	16	5	40
FMS-17-199	Waste	0.82	421	0.5	0.04	26	560	10	0.36	3	2	15	10	0.02	5	5	22	5	59
FMS-17-199	Waste	0.59	980	0.5	0.03	19	520	7	0.26	1	2	46	10	0.01	5	5	18	5	40

red font indicates non-detect sample, at half of the detection limit

average	0.90928571	714.857143	0.60714286	0.02857143	28.3571429	502.857143	9.71428571	0.26285714	1.21428571	3.35714286	29.5714286	10	0.06	5	5	28.2857143	5	67.4285714
geomean	0.85042587	681.716412	0.58006469	0.02783927	26.8557448	484.090182	8.18784811	0.23437884	1.13653348	3.07097855	23.629658	10	0.04857852	5	5	26.4135975	5	63.7008313
75th percentile	1.1025	856.25	0.5	0.03	34.75	555	10	0.3075	1	4	32.25	10	0.0875	5	5	35.25	5	81.75
95th percentile	1.4065	1088.75	1	0.04	41.35	717.5	21.5	0.398	2.35	5.35	80.4	10	0.1105	5	5	43.8	5	94.7

geomean percent	8.50E-01	6.82E-02	5.80E-05	2.78E-02	2.69E-03	4.84E-02	8.19E-04	2.34E-01	1.14E-04	3.07E-04	2.36E-03	1.00E-03	4.86E-02	5.00E-04	5.00E-04	2.64E-03	5.00E-04	6.37E-03

Appendix C - Fifteen Mile Stream Mine Site Project
Dust Exposure Model, Human Exposure and Predicted Risk

Summary of Maximum RQ or ILCR Values for the Indigenous Receptor

Area	Chemical	Baseline	Project	Project + Baseline
Non-carcinogens				
Haul Road_Max	Aluminum	8.2E-01	1.4E-04	8.2E-01
Haul Road_Max	Arsenic	1.9E-01	1.9E-03	1.9E-01
Haul Road_Max	Barium	9.4E-03	5.6E-07	9.4E-03
Haul Road_Max	Chromium	1.4E-01	2.3E-04	1.4E-01
Haul Road_Max	Cobalt	5.8E-02	3.7E-03	6.1E-02
Haul Road_Max	Copper	6.9E-03	2.9E-04	7.2E-03
Haul Road_Max	Lead	1.4E-01	3.9E-03	1.5E-01
Haul Road_Max	Manganese	5.3E-01	5.8E-04	5.3E-01
Haul Road_Max	Molybdenum	9.3E-04	3.0E-05	9.6E-04
Haul Road_Max	Nickel	2.5E-02	5.6E-04	2.5E-02
Haul Road_Max	Strontium	3.0E-03	2.6E-07	3.0E-03
Haul Road_Max	Vanadium	8.9E-02	1.6E-05	8.9E-02
Haul Road_Max	Zinc	5.1E-03	2.7E-03	7.8E-03
Haul Road_Average	Aluminum	8.4E-01	5.2E-05	8.4E-01
Haul Road_Average	Arsenic	1.9E-01	1.5E-03	1.9E-01
Haul Road_Average	Barium	1.8E-02	2.5E-07	1.8E-02
Haul Road_Average	Chromium	1.6E-01	2.1E-04	1.6E-01
Haul Road_Average	Cobalt	6.2E-02	3.7E-03	6.6E-02
Haul Road_Average	Copper	1.0E-02	2.9E-04	1.1E-02
Haul Road_Average	Lead	1.5E-01	3.9E-03	1.5E-01
Haul Road_Average	Manganese	1.0E+00	5.7E-04	1.0E+00
Haul Road_Average	Molybdenum	1.5E-03	3.0E-05	1.5E-03
Haul Road_Average	Nickel	3.8E-02	5.5E-04	3.8E-02
Haul Road_Average	Strontium	5.9E-03	1.2E-07	5.9E-03
Haul Road_Average	Vanadium	9.3E-02	6.0E-06	9.3E-02
Haul Road_Average	Zinc	7.6E-03	2.7E-03	1.0E-02
Carcinogens				
Haul Road_Max	Arsenic_cancer	**1.6E+00**	3.7E-02	**1.6E+00**
Haul Road_Average	Arsenic_cancer	**1.8E+00**	3.2E-02	**1.8E+00**

Detailed Summary of RQ or ILCR Values for Indigenous Receptors

Area	Scenario	Chemical	Abbreviation	Type	Infant	Toddler	Child	Adolescent	Adult	Max	ILCR
Haul Road_Max	Baseline	Aluminum	Haul Road_Max_Baseline_Aluminum	RfD	3.93E-01	8.20E-01	1.41E-01	8.91E-02	8.19E-02	8.20E-01	0.00E+00
Haul Road_Max	Baseline	Arsenic	Haul Road_Max_Baseline_Arsenic	RfD	8.35E-02	1.87E-01	4.06E-02	2.27E-02	2.02E-02	1.87E-01	0.00E+00
Haul Road_Max	Baseline	Arsenic_cancer	Haul Road_Max_Baseline_Arsenic_cancer	RsD	2.61E-02	5.26E-01	1.78E-01	1.14E-01	7.56E-01	0.00E+00	1.60E+00
Haul Road_Max	Baseline	Barium	Haul Road_Max_Baseline_Barium	RfD	4.39E-04	9.43E-03	6.24E-03	6.28E-03	5.84E-03	9.43E-03	0.00E+00
Haul Road_Max	Baseline	Chromium	Haul Road_Max_Baseline_Chromium	RfD	5.26E-02	1.38E-01	4.70E-02	2.74E-02	2.92E-02	1.38E-01	0.00E+00
Haul Road_Max	Baseline	Cobalt	Haul Road_Max_Baseline_Cobalt	RfD	1.83E-02	5.77E-02	2.24E-02	1.52E-02	1.76E-02	5.77E-02	0.00E+00
Haul Road_Max	Baseline	Copper	Haul Road_Max_Baseline_Copper	RfD	2.75E-04	6.94E-03	5.80E-03	3.74E-03	4.28E-03	6.94E-03	0.00E+00
Haul Road_Max	Baseline	Lead	Haul Road_Max_Baseline_Lead	RfD	6.85E-02	1.43E-01	2.49E-02	1.53E-02	1.34E-02	1.43E-01	0.00E+00
Haul Road_Max	Baseline	Manganese	Haul Road_Max_Baseline_Manganese	RfD	1.48E-02	5.34E-01	3.66E-01	3.65E-01	3.44E-01	5.34E-01	0.00E+00
Haul Road_Max	Baseline	Molybdenum	Haul Road_Max_Baseline_Molybdenum	RfD	5.45E-05	9.34E-04	7.79E-04	4.81E-04	5.39E-04	9.34E-04	0.00E+00
Haul Road_Max	Baseline	Nickel	Haul Road_Max_Baseline_Nickel	RfD	3.19E-03	2.45E-02	1.83E-02	1.09E-02	1.25E-02	2.45E-02	0.00E+00
Haul Road_Max	Baseline	Strontium	Haul Road_Max_Baseline_Strontium	RfD	3.76E-05	3.04E-03	2.39E-03	2.03E-03	1.98E-03	3.04E-03	0.00E+00
Haul Road_Max	Baseline	Vanadium	Haul Road_Max_Baseline_Vanadium	RfD	4.18E-02	8.93E-02	1.77E-02	1.03E-02	1.00E-02	8.93E-02	0.00E+00
Haul Road_Max	Baseline	Zinc	Haul Road_Max_Baseline_Zinc	RfD	1.88E-04	5.10E-03	4.35E-03	2.77E-03	2.67E-03	5.10E-03	0.00E+00
Haul Road_Max	Project	Aluminum	Haul Road_Max_Project_Aluminum	RfD	3.16E-05	1.39E-04	8.59E-05	4.96E-05	5.38E-05	1.39E-04	0.00E+00
Haul Road_Max	Project	Arsenic	Haul Road_Max_Project_Arsenic	RfD	1.62E-04	1.86E-03	1.20E-03	6.90E-04	6.20E-04	1.86E-03	0.00E+00
Haul Road_Max	Project	Arsenic_cancer	Haul Road_Max_Project_Arsenic_cancer	RsD	5.06E-05	5.24E-03	5.25E-03	3.45E-03	2.32E-02	0.00E+00	3.72E-02
Haul Road_Max	Project	Barium	Haul Road_Max_Project_Barium	RfD	6.18E-08	5.60E-07	3.73E-07	3.07E-07	2.98E-07	5.60E-07	0.00E+00
Haul Road_Max	Project	Chromium	Haul Road_Max_Project_Chromium	RfD	7.10E-06	2.33E-04	1.83E-04	1.19E-04	1.05E-04	2.33E-04	0.00E+00
Haul Road_Max	Project	Cobalt	Haul Road_Max_Project_Cobalt	RfD	2.49E-06	3.72E-03	3.03E-03	2.01E-03	1.71E-03	3.72E-03	0.00E+00
Haul Road_Max	Project	Copper	Haul Road_Max_Project_Copper	RfD	7.87E-08	2.88E-04	2.38E-04	1.59E-04	1.34E-04	2.88E-04	0.00E+00
Haul Road_Max	Project	Lead	Haul Road_Max_Project_Lead	RfD	3.83E-06	3.93E-03	3.18E-03	2.09E-03	1.77E-03	3.93E-03	0.00E+00
Haul Road_Max	Project	Manganese	Haul Road_Max_Project_Manganese	RfD	1.41E-06	5.84E-04	4.66E-04	3.06E-04	2.60E-04	5.84E-04	0.00E+00
Haul Road_Max	Project	Molybdenum	Haul Road_Max_Project_Molybdenum	RfD	7.08E-09	3.02E-05	2.33E-05	1.46E-05	1.26E-05	3.02E-05	0.00E+00
Haul Road_Max	Project	Nickel	Haul Road_Max_Project_Nickel	RfD	6.86E-07	5.56E-04	4.28E-04	2.69E-04	2.32E-04	5.56E-04	0.00E+00
Haul Road_Max	Project	Strontium	Haul Road_Max_Project_Strontium	RfD	1.10E-08	2.64E-07	2.03E-07	1.65E-07	1.62E-07	2.64E-07	0.00E+00
Haul Road_Max	Project	Vanadium	Haul Road_Max_Project_Vanadium	RfD	3.53E-06	1.62E-05	1.00E-05	5.87E-06	6.44E-06	1.62E-05	0.00E+00
Haul Road_Max	Project	Zinc	Haul Road_Max_Project_Zinc	RfD	3.72E-08	2.65E-03	2.20E-03	1.47E-03	1.24E-03	2.65E-03	0.00E+00
Haul Road_Average	Baseline	Aluminum	Haul Road_Average_Baseline_Aluminum	RfD	3.93E-01	8.39E-01	1.53E-01	1.04E-01	9.51E-02	8.39E-01	0.00E+00
Haul Road_Average	Baseline	Arsenic	Haul Road_Average_Baseline_Arsenic	RfD	8.35E-02	1.92E-01	4.57E-02	2.55E-02	2.32E-02	1.92E-01	0.00E+00
Haul Road_Average	Baseline	Arsenic_cancer	Haul Road_Average_Baseline_Arsenic_cancer	RsD	2.61E-02	5.40E-01	2.00E-01	1.27E-01	8.70E-01	0.00E+00	1.76E+00
Haul Road_Average	Baseline	Barium	Haul Road_Average_Baseline_Barium	RfD	4.39E-04	1.78E-02	1.22E-02	1.24E-02	1.15E-02	1.78E-02	0.00E+00
Haul Road_Average	Baseline	Chromium	Haul Road_Average_Baseline_Chromium	RfD	5.26E-02	1.57E-01	6.76E-02	3.80E-02	4.11E-02	1.57E-01	0.00E+00
Haul Road_Average	Baseline	Cobalt	Haul Road_Average_Baseline_Cobalt	RfD	1.83E-02	6.24E-02	2.72E-02	1.80E-02	2.06E-02	6.24E-02	0.00E+00
Haul Road_Average	Baseline	Copper	Haul Road_Average_Baseline_Copper	RfD	2.75E-04	1.04E-02	9.29E-03	5.77E-03	6.47E-03	1.04E-02	0.00E+00
Haul Road_Average	Baseline	Lead	Haul Road_Average_Baseline_Lead	RfD	6.85E-02	1.46E-01	2.73E-02	1.78E-02	1.56E-02	1.46E-01	0.00E+00
Haul Road_Average	Baseline	Manganese	Haul Road_Average_Baseline_Manganese	RfD	1.48E-02	1.00E+00	6.99E-01	7.06E-01	6.59E-01	1.00E+00	0.00E+00
Haul Road_Average	Baseline	Molybdenum	Haul Road_Average_Baseline_Molybdenum	RfD	5.45E-05	1.47E-03	1.32E-03	7.92E-04	8.77E-04	1.47E-03	0.00E+00
Haul Road_Average	Baseline	Nickel	Haul Road_Average_Baseline_Nickel	RfD	3.19E-03	3.75E-02	3.19E-02	1.84E-02	2.07E-02	3.75E-02	0.00E+00
Haul Road_Average	Baseline	Strontium	Haul Road_Average_Baseline_Strontium	RfD	3.76E-05	5.88E-03	4.67E-03	3.98E-03	3.86E-03	5.88E-03	0.00E+00
Haul Road_Average	Baseline	Vanadium	Haul Road_Average_Baseline_Vanadium	RfD	4.18E-02	9.27E-02	2.14E-02	1.23E-02	1.22E-02	9.27E-02	0.00E+00
Haul Road_Average	Baseline	Zinc	Haul Road_Average_Baseline_Zinc	RfD	1.88E-04	7.61E-03	6.81E-03	4.29E-03	4.28E-03	7.61E-03	0.00E+00
Haul Road_Average	Project	Aluminum	Haul Road_Average_Project_Aluminum	RfD	7.90E-06	5.21E-05	3.92E-05	2.25E-05	2.44E-05	5.21E-05	0.00E+00
Haul Road_Average	Project	Arsenic	Haul Road_Average_Project_Arsenic	RfD	4.05E-05	1.51E-03	1.05E-03	6.01E-04	5.29E-04	1.51E-03	0.00E+00
Haul Road_Average	Project	Arsenic_cancer	Haul Road_Average_Project_Arsenic_cancer	RsD	1.26E-05	4.23E-03	4.59E-03	3.01E-03	1.98E-02	0.00E+00	3.17E-02
Haul Road_Average	Project	Barium	Haul Road_Average_Project_Barium	RfD	1.54E-08	2.47E-07	1.80E-07	1.50E-07	1.45E-07	2.47E-07	0.00E+00
Haul Road_Average	Project	Chromium	Haul Road_Average_Project_Chromium	RfD	1.78E-06	2.09E-04	1.69E-04	1.11E-04	9.53E-05	2.09E-04	0.00E+00
Haul Road_Average	Project	Cobalt	Haul Road_Average_Project_Cobalt	RfD	6.22E-07	3.71E-03	3.02E-03	2.00E-03	1.70E-03	3.71E-03	0.00E+00
Haul Road_Average	Project	Copper	Haul Road_Average_Project_Copper	RfD	1.97E-08	2.88E-04	2.38E-04	1.59E-04	1.34E-04	2.88E-04	0.00E+00
Haul Road_Average	Project	Lead	Haul Road_Average_Project_Lead	RfD	9.58E-07	3.92E-03	3.18E-03	2.09E-03	1.77E-03	3.92E-03	0.00E+00
Haul Road_Average	Project	Manganese	Haul Road_Average_Project_Manganese	RfD	3.52E-07	5.74E-04	4.60E-04	3.01E-04	2.55E-04	5.74E-04	0.00E+00
Haul Road_Average	Project	Molybdenum	Haul Road_Average_Project_Molybdenum	RfD	1.77E-09	3.02E-05	2.32E-05	1.46E-05	1.26E-05	3.02E-05	0.00E+00
Haul Road_Average	Project	Nickel	Haul Road_Average_Project_Nickel	RfD	1.72E-07	5.54E-04	4.26E-04	2.68E-04	2.31E-04	5.54E-04	0.00E+00
Haul Road_Average	Project	Strontium	Haul Road_Average_Project_Strontium	RfD	2.76E-09	1.24E-07	9.88E-08	8.05E-08	7.89E-08	1.24E-07	0.00E+00
Haul Road_Average	Project	Vanadium	Haul Road_Average_Project_Vanadium	RfD	8.82E-07	5.98E-06	4.51E-06	2.59E-06	2.84E-06	5.98E-06	0.00E+00
Haul Road_Average	Project	Zinc	Haul Road_Average_Project_Zinc	RfD	9.31E-09	2.65E-03	2.20E-03	1.47E-03	1.24E-03	2.65E-03	0.00E+00

Summary of Soil Concentrations and Comparison to Guidelines

Area	COPC	Baseline	Incremental Contribution of Dust Deposition Outside of PDA over 6 years of Operations		Soil Quality Guidelines	
			Project	Project + Baseline	NSE	CCME
Haul Road_Max	Aluminum	2.24E+04	4.51E-01	2.24E+04	1.54E+04	n/a
Haul Road_Max	Arsenic	1.00E+01	4.84E-03	1.00E+01	3.10E+01	1.20E+01
Haul Road_Max	Arsenic_cancer	1.00E+01	4.84E-03	1.00E+01	n/a	n/a
Haul Road_Max	Barium	3.50E+01	1.23E-03	3.50E+01	1.00E+04	7.50E+02
Haul Road_Max	Chromium	2.10E+01	7.08E-04	2.10E+01	2.20E+02	6.40E+01
Haul Road_Max	Cobalt	1.02E+01	3.47E-04	1.02E+01	2.20E+01	4.00E+01
Haul Road_Max	Copper	1.00E+01	7.14E-04	1.00E+01	1.10E+03	6.30E+01
Haul Road_Max	Lead	1.64E+01	2.29E-04	1.64E+01	1.40E+02	7.00E+01
Haul Road_Max	Manganese	8.01E+02	1.91E-02	8.01E+02	n/a	n/a
Haul Road_Max	Molybdenum	5.00E-01	1.62E-05	5.00E-01	1.10E+02	5.00E+00
Haul Road_Max	Nickel	1.40E+01	7.53E-04	1.40E+01	3.30E+02	4.50E+01
Haul Road_Max	Strontium	9.00E+00	6.61E-04	9.00E+00	9.40E+03	n/a
Haul Road_Max	Vanadium	3.50E+01	7.39E-04	3.50E+01	3.90E+01	1.30E+02
Haul Road_Max	Zinc	3.60E+01	1.78E-03	3.60E+01	5.60E+03	2.50E+02
Haul Road_Average	Aluminum	2.24E+04	1.13E-01	2.24E+04	1.54E+04	n/a
Haul Road_Average	Arsenic	1.00E+01	1.21E-03	1.00E+01	3.10E+01	1.20E+01
Haul Road_Average	Arsenic_cancer	1.00E+01	1.21E-03	1.00E+01	n/a	n/a
Haul Road_Average	Barium	3.50E+01	3.08E-04	3.50E+01	1.00E+04	7.50E+02
Haul Road_Average	Chromium	2.10E+01	1.77E-04	2.10E+01	2.20E+02	6.40E+01
Haul Road_Average	Cobalt	1.02E+01	8.68E-05	1.02E+01	2.20E+01	4.00E+01
Haul Road_Average	Copper	1.00E+01	1.79E-04	1.00E+01	1.10E+03	6.30E+01
Haul Road_Average	Lead	1.64E+01	5.73E-05	1.64E+01	1.40E+02	7.00E+01
Haul Road_Average	Manganese	8.01E+02	4.77E-03	8.01E+02	n/a	n/a
Haul Road_Average	Molybdenum	5.00E-01	4.06E-06	5.00E-01	1.10E+02	5.00E+00
Haul Road_Average	Nickel	1.40E+01	1.88E-04	1.40E+01	3.30E+02	4.50E+01
Haul Road_Average	Strontium	9.00E+00	1.65E-04	9.00E+00	9.40E+03	n/a
Haul Road_Average	Vanadium	3.50E+01	1.85E-04	3.50E+01	3.90E+01	1.30E+02
Haul Road_Average	Zinc	3.60E+01	4.46E-04	3.60E+01	5.60E+03	2.50E+02

Summary of Soil Concentrations and Comparison to Guidelines

Area	COPC	Baseline	Incremental Contribution of Dust Deposition Outside of PDA over 6 years of Operations		Soil Quality Guidelines	
			Project	Project + Baseline	NSE	CCME
Haul Road_Max	Aluminum	2.24E+04	1.80E+00	2.24E+04	1.54E+04	n/a
Haul Road_Max	Arsenic	1.00E+01	1.94E-02	1.00E+01	3.10E+01	1.20E+01
Haul Road_Max	Arsenic_cancer	1.00E+01	1.94E-02	1.00E+01	n/a	n/a
Haul Road_Max	Barium	3.50E+01	4.93E-03	3.50E+01	1.00E+04	7.50E+02
Haul Road_Max	Chromium	2.10E+01	2.83E-03	2.10E+01	2.20E+02	6.40E+01
Haul Road_Max	Cobalt	1.02E+01	1.39E-03	1.02E+01	2.20E+01	4.00E+01
Haul Road_Max	Copper	1.00E+01	2.86E-03	1.00E+01	1.10E+03	6.30E+01
Haul Road_Max	Lead	1.64E+01	9.17E-04	1.64E+01	1.40E+02	7.00E+01
Haul Road_Max	Manganese	8.01E+02	7.64E-02	8.01E+02	n/a	n/a
Haul Road_Max	Molybdenum	5.00E-01	6.50E-05	5.00E-01	1.10E+02	5.00E+00
Haul Road_Max	Nickel	1.40E+01	3.01E-03	1.40E+01	3.30E+02	4.50E+01
Haul Road_Max	Strontium	9.00E+00	2.64E-03	9.00E+00	9.40E+03	n/a
Haul Road_Max	Vanadium	3.50E+01	2.96E-03	3.50E+01	3.90E+01	1.30E+02
Haul Road_Max	Zinc	3.60E+01	7.13E-03	3.60E+01	5.60E+03	2.50E+02
Haul Road_Average	Aluminum	2.24E+04	4.51E-01	2.24E+04	1.54E+04	n/a
Haul Road_Average	Arsenic	1.00E+01	4.84E-03	1.00E+01	3.10E+01	1.20E+01
Haul Road_Average	Arsenic_cancer	1.00E+01	4.84E-03	1.00E+01	n/a	n/a
Haul Road_Average	Barium	3.50E+01	1.23E-03	3.50E+01	1.00E+04	7.50E+02
Haul Road_Average	Chromium	2.10E+01	7.08E-04	2.10E+01	2.20E+02	6.40E+01
Haul Road_Average	Cobalt	1.02E+01	3.47E-04	1.02E+01	2.20E+01	4.00E+01
Haul Road_Average	Copper	1.00E+01	7.14E-04	1.00E+01	1.10E+03	6.30E+01
Haul Road_Average	Lead	1.64E+01	2.29E-04	1.64E+01	1.40E+02	7.00E+01
Haul Road_Average	Manganese	8.01E+02	1.91E-02	8.01E+02	n/a	n/a
Haul Road_Average	Molybdenum	5.00E-01	1.62E-05	5.00E-01	1.10E+02	5.00E+00
Haul Road_Average	Nickel	1.40E+01	7.53E-04	1.40E+01	3.30E+02	4.50E+01
Haul Road_Average	Strontium	9.00E+00	6.61E-04	9.00E+00	9.40E+03	n/a
Haul Road_Average	Vanadium	3.50E+01	7.39E-04	3.50E+01	3.90E+01	1.30E+02
Haul Road_Average	Zinc	3.60E+01	1.78E-03	3.60E+01	5.60E+03	2.50E+02

Summary of Berry Concentrations Used to Estimate Human Exposures [mg/kg-WW]

Area	COPC	Baseline	Incremental Contribution of Dust Deposition Outside of PDA over 6 years of Operations	
			Project	Project + Baseline
Haul Road_Max	Aluminum	3.10E+00	3.76E-02	3.14E+00
Haul Road_Max	Arsenic	5.79E-03	2.49E-04	6.04E-03
Haul Road_Max	Arsenic_cancer	5.79E-03	2.49E-04	6.04E-03
Haul Road_Max	Barium	2.55E+00	1.92E-04	2.55E+00
Haul Road_Max	Chromium	8.00E-02	6.18E-05	8.00E-02
Haul Road_Max	Cobalt	2.40E-02	2.98E-05	2.40E-02
Haul Road_Max	Copper	1.16E+00	1.42E-04	1.16E+00
Haul Road_Max	Lead	3.00E-03	1.92E-05	3.02E-03
Haul Road_Max	Manganese	9.73E+01	3.91E-03	9.73E+01
Haul Road_Max	Molybdenum	4.61E-02	2.85E-06	4.61E-02
Haul Road_Max	Nickel	5.60E-01	9.29E-05	5.60E-01
Haul Road_Max	Strontium	3.72E+00	3.28E-04	3.72E+00
Haul Road_Max	Vanadium	2.89E-02	6.22E-05	2.89E-02
Haul Road_Max	Zinc	4.16E+00	3.55E-04	4.16E+00
Haul Road_Average	Aluminum	3.10E+00	9.41E-03	3.11E+00
Haul Road_Average	Arsenic	5.79E-03	6.23E-05	5.85E-03
Haul Road_Average	Arsenic_cancer	5.79E-03	6.23E-05	5.85E-03
Haul Road_Average	Barium	2.55E+00	4.81E-05	2.55E+00
Haul Road_Average	Chromium	8.00E-02	1.54E-05	8.00E-02
Haul Road_Average	Cobalt	2.40E-02	7.44E-06	2.40E-02
Haul Road_Average	Copper	1.16E+00	3.56E-05	1.16E+00
Haul Road_Average	Lead	3.00E-03	4.79E-06	3.00E-03
Haul Road_Average	Manganese	9.73E+01	9.78E-04	9.73E+01
Haul Road_Average	Molybdenum	4.61E-02	7.12E-07	4.61E-02
Haul Road_Average	Nickel	5.60E-01	2.32E-05	5.60E-01
Haul Road_Average	Strontium	3.72E+00	8.21E-05	3.72E+00
Haul Road_Average	Vanadium	2.89E-02	1.56E-05	2.89E-02
Haul Road_Average	Zinc	4.16E+00	8.87E-05	4.16E+00

Summary of Leaves Concentrations Used to Estimate Human Exposures [mg/kg-WW]

Area	COPC	Baseline	Incremental Contribution of Dust Deposition Outside of PDA over 6 years of Operations	
			Project	Project + Baseline
Haul Road_Max	Aluminum	7.06E+01	6.70E-02	7.07E+01
Haul Road_Max	Arsenic	7.80E-03	5.54E-04	8.35E-03
Haul Road_Max	Arsenic_cancer	7.80E-03	5.54E-04	8.35E-03
Haul Road_Max	Barium	3.74E+01	1.50E-03	3.74E+01
Haul Road_Max	Chromium	8.00E-02	1.06E-04	8.01E-02
Haul Road_Max	Cobalt	5.31E-02	5.23E-05	5.32E-02
Haul Road_Max	Copper	2.35E+00	2.72E-04	2.35E+00
Haul Road_Max	Lead	4.50E-02	3.40E-05	4.50E-02
Haul Road_Max	Manganese	1.43E+03	3.69E-02	1.43E+03
Haul Road_Max	Molybdenum	8.70E-02	5.19E-06	8.70E-02
Haul Road_Max	Nickel	8.80E-01	1.57E-04	8.80E-01
Haul Road_Max	Strontium	3.06E+01	2.34E-03	3.06E+01
Haul Road_Max	Vanadium	4.00E-02	1.08E-04	4.01E-02
Haul Road_Max	Zinc	1.10E+01	8.05E-04	1.10E+01
Haul Road_Average	Aluminum	7.06E+01	1.68E-02	7.06E+01
Haul Road_Average	Arsenic	7.80E-03	1.38E-04	7.94E-03
Haul Road_Average	Arsenic_cancer	7.80E-03	1.38E-04	7.94E-03
Haul Road_Average	Barium	3.74E+01	3.74E-04	3.74E+01
Haul Road_Average	Chromium	8.00E-02	2.65E-05	8.00E-02
Haul Road_Average	Cobalt	5.31E-02	1.31E-05	5.31E-02
Haul Road_Average	Copper	2.35E+00	6.79E-05	2.35E+00
Haul Road_Average	Lead	4.50E-02	8.50E-06	4.50E-02
Haul Road_Average	Manganese	1.43E+03	9.22E-03	1.43E+03
Haul Road_Average	Molybdenum	8.70E-02	1.30E-06	8.70E-02
Haul Road_Average	Nickel	8.80E-01	3.92E-05	8.80E-01
Haul Road_Average	Strontium	3.06E+01	5.86E-04	3.06E+01
Haul Road_Average	Vanadium	4.00E-02	2.71E-05	4.00E-02
Haul Road_Average	Zinc	1.10E+01	2.01E-04	1.10E+01

Summary of Predicted Human Exposures for Each Lifestage Category, Scenario and Chemical

					Estimated Daily Intake								
					Soil	Dust	Berries	Leaves	Fish	Deer	Swim: Derm+Ing	Total	RQ
					SIR	AIR	Berries	Leaves	Fish	Deer	Water	EDI	Total
Area	Scenario	Receptor	Chemical	Abbreviation	ug/day	ug/day	ug/day	ug/day	ug/day	ug/day	ug/day	ug/day	Unitless
Haul Road_Max	Baseline	Adult	Aluminum	Haul Road_Max_Baseline_Adult_Aluminum	4.48E+02	9.30E+01	2.82E+01	1.06E+02	1.79E+00	1.50E+02	8.83E-01	8.28E+02	8.19E-02
Haul Road_Max	Baseline	Adult	Arsenic	Haul Road_Max_Baseline_Adult_Arsenic	2.00E-01	4.15E-02	5.27E-02	1.17E-02	9.21E-02	3.67E-03	2.61E-02	4.28E-01	2.02E-02
Haul Road_Max	Baseline	Adult	Arsenic_cancer	Haul Road_Max_Baseline_Adult_Arsenic_cancer	2.00E-01	4.15E-02	5.27E-02	1.17E-02	9.21E-02	3.67E-03	2.61E-02	4.28E-01	1.01E+00
Haul Road_Max	Baseline	Adult	Barium	Haul Road_Max_Baseline_Adult_Barium	7.00E-01	1.45E-01	2.32E+01	5.61E+01	0.00E+00	2.48E+00	0.00E+00	8.26E+01	5.84E-03
Haul Road_Max	Baseline	Adult	Chromium	Haul Road_Max_Baseline_Adult_Chromium	4.20E-01	8.71E-02	7.28E-01	1.20E-01	1.12E-01	5.92E-01	2.31E-03	2.06E+00	2.92E-02
Haul Road_Max	Baseline	Adult	Cobalt	Haul Road_Max_Baseline_Adult_Cobalt	2.04E-01	4.23E-02	2.18E-01	7.97E-02	5.50E-02	1.14E+00	8.41E-04	1.74E+00	1.76E-02
Haul Road_Max	Baseline	Adult	Copper	Haul Road_Max_Baseline_Adult_Copper	2.00E-01	4.15E-02	1.06E+01	3.52E+00	1.54E+00	1.17E+01	3.24E-03	2.75E+01	4.28E-03
Haul Road_Max	Baseline	Adult	Lead	Haul Road_Max_Baseline_Adult_Lead	3.28E-01	6.81E-02	2.73E-02	6.75E-02	5.59E-02	2.11E-02	1.22E-03	5.69E-01	1.34E-02
Haul Road_Max	Baseline	Adult	Manganese	Haul Road_Max_Baseline_Adult_Manganese	1.60E+01	3.32E+00	8.85E+02	2.15E+03	7.77E+00	2.53E+02	2.82E-01	3.31E+03	3.44E-01
Haul Road_Max	Baseline	Adult	Molybdenum	Haul Road_Max_Baseline_Adult_Molybdenum	1.00E-02	2.08E-03	4.19E-01	1.31E-01	4.50E-02	2.65E-01	4.21E-03	8.76E-01	5.39E-04
Haul Road_Max	Baseline	Adult	Nickel	Haul Road_Max_Baseline_Adult_Nickel	2.80E-01	5.81E-02	5.09E+00	1.32E+00	4.50E-02	2.89E+00	4.21E-03	9.69E+00	1.25E-02
Haul Road_Max	Baseline	Adult	Strontium	Haul Road_Max_Baseline_Adult_Strontium	1.80E-01	3.73E-02	3.39E+01	4.59E+01	0.00E+00	4.10E+00	0.00E+00	8.41E+01	1.98E-03
Haul Road_Max	Baseline	Adult	Vanadium	Haul Road_Max_Baseline_Adult_Vanadium	7.00E-01	1.45E-01	2.63E-01	6.00E-02	0.00E+00	3.20E-01	0.00E+00	1.49E+00	1.00E-02
Haul Road_Max	Baseline	Adult	Zinc	Haul Road_Max_Baseline_Adult_Zinc	7.20E-01	1.49E-01	3.79E+01	1.65E+01	3.50E+01	4.77E-01	1.05E-02	9.07E+01	2.67E-03
Haul Road_Max	Baseline	Adolescent	Aluminum	Haul Road_Max_Baseline_Adolescent_Aluminum	4.48E+02	8.74E+01	2.00E+01	1.06E+02	1.79E+00	9.71E+01	8.38E-01	7.61E+02	8.91E-02
Haul Road_Max	Baseline	Adolescent	Arsenic	Haul Road_Max_Baseline_Adolescent_Arsenic	2.00E-01	3.90E-02	3.73E-02	1.17E-02	9.21E-02	2.38E-03	2.47E-02	4.07E-01	2.27E-02
Haul Road_Max	Baseline	Adolescent	Arsenic_cancer	Haul Road_Max_Baseline_Adolescent_Arsenic_cancer	2.00E-01	3.90E-02	3.73E-02	1.17E-02	9.21E-02	2.38E-03	2.47E-02	4.07E-01	1.14E+00
Haul Road_Max	Baseline	Adolescent	Barium	Haul Road_Max_Baseline_Adolescent_Barium	7.00E-01	1.37E-01	1.64E+01	5.61E+01	0.00E+00	1.61E+00	0.00E+00	7.50E+01	6.28E-03
Haul Road_Max	Baseline	Adolescent	Chromium	Haul Road_Max_Baseline_Adolescent_Chromium	4.20E-01	8.19E-02	5.15E-01	1.20E-01	1.12E-01	3.84E-01	2.20E-03	1.64E+00	2.74E-02
Haul Road_Max	Baseline	Adolescent	Cobalt	Haul Road_Max_Baseline_Adolescent_Cobalt	2.04E-01	3.98E-02	1.55E-01	7.97E-02	5.50E-02	7.38E-01	7.98E-04	1.27E+00	1.52E-02
Haul Road_Max	Baseline	Adolescent	Copper	Haul Road_Max_Baseline_Adolescent_Copper	2.00E-01	3.90E-02	7.47E+00	3.52E+00	1.54E+00	7.56E+00	3.07E-03	2.03E+01	3.74E-03
Haul Road_Max	Baseline	Adolescent	Lead	Haul Road_Max_Baseline_Adolescent_Lead	3.28E-01	6.40E-02	1.93E-02	6.75E-02	5.59E-02	1.37E-02	1.16E-03	5.49E-01	1.53E-02
Haul Road_Max	Baseline	Adolescent	Manganese	Haul Road_Max_Baseline_Adolescent_Manganese	1.60E+01	3.12E+00	6.27E+02	2.15E+03	7.77E+00	1.64E+02	2.67E-01	2.96E+03	3.65E-01
Haul Road_Max	Baseline	Adolescent	Molybdenum	Haul Road_Max_Baseline_Adolescent_Molybdenum	1.00E-02	1.95E-03	2.97E-01	1.31E-01	4.50E-02	1.72E-01	3.99E-03	6.60E-01	4.81E-04
Haul Road_Max	Baseline	Adolescent	Nickel	Haul Road_Max_Baseline_Adolescent_Nickel	2.80E-01	5.46E-02	3.61E+00	1.32E+00	4.50E-02	1.87E+00	3.99E-03	7.18E+00	1.09E-02
Haul Road_Max	Baseline	Adolescent	Strontium	Haul Road_Max_Baseline_Adolescent_Strontium	1.80E-01	3.51E-02	2.40E+01	4.59E+01	0.00E+00	2.65E+00	0.00E+00	7.27E+01	2.03E-03
Haul Road_Max	Baseline	Adolescent	Vanadium	Haul Road_Max_Baseline_Adolescent_Vanadium	7.00E-01	1.37E-01	1.86E-01	6.00E-02	0.00E+00	2.07E-01	0.00E+00	1.29E+00	1.03E-02
Haul Road_Max	Baseline	Adolescent	Zinc	Haul Road_Max_Baseline_Adolescent_Zinc	7.20E-01	1.40E-01	2.68E+01	1.65E+01	3.50E+01	3.09E-01	9.98E-03	7.95E+01	2.77E-03
Haul Road_Max	Baseline	Child	Aluminum	Haul Road_Max_Baseline_Child_Aluminum	4.48E+02	8.12E+01	2.48E+01	3.53E+01	1.48E+00	6.94E+01	1.25E+00	6.61E+02	1.41E-01
Haul Road_Max	Baseline	Child	Arsenic	Haul Road_Max_Baseline_Child_Arsenic	2.00E-01	3.62E-02	4.63E-02	3.90E-03	7.60E-02	1.70E-03	3.68E-02	4.01E-01	4.06E-02
Haul Road_Max	Baseline	Child	Arsenic_cancer	Haul Road_Max_Baseline_Child_Arsenic_cancer	2.00E-01	3.62E-02	4.63E-02	3.90E-03	7.60E-02	1.70E-03	3.68E-02	4.01E-01	2.03E+00
Haul Road_Max	Baseline	Child	Barium	Haul Road_Max_Baseline_Child_Barium	7.00E-01	1.27E-01	2.04E+01	1.87E+01	0.00E+00	1.15E+00	0.00E+00	4.11E+01	6.24E-03
Haul Road_Max	Baseline	Child	Chromium	Haul Road_Max_Baseline_Child_Chromium	4.20E-01	7.61E-02	6.39E-01	4.00E-02	9.23E-02	2.74E-01	3.26E-03	1.55E+00	4.70E-02
Haul Road_Max	Baseline	Child	Cobalt	Haul Road_Max_Baseline_Child_Cobalt	2.04E-01	3.70E-02	1.92E-01	2.66E-02	4.54E-02	5.27E-01	1.19E-03	1.03E+00	2.24E-02
Haul Road_Max	Baseline	Child	Copper	Haul Road_Max_Baseline_Child_Copper	2.00E-01	3.62E-02	9.27E+00	1.17E+00	1.27E+00	5.40E+00	4.57E-03	1.74E+01	5.80E-03
Haul Road_Max	Baseline	Child	Lead	Haul Road_Max_Baseline_Child_Lead	3.28E-01	5.95E-02	2.40E-02	2.25E-02	4.61E-02	9.77E-03	1.72E-03	4.92E-01	2.49E-02
Haul Road_Max	Baseline	Child	Manganese	Haul Road_Max_Baseline_Child_Manganese	1.60E+01	2.90E+00	7.78E+02	7.15E+02	6.41E+00	1.17E+02	3.97E-01	1.64E+03	3.66E-01
Haul Road_Max	Baseline	Child	Molybdenum	Haul Road_Max_Baseline_Child_Molybdenum	1.00E-02	1.81E-03	3.68E-01	4.35E-02	3.71E-02	1.23E-01	5.93E-03	5.90E-01	7.79E-04
Haul Road_Max	Baseline	Child	Nickel	Haul Road_Max_Baseline_Child_Nickel	2.80E-01	5.07E-02	4.47E+00	4.40E-01	3.71E-02	1.34E+00	5.93E-03	6.63E+00	1.83E-02
Haul Road_Max	Baseline	Child	Strontium	Haul Road_Max_Baseline_Child_Strontium	1.80E-01	3.26E-02	2.98E+01	1.53E+01	0.00E+00	1.90E+00	0.00E+00	4.72E+01	2.39E-03
Haul Road_Max	Baseline	Child	Vanadium	Haul Road_Max_Baseline_Child_Vanadium	7.00E-01	1.27E-01	2.31E-01	2.00E-02	0.00E+00	1.48E-01	0.00E+00	1.23E+00	1.77E-02
Haul Road_Max	Baseline	Child	Zinc	Haul Road_Max_Baseline_Child_Zinc	7.20E-01	1.30E-01	3.33E+01	5.50E+00	2.89E+01	2.21E-01	1.48E-02	6.87E+01	4.35E-03
Haul Road_Max	Baseline	Toddler	Aluminum	Haul Road_Max_Baseline_Toddler_Aluminum	1.79E+03	4.65E+01	1.07E+01	3.53E+01	8.97E-01	4.72E+01	1.16E+00	1.93E+03	8.20E-01
Haul Road_Max	Baseline	Toddler	Arsenic	Haul Road_Max_Baseline_Toddler_Arsenic	8.00E-01	2.07E-02	1.99E-02	3.90E-03	4.60E-02	1.15E-03	3.43E-02	9.26E-01	1.87E-01
Haul Road_Max	Baseline	Toddler	Arsenic_cancer	Haul Road_Max_Baseline_Toddler_Arsenic_cancer	8.00E-01	2.07E-02	1.99E-02	3.90E-03	4.60E-02	1.15E-03	3.43E-02	9.26E-01	9.35E+00
Haul Road_Max	Baseline	Toddler	Barium	Haul Road_Max_Baseline_Toddler_Barium	2.80E+00	7.26E-02	8.77E+00	1.87E+01	0.00E+00	7.82E-01	0.00E+00	3.11E+01	9.43E-03
Haul Road_Max	Baseline	Toddler	Chromium	Haul Road_Max_Baseline_Toddler_Chromium	1.68E+00	4.36E-02	2.75E-01	4.00E-02	5.59E-02	1.86E-01	3.04E-03	2.28E+00	1.38E-01
Haul Road_Max	Baseline	Toddler	Cobalt	Haul Road_Max_Baseline_Toddler_Cobalt	8.16E-01	2.12E-02	8.25E-02	2.66E-02	2.75E-02	3.58E-01	1.11E-03	1.33E+00	5.77E-02
Haul Road_Max	Baseline	Toddler	Copper	Haul Road_Max_Baseline_Toddler_Copper	8.00E-01	2.07E-02	3.99E+00	1.17E+00	7.68E-01	3.67E+00	4.26E-03	1.04E+01	6.94E-03
Haul Road_Max	Baseline	Toddler	Lead	Haul Road_Max_Baseline_Toddler_Lead	1.31E+00	3.40E-02	1.03E-02	2.25E-02	2.79E-02	6.64E-03	1.61E-03	1.42E+00	1.43E-01
Haul Road_Max	Baseline	Toddler	Manganese	Haul Road_Max_Baseline_Toddler_Manganese	6.41E+01	1.66E+00	3.35E+02	7.15E+02	3.88E+00	7.95E+01	3.71E-01	1.20E+03	5.34E-01
Haul Road_Max	Baseline	Toddler	Molybdenum	Haul Road_Max_Baseline_Toddler_Molybdenum	4.00E-02	1.04E-03	1.58E-01	4.35E-02	2.25E-02	8.36E-02	5.54E-03	3.54E-01	9.34E-04
Haul Road_Max	Baseline	Toddler	Nickel	Haul Road_Max_Baseline_Toddler_Nickel	1.12E+00	2.90E-02	1.92E+00	4.40E-01	2.25E-02	9.10E-01	5.54E-03	4.45E+00	2.45E-02
Haul Road_Max	Baseline	Toddler	Strontium	Haul Road_Max_Baseline_Toddler_Strontium	7.20E-01	1.87E-02	1.28E+01	1.53E+01	0.00E+00	1.29E+00	0.00E+00	3.01E+01	3.04E-03
Haul Road_Max	Baseline	Toddler	Vanadium	Haul Road_Max_Baseline_Toddler_Vanadium	2.80E+00	7.26E-02	9.93E-02	2.00E-02	0.00E+00	1.01E-01	0.00E+00	3.09E+00	8.93E-02
Haul Road_Max	Baseline	Toddler	Zinc	Haul Road_Max_Baseline_Toddler_Zinc	2.88E+00	7.47E-02	1.43E+01	5.50E+00	1.75E+01	1.50E-01	1.38E-02	4.04E+01	5.10E-03
Haul Road_Max	Project	Adult	Aluminum	Haul Road_Max_Project_Adult_Aluminum	3.61E-02	7.48E-03	3.43E-01	1.01E-01	0.00E+00	5.76E-02	0.00E+00	5.44E-01	5.38E-05
Haul Road_Max	Project	Adult	Arsenic	Haul Road_Max_Project_Adult_Arsenic	3.88E-04	8.04E-05	2.27E-03	8.31E-04	7.43E-03	4.79E-05	2.10E-03	1.31E-02	6.20E-04
Haul Road_Max	Project	Adult	Arsenic_cancer	Haul Road_Max_Project_Adult_Arsenic_cancer	3.88E-04	8.04E-05	2.27E-03	8.31E-04	7.43E-03	4.79E-05	2.10E-03	1.31E-02	3.10E-02
Haul Road_Max	Project	Adult	Barium	Haul Road_Max_Project_Adult_Barium	9.86E-05	2.05E-05	1.75E-03	2.24E-03	0.00E+00	1.02E-04	0.00E+00	4.22E-03	2.98E-07
Haul Road_Max	Project	Adult	Chromium	Haul Road_Max_Project_Adult_Chromium	5.67E-05	1.18E-05	5.62E-04	1.59E-04	6.10E-03	3.86E-04	1.26E-04	7.40E-03	1.05E-04

Haul Road_Max	Project	Adult	Cobalt	Haul Road_Max_Project_Adult_Cobalt	2.78E-05	5.76E-06	2.71E-04	7.85E-05	1.62E-01	4.23E-03	2.48E-03	1.69E-01	1.71E-03
Haul Road_Max	Project	Adult	Copper	Haul Road_Max_Project_Adult_Copper	5.71E-05	1.19E-05	1.30E-03	4.07E-04	8.58E-01	2.73E-03	1.81E-03	8.64E-01	1.34E-04
Haul Road_Max	Project	Adult	Lead	Haul Road_Max_Project_Adult_Lead	1.83E-05	3.81E-06	1.74E-04	5.10E-05	7.32E-02	4.09E-05	1.60E-03	7.51E-02	1.77E-03
Haul Road_Max	Project	Adult	Manganese	Haul Road_Max_Project_Adult_Manganese	1.53E-03	3.17E-04	3.56E-02	5.53E-02	2.32E+00	9.10E-03	8.41E-02	2.50E+00	2.60E-04
Haul Road_Max	Project	Adult	Molybdenum	Haul Road_Max_Project_Adult_Molybdenum	1.30E-06	2.70E-07	2.59E-05	7.79E-06	1.80E-02	7.55E-04	1.68E-03	2.05E-02	1.26E-05
Haul Road_Max	Project	Adult	Nickel	Haul Road_Max_Project_Adult_Nickel	6.03E-05	1.25E-05	8.45E-04	2.35E-04	1.58E-01	6.98E-03	1.47E-02	1.80E-01	2.32E-04
Haul Road_Max	Project	Adult	Strontium	Haul Road_Max_Project_Adult_Strontium	5.29E-05	1.10E-05	2.99E-03	3.51E-03	0.00E+00	3.17E-04	0.00E+00	6.88E-03	1.62E-07
Haul Road_Max	Project	Adult	Vanadium	Haul Road_Max_Project_Adult_Vanadium	5.91E-05	1.23E-05	5.66E-04	1.63E-04	0.00E+00	1.56E-04	0.00E+00	9.57E-04	6.44E-06
Haul Road_Max	Project	Adult	Zinc	Haul Road_Max_Project_Adult_Zinc	1.43E-04	2.96E-05	3.23E-03	1.21E-03	4.20E+01	1.20E-04	1.26E-02	4.20E+01	1.24E-03
Haul Road_Max	Project	Adolescent	Aluminum	Haul Road_Max_Project_Adolescent_Aluminum	3.61E-02	7.03E-03	2.43E-01	1.01E-01	0.00E+00	3.74E-02	0.00E+00	4.24E-01	4.96E-05
Haul Road_Max	Project	Adolescent	Arsenic	Haul Road_Max_Project_Adolescent_Arsenic	3.88E-04	7.56E-05	1.61E-03	8.31E-04	7.43E-03	3.10E-05	2.00E-03	1.24E-02	6.90E-04
Haul Road_Max	Project	Adolescent	Arsenic_cancer	Haul Road_Max_Project_Adolescent_Arsenic_cancer	3.88E-04	7.56E-05	1.61E-03	8.31E-04	7.43E-03	3.10E-05	2.00E-03	1.24E-02	3.45E-02
Haul Road_Max	Project	Adolescent	Barium	Haul Road_Max_Project_Adolescent_Barium	9.86E-05	1.92E-05	1.24E-03	2.24E-03	0.00E+00	6.64E-05	0.00E+00	3.67E-03	3.07E-07
Haul Road_Max	Project	Adolescent	Chromium	Haul Road_Max_Project_Adolescent_Chromium	5.67E-05	1.11E-05	3.98E-04	1.59E-04	6.10E-03	2.50E-04	1.20E-04	7.10E-03	1.19E-04
Haul Road_Max	Project	Adolescent	Cobalt	Haul Road_Max_Project_Adolescent_Cobalt	2.78E-05	5.42E-06	1.92E-04	7.85E-05	1.62E-01	2.74E-03	2.36E-03	1.68E-01	2.01E-03
Haul Road_Max	Project	Adolescent	Copper	Haul Road_Max_Project_Adolescent_Copper	5.71E-05	1.11E-05	9.17E-04	4.07E-04	8.58E-01	1.77E-03	1.72E-03	8.63E-01	1.59E-04
Haul Road_Max	Project	Adolescent	Lead	Haul Road_Max_Project_Adolescent_Lead	1.83E-05	3.58E-06	1.24E-04	5.10E-05	7.32E-02	2.65E-05	1.52E-03	7.49E-02	2.09E-03
Haul Road_Max	Project	Adolescent	Manganese	Haul Road_Max_Project_Adolescent_Manganese	1.53E-03	2.98E-04	2.52E-02	5.53E-02	2.32E+00	5.90E-03	7.98E-02	2.49E+00	3.06E-04
Haul Road_Max	Project	Adolescent	Molybdenum	Haul Road_Max_Project_Adolescent_Molybdenum	1.30E-06	2.53E-07	1.84E-05	7.79E-06	1.80E-02	4.89E-04	1.60E-03	2.01E-02	1.46E-05
Haul Road_Max	Project	Adolescent	Nickel	Haul Road_Max_Project_Adolescent_Nickel	6.03E-05	1.17E-05	5.99E-04	2.35E-04	1.58E-01	4.53E-03	1.40E-02	1.77E-01	2.69E-04
Haul Road_Max	Project	Adolescent	Strontium	Haul Road_Max_Project_Adolescent_Strontium	5.29E-05	1.03E-05	2.12E-03	3.51E-03	0.00E+00	2.05E-04	0.00E+00	5.90E-03	1.65E-07
Haul Road_Max	Project	Adolescent	Vanadium	Haul Road_Max_Project_Adolescent_Vanadium	5.91E-05	1.15E-05	4.01E-04	1.63E-04	0.00E+00	1.01E-04	0.00E+00	7.36E-04	5.87E-06
Haul Road_Max	Project	Adolescent	Zinc	Haul Road_Max_Project_Adolescent_Zinc	1.43E-04	2.78E-05	2.29E-03	1.21E-03	4.20E+01	7.76E-05	1.20E-02	4.20E+01	1.47E-03
Haul Road_Max	Project	Child	Aluminum	Haul Road_Max_Project_Child_Aluminum	3.61E-02	6.54E-03	3.01E-01	3.35E-02	0.00E+00	2.67E-02	0.00E+00	4.04E-01	8.59E-05
Haul Road_Max	Project	Child	Arsenic	Haul Road_Max_Project_Child_Arsenic	3.88E-04	7.02E-05	1.99E-03	2.77E-04	6.13E-03	2.22E-05	2.97E-03	1.18E-02	1.20E-03
Haul Road_Max	Project	Child	Arsenic_cancer	Haul Road_Max_Project_Child_Arsenic_cancer	3.88E-04	7.02E-05	1.99E-03	2.77E-04	6.13E-03	2.22E-05	2.97E-03	1.18E-02	6.00E-02
Haul Road_Max	Project	Child	Barium	Haul Road_Max_Project_Child_Barium	9.86E-05	1.79E-05	1.54E-03	7.48E-04	0.00E+00	4.74E-05	0.00E+00	2.45E-03	3.73E-07
Haul Road_Max	Project	Child	Chromium	Haul Road_Max_Project_Child_Chromium	5.67E-05	1.03E-05	4.94E-04	5.29E-05	5.03E-03	1.78E-04	1.78E-04	6.00E-03	1.83E-04
Haul Road_Max	Project	Child	Cobalt	Haul Road_Max_Project_Child_Cobalt	2.78E-05	5.03E-06	2.38E-04	2.62E-05	1.34E-01	1.96E-03	3.50E-03	1.40E-01	3.03E-03
Haul Road_Max	Project	Child	Copper	Haul Road_Max_Project_Child_Copper	5.71E-05	1.04E-05	1.14E-03	1.36E-04	7.08E-01	1.27E-03	2.55E-03	7.13E-01	2.38E-04
Haul Road_Max	Project	Child	Lead	Haul Road_Max_Project_Child_Lead	1.83E-05	3.33E-06	1.53E-04	1.70E-05	6.04E-02	1.90E-05	2.25E-03	6.28E-02	3.18E-03
Haul Road_Max	Project	Child	Manganese	Haul Road_Max_Project_Child_Manganese	1.53E-03	2.77E-04	3.13E-02	1.84E-02	1.91E+00	4.21E-03	1.19E-01	2.09E+00	4.66E-04
Haul Road_Max	Project	Child	Molybdenum	Haul Road_Max_Project_Child_Molybdenum	1.30E-06	2.35E-07	2.28E-05	2.60E-06	1.49E-02	3.50E-04	2.37E-03	1.76E-02	2.33E-05
Haul Road_Max	Project	Child	Nickel	Haul Road_Max_Project_Child_Nickel	6.03E-05	1.09E-05	7.43E-04	7.85E-05	1.30E-01	3.23E-03	2.08E-02	1.55E-01	4.28E-04
Haul Road_Max	Project	Child	Strontium	Haul Road_Max_Project_Child_Strontium	5.29E-05	9.58E-06	2.62E-03	1.17E-03	0.00E+00	1.47E-04	0.00E+00	4.01E-03	2.03E-07
Haul Road_Max	Project	Child	Vanadium	Haul Road_Max_Project_Child_Vanadium	5.91E-05	1.07E-05	4.98E-04	5.42E-05	0.00E+00	7.23E-05	0.00E+00	6.94E-04	1.00E-05
Haul Road_Max	Project	Child	Zinc	Haul Road_Max_Project_Child_Zinc	1.43E-04	2.59E-05	2.84E-03	4.03E-04	3.47E+01	5.54E-05	1.78E-02	3.47E+01	2.20E-03
Haul Road_Max	Project	Toddler	Aluminum	Haul Road_Max_Project_Toddler_Aluminum	1.44E-01	3.74E-03	1.29E-01	3.35E-02	0.00E+00	1.81E-02	0.00E+00	3.29E-01	1.39E-04
Haul Road_Max	Project	Toddler	Arsenic	Haul Road_Max_Project_Toddler_Arsenic	1.55E-03	4.02E-05	8.57E-04	2.77E-04	3.71E-03	1.51E-05	2.77E-03	9.22E-03	1.86E-03
Haul Road_Max	Project	Toddler	Arsenic_cancer	Haul Road_Max_Project_Toddler_Arsenic_cancer	1.55E-03	4.02E-05	8.57E-04	2.77E-04	3.71E-03	1.51E-05	2.77E-03	9.22E-03	9.31E-02
Haul Road_Max	Project	Toddler	Barium	Haul Road_Max_Project_Toddler_Barium	3.94E-04	1.02E-05	6.62E-04	7.48E-04	0.00E+00	3.22E-05	0.00E+00	1.85E-03	5.60E-07
Haul Road_Max	Project	Toddler	Chromium	Haul Road_Max_Project_Toddler_Chromium	2.27E-04	5.88E-06	2.12E-04	5.29E-05	3.05E-03	1.21E-04	1.66E-04	3.84E-03	2.33E-04
Haul Road_Max	Project	Toddler	Cobalt	Haul Road_Max_Project_Toddler_Cobalt	1.11E-04	2.88E-06	1.02E-04	2.62E-05	8.11E-02	1.33E-03	3.27E-03	8.60E-02	3.72E-03
Haul Road_Max	Project	Toddler	Copper	Haul Road_Max_Project_Toddler_Copper	2.28E-04	5.93E-06	4.89E-04	1.36E-04	4.29E-01	8.60E-04	2.38E-03	4.33E-01	2.88E-04
Haul Road_Max	Project	Toddler	Lead	Haul Road_Max_Project_Toddler_Lead	7.34E-05	1.90E-06	6.59E-05	1.70E-05	3.66E-02	1.29E-05	2.10E-03	3.89E-02	3.93E-03
Haul Road_Max	Project	Toddler	Manganese	Haul Road_Max_Project_Toddler_Manganese	6.11E-03	1.58E-04	1.34E-02	1.84E-02	1.16E+00	2.87E-03	1.11E-01	1.31E+00	5.84E-04
Haul Road_Max	Project	Toddler	Molybdenum	Haul Road_Max_Project_Toddler_Molybdenum	5.20E-06	1.35E-07	9.80E-06	2.60E-06	9.00E-03	2.38E-04	2.21E-03	1.15E-02	3.02E-05
Haul Road_Max	Project	Toddler	Nickel	Haul Road_Max_Project_Toddler_Nickel	2.41E-04	6.25E-06	3.19E-04	7.85E-05	7.88E-02	2.20E-03	1.94E-02	1.01E-01	5.56E-04
Haul Road_Max	Project	Toddler	Strontium	Haul Road_Max_Project_Toddler_Strontium	2.11E-04	5.48E-06	1.13E-03	1.17E-03	0.00E+00	9.97E-05	0.00E+00	2.62E-03	2.64E-07
Haul Road_Max	Project	Toddler	Vanadium	Haul Road_Max_Project_Toddler_Vanadium	2.37E-04	6.14E-06	2.14E-04	5.42E-05	0.00E+00	4.91E-05	0.00E+00	5.60E-04	1.62E-05
Haul Road_Max	Project	Toddler	Zinc	Haul Road_Max_Project_Toddler_Zinc	5.71E-04	1.48E-05	1.22E-03	4.03E-04	2.10E+01	3.77E-05	1.66E-02	2.10E+01	2.65E-03
Haul Road_Average	Baseline	Adult	Aluminum	Haul Road_Average_Baseline_Adult_Aluminum	4.48E+02	9.30E+01	5.64E+01	2.12E+02	1.79E+00	1.50E+02	8.83E-01	9.62E+02	9.51E-02
Haul Road_Average	Baseline	Adult	Arsenic	Haul Road_Average_Baseline_Adult_Arsenic	2.00E-01	4.15E-02	1.05E-01	2.34E-02	9.21E-02	3.67E-03	2.61E-02	4.92E-01	2.32E-02
Haul Road_Average	Baseline	Adult	Arsenic_cancer	Haul Road_Average_Baseline_Adult_Arsenic_cancer	2.00E-01	4.15E-02	1.05E-01	2.34E-02	9.21E-02	3.67E-03	2.61E-02	4.92E-01	1.16E+00
Haul Road_Average	Baseline	Adult	Barium	Haul Road_Average_Baseline_Adult_Barium	7.00E-01	1.45E-01	4.64E+01	1.12E+02	0.00E+00	2.48E+00	0.00E+00	1.62E+02	1.15E-02
Haul Road_Average	Baseline	Adult	Chromium	Haul Road_Average_Baseline_Adult_Chromium	4.20E-01	8.71E-02	1.46E+00	2.40E-01	1.12E-01	5.92E-01	2.31E-03	2.91E+00	4.11E-02
Haul Road_Average	Baseline	Adult	Cobalt	Haul Road_Average_Baseline_Adult_Cobalt	2.04E-01	4.23E-02	4.37E-01	1.59E-01	5.50E-02	1.14E+00	8.41E-04	2.04E+00	2.06E-02
Haul Road_Average	Baseline	Adult	Copper	Haul Road_Average_Baseline_Adult_Copper	2.00E-01	4.15E-02	2.11E+01	7.05E+00	1.54E+00	1.17E+01	3.24E-03	4.16E+01	6.47E-03
Haul Road_Average	Baseline	Adult	Lead	Haul Road_Average_Baseline_Adult_Lead	3.28E-01	6.81E-02	5.46E-02	1.35E-01	5.59E-02	2.11E-02	1.22E-03	6.64E-01	1.56E-02
Haul Road_Average	Baseline	Adult	Manganese	Haul Road_Average_Baseline_Adult_Manganese	1.60E+01	3.32E+00	1.77E+03	4.29E+03	7.77E+00	2.53E+02	2.82E-01	6.34E+03	6.59E-01
Haul Road_Average	Baseline	Adult	Molybdenum	Haul Road_Average_Baseline_Adult_Molybdenum	1.00E-02	2.08E-03	8.38E-01	2.61E-01	4.50E-02	2.65E-01	4.21E-03	1.43E+00	8.77E-04
Haul Road_Average	Baseline	Adult	Nickel	Haul Road_Average_Baseline_Adult_Nickel	2.80E-01	5.81E-02	1.02E+01	2.64E+00	4.50E-02	2.89E+00	4.21E-03	1.61E+01	2.07E-02
Haul Road_Average	Baseline	Adult	Strontium	Haul Road_Average_Baseline_Adult_Strontium	1.80E-01	3.73E-02	6.77E+01	9.18E+01	0.00E+00	4.10E+00	0.00E+00	1.64E+02	3.86E-03
Haul Road_Average	Baseline	Adult	Vanadium	Haul Road_Average_Baseline_Adult_Vanadium	7.00E-01	1.45E-01	5.26E-01	1.20E-01	0.00E+00	3.20E-01	0.00E+00	1.81E+00	1.22E-02
Haul Road_Average	Baseline	Adult	Zinc	Haul Road_Average_Baseline_Adult_Zinc	7.20E-01	1.49E-01	7.57E+01	3.30E+01	3.50E+01	4.77E-01	1.05E-02	1.45E+02	4.28E-03
Haul Road_Average	Baseline	Adolescent	Aluminum	Haul Road_Average_Baseline_Adolescent_Aluminum	4.48E+02	8.74E+01	4.00E+01	2.12E+02	1.79E+00	9.71E+01	8.38E-01	8.87E+02	1.04E-01

Haul Road_Average	Baseline	Adolescent	Arsenic	Haul Road_Average_Baseline_Adolescent_Arsenic	2.00E-01	3.90E-02	7.47E-02	2.34E-02	9.21E-02	2.38E-03	2.47E-02	4.56E-01	2.55E-02
Haul Road_Average	Baseline	Adolescent	Arsenic_cancer	Haul Road_Average_Baseline_Adolescent_Arsenic_cancer	2.00E-01	3.90E-02	7.47E-02	2.34E-02	9.21E-02	2.38E-03	2.47E-02	4.56E-01	1.27E+00
Haul Road_Average	Baseline	Adolescent	Barium	Haul Road_Average_Baseline_Adolescent_Barium	7.00E-01	1.37E-01	3.29E+01	1.12E+02	0.00E+00	1.61E+00	0.00E+00	1.48E+02	1.24E-02
Haul Road_Average	Baseline	Adolescent	Chromium	Haul Road_Average_Baseline_Adolescent_Chromium	4.20E-01	8.19E-02	1.03E+00	2.40E-01	1.12E-01	3.84E-01	2.20E-03	2.27E+00	3.80E-02
Haul Road_Average	Baseline	Adolescent	Cobalt	Haul Road_Average_Baseline_Adolescent_Cobalt	2.04E-01	3.98E-02	3.09E-01	1.59E-01	5.50E-02	7.38E-01	7.98E-04	1.51E+00	1.80E-02
Haul Road_Average	Baseline	Adolescent	Copper	Haul Road_Average_Baseline_Adolescent_Copper	2.00E-01	3.90E-02	1.49E+01	7.05E+00	1.54E+00	7.56E+00	3.07E-03	3.13E+01	5.77E-03
Haul Road_Average	Baseline	Adolescent	Lead	Haul Road_Average_Baseline_Adolescent_Lead	3.28E-01	6.40E-02	3.87E-02	1.35E-01	5.59E-02	1.37E-02	1.16E-03	6.36E-01	1.78E-02
Haul Road_Average	Baseline	Adolescent	Manganese	Haul Road_Average_Baseline_Adolescent_Manganese	1.60E+01	3.12E+00	1.25E+03	4.29E+03	7.77E+00	1.64E+02	2.67E-01	5.74E+03	7.06E-01
Haul Road_Average	Baseline	Adolescent	Molybdenum	Haul Road_Average_Baseline_Adolescent_Molybdenum	1.00E-02	1.95E-03	5.94E-01	2.61E-01	4.50E-02	1.72E-01	3.99E-03	1.09E+00	7.92E-04
Haul Road_Average	Baseline	Adolescent	Nickel	Haul Road_Average_Baseline_Adolescent_Nickel	2.80E-01	5.46E-02	7.21E+00	2.64E+00	4.50E-02	1.87E+00	3.99E-03	1.21E+01	1.84E-02
Haul Road_Average	Baseline	Adolescent	Strontium	Haul Road_Average_Baseline_Adolescent_Strontium	1.80E-01	3.51E-02	4.80E+01	9.18E+01	0.00E+00	2.65E+00	0.00E+00	1.43E+02	3.98E-03
Haul Road_Average	Baseline	Adolescent	Vanadium	Haul Road_Average_Baseline_Adolescent_Vanadium	7.00E-01	1.37E-01	3.72E-01	1.20E-01	0.00E+00	2.07E-01	0.00E+00	1.54E+00	1.23E-02
Haul Road_Average	Baseline	Adolescent	Zinc	Haul Road_Average_Baseline_Adolescent_Zinc	7.20E-01	1.40E-01	5.36E+01	3.30E+01	3.50E+01	3.09E-01	9.98E-03	1.23E+02	4.29E-03
Haul Road_Average	Baseline	Child	Aluminum	Haul Road_Average_Baseline_Child_Aluminum	4.48E+02	8.12E+01	4.96E+01	7.06E+01	1.48E+00	6.94E+01	1.25E+00	7.21E+02	1.53E-01
Haul Road_Average	Baseline	Child	Arsenic	Haul Road_Average_Baseline_Child_Arsenic	2.00E-01	3.62E-02	9.26E-02	7.80E-03	7.60E-02	1.70E-03	3.68E-02	4.51E-01	4.57E-02
Haul Road_Average	Baseline	Child	Arsenic_cancer	Haul Road_Average_Baseline_Child_Arsenic_cancer	2.00E-01	3.62E-02	9.26E-02	7.80E-03	7.60E-02	1.70E-03	3.68E-02	4.51E-01	2.29E+00
Haul Road_Average	Baseline	Child	Barium	Haul Road_Average_Baseline_Child_Barium	7.00E-01	1.27E-01	4.08E+01	3.74E+01	0.00E+00	1.15E+00	0.00E+00	8.02E+01	1.22E-02
Haul Road_Average	Baseline	Child	Chromium	Haul Road_Average_Baseline_Child_Chromium	4.20E-01	7.61E-02	1.28E+00	8.00E-02	9.23E-02	2.74E-01	3.26E-03	2.22E+00	6.76E-02
Haul Road_Average	Baseline	Child	Cobalt	Haul Road_Average_Baseline_Child_Cobalt	2.04E-01	3.70E-02	3.84E-01	5.31E-02	4.54E-02	5.27E-01	1.19E-03	1.25E+00	2.72E-02
Haul Road_Average	Baseline	Child	Copper	Haul Road_Average_Baseline_Child_Copper	2.00E-01	3.62E-02	1.85E+01	2.35E+00	1.27E+00	5.40E+00	4.57E-03	2.78E+01	9.29E-03
Haul Road_Average	Baseline	Child	Lead	Haul Road_Average_Baseline_Child_Lead	3.28E-01	5.95E-02	4.80E-02	4.50E-02	4.61E-02	9.77E-03	1.72E-03	5.38E-01	2.73E-02
Haul Road_Average	Baseline	Child	Manganese	Haul Road_Average_Baseline_Child_Manganese	1.60E+01	2.90E+00	1.56E+03	1.43E+03	6.41E+00	1.17E+02	3.97E-01	3.13E+03	6.99E-01
Haul Road_Average	Baseline	Child	Molybdenum	Haul Road_Average_Baseline_Child_Molybdenum	1.00E-02	1.81E-03	7.37E-01	8.70E-02	3.71E-02	1.23E-01	5.93E-03	1.00E+00	1.32E-03
Haul Road_Average	Baseline	Child	Nickel	Haul Road_Average_Baseline_Child_Nickel	2.80E-01	5.07E-02	8.95E+00	8.80E-01	3.71E-02	1.34E+00	5.93E-03	1.15E+01	3.19E-02
Haul Road_Average	Baseline	Child	Strontium	Haul Road_Average_Baseline_Child_Strontium	1.80E-01	3.26E-02	5.95E+01	3.06E+01	0.00E+00	1.90E+00	0.00E+00	9.22E+01	4.67E-03
Haul Road_Average	Baseline	Child	Vanadium	Haul Road_Average_Baseline_Child_Vanadium	7.00E-01	1.27E-01	4.62E-01	4.00E-02	0.00E+00	1.48E-01	0.00E+00	1.48E+00	2.14E-02
Haul Road_Average	Baseline	Child	Zinc	Haul Road_Average_Baseline_Child_Zinc	7.20E-01	1.30E-01	6.65E+01	1.10E+01	2.89E+01	2.21E-01	1.48E-02	1.08E+02	6.81E-03
Haul Road_Average	Baseline	Toddler	Aluminum	Haul Road_Average_Baseline_Toddler_Aluminum	1.79E+03	4.65E+01	2.13E+01	7.06E+01	8.97E-01	4.72E+01	1.16E+00	1.98E+03	8.39E-01
Haul Road_Average	Baseline	Toddler	Arsenic	Haul Road_Average_Baseline_Toddler_Arsenic	8.00E-01	2.07E-02	3.98E-02	7.80E-03	4.60E-02	1.15E-03	3.43E-02	9.50E-01	1.92E-01
Haul Road_Average	Baseline	Toddler	Arsenic_cancer	Haul Road_Average_Baseline_Toddler_Arsenic_cancer	8.00E-01	2.07E-02	3.98E-02	7.80E-03	4.60E-02	1.15E-03	3.43E-02	9.50E-01	9.59E+00
Haul Road_Average	Baseline	Toddler	Barium	Haul Road_Average_Baseline_Toddler_Barium	2.80E+00	7.26E-02	1.75E+01	3.74E+01	0.00E+00	7.82E-01	0.00E+00	5.86E+01	1.78E-02
Haul Road_Average	Baseline	Toddler	Chromium	Haul Road_Average_Baseline_Toddler_Chromium	1.68E+00	4.36E-02	5.50E-01	8.00E-02	5.59E-02	1.86E-01	3.04E-03	2.60E+00	1.57E-01
Haul Road_Average	Baseline	Toddler	Cobalt	Haul Road_Average_Baseline_Toddler_Cobalt	8.16E-01	2.12E-02	1.65E-01	5.31E-02	2.75E-02	3.58E-01	1.11E-03	1.44E+00	6.24E-02
Haul Road_Average	Baseline	Toddler	Copper	Haul Road_Average_Baseline_Toddler_Copper	8.00E-01	2.07E-02	7.97E+00	2.35E+00	7.68E-01	3.67E+00	4.26E-03	1.56E+01	1.04E-02
Haul Road_Average	Baseline	Toddler	Lead	Haul Road_Average_Baseline_Toddler_Lead	1.31E+00	3.40E-02	2.06E-02	4.50E-02	2.79E-02	6.64E-03	1.61E-03	1.45E+00	1.46E-01
Haul Road_Average	Baseline	Toddler	Manganese	Haul Road_Average_Baseline_Toddler_Manganese	6.41E+01	1.66E+00	6.69E+02	1.43E+03	3.88E+00	7.95E+01	3.71E-01	2.25E+03	1.00E+00
Haul Road_Average	Baseline	Toddler	Molybdenum	Haul Road_Average_Baseline_Toddler_Molybdenum	4.00E-02	1.04E-03	3.17E-01	8.70E-02	2.25E-02	8.36E-02	5.54E-03	5.56E-01	1.47E-03
Haul Road_Average	Baseline	Toddler	Nickel	Haul Road_Average_Baseline_Toddler_Nickel	1.12E+00	2.90E-02	3.85E+00	8.80E-01	2.25E-02	9.10E-01	5.54E-03	6.81E+00	3.75E-02
Haul Road_Average	Baseline	Toddler	Strontium	Haul Road_Average_Baseline_Toddler_Strontium	7.20E-01	1.87E-02	2.56E+01	3.06E+01	0.00E+00	1.29E+00	0.00E+00	5.82E+01	5.88E-03
Haul Road_Average	Baseline	Toddler	Vanadium	Haul Road_Average_Baseline_Toddler_Vanadium	2.80E+00	7.26E-02	1.99E-01	4.00E-02	0.00E+00	1.01E-01	0.00E+00	3.21E+00	9.27E-02
Haul Road_Average	Baseline	Toddler	Zinc	Haul Road_Average_Baseline_Toddler_Zinc	2.88E+00	7.47E-02	2.86E+01	1.10E+01	1.75E+01	1.50E-01	1.38E-02	6.02E+01	7.61E-03
Haul Road_Average	Project	Adult	Aluminum	Haul Road_Average_Project_Adult_Aluminum	9.02E-03	1.87E-03	1.71E-01	5.03E-02	0.00E+00	1.44E-02	0.00E+00	2.47E-01	2.44E-05
Haul Road_Average	Project	Adult	Arsenic	Haul Road_Average_Project_Adult_Arsenic	9.69E-05	2.01E-05	1.13E-03	4.15E-04	7.43E-03	2.35E-05	2.10E-03	1.12E-02	5.29E-04
Haul Road_Average	Project	Adult	Arsenic_cancer	Haul Road_Average_Project_Adult_Arsenic_cancer	9.69E-05	2.01E-05	1.13E-03	4.15E-04	7.43E-03	2.35E-05	2.10E-03	1.12E-02	2.64E-02
Haul Road_Average	Project	Adult	Barium	Haul Road_Average_Project_Adult_Barium	2.46E-05	5.11E-06	8.76E-04	1.12E-03	0.00E+00	2.56E-05	0.00E+00	2.05E-03	1.45E-07
Haul Road_Average	Project	Adult	Chromium	Haul Road_Average_Project_Adult_Chromium	1.42E-05	2.94E-06	2.81E-04	7.94E-05	6.10E-03	1.34E-04	1.26E-04	6.74E-03	9.53E-05
Haul Road_Average	Project	Adult	Cobalt	Haul Road_Average_Project_Adult_Cobalt	6.94E-06	1.44E-06	1.35E-04	3.93E-05	1.62E-01	3.78E-03	2.48E-03	1.69E-01	1.70E-03
Haul Road_Average	Project	Adult	Copper	Haul Road_Average_Project_Adult_Copper	1.43E-05	2.96E-06	6.48E-04	2.04E-04	8.58E-01	1.68E-03	1.81E-03	8.62E-01	1.34E-04
Haul Road_Average	Project	Adult	Lead	Haul Road_Average_Project_Adult_Lead	4.59E-06	9.52E-07	8.72E-05	2.55E-05	7.32E-02	3.66E-05	1.60E-03	7.49E-02	1.77E-03
Haul Road_Average	Project	Adult	Manganese	Haul Road_Average_Project_Adult_Manganese	3.82E-04	7.92E-05	1.78E-02	2.77E-02	2.32E+00	4.12E-03	8.41E-02	2.45E+00	2.55E-04
Haul Road_Average	Project	Adult	Molybdenum	Haul Road_Average_Project_Adult_Molybdenum	3.25E-07	6.74E-08	1.30E-05	3.89E-06	1.80E-02	7.43E-04	1.68E-03	2.04E-02	1.26E-05
Haul Road_Average	Project	Adult	Nickel	Haul Road_Average_Project_Adult_Nickel	1.51E-05	3.13E-06	4.23E-04	1.18E-04	1.58E-01	6.59E-03	1.47E-02	1.79E-01	2.31E-04
Haul Road_Average	Project	Adult	Strontium	Haul Road_Average_Project_Adult_Strontium	1.32E-05	2.74E-06	1.49E-03	1.76E-03	0.00E+00	7.92E-05	0.00E+00	3.35E-03	7.89E-08
Haul Road_Average	Project	Adult	Vanadium	Haul Road_Average_Project_Adult_Vanadium	1.48E-05	3.07E-06	2.83E-04	8.13E-05	0.00E+00	3.90E-05	0.00E+00	4.21E-04	2.84E-06
Haul Road_Average	Project	Adult	Zinc	Haul Road_Average_Project_Adult_Zinc	3.57E-05	7.40E-06	1.61E-03	6.04E-04	4.20E+01	9.23E-05	1.26E-02	4.20E+01	1.24E-03
Haul Road_Average	Project	Adolescent	Aluminum	Haul Road_Average_Project_Adolescent_Aluminum	9.02E-03	1.76E-03	1.21E-01	5.03E-02	0.00E+00	9.34E-03	0.00E+00	1.92E-01	2.25E-05
Haul Road_Average	Project	Adolescent	Arsenic	Haul Road_Average_Project_Adolescent_Arsenic	9.69E-05	1.89E-05	8.03E-04	4.15E-04	7.43E-03	1.52E-05	2.00E-03	1.08E-02	6.01E-04
Haul Road_Average	Project	Adolescent	Arsenic_cancer	Haul Road_Average_Project_Adolescent_Arsenic_cancer	9.69E-05	1.89E-05	8.03E-04	4.15E-04	7.43E-03	1.52E-05	2.00E-03	1.08E-02	3.01E-02
Haul Road_Average	Project	Adolescent	Barium	Haul Road_Average_Project_Adolescent_Barium	2.46E-05	4.80E-06	6.20E-04	1.12E-03	0.00E+00	1.66E-05	0.00E+00	1.79E-03	1.50E-07
Haul Road_Average	Project	Adolescent	Chromium	Haul Road_Average_Project_Adolescent_Chromium	1.42E-05	2.76E-06	1.99E-04	7.94E-05	6.10E-03	8.72E-05	1.20E-04	6.60E-03	1.11E-04
Haul Road_Average	Project	Adolescent	Cobalt	Haul Road_Average_Project_Adolescent_Cobalt	6.94E-06	1.35E-06	9.59E-05	3.93E-05	1.62E-01	2.45E-03	2.36E-03	1.67E-01	2.00E-03
Haul Road_Average	Project	Adolescent	Copper	Haul Road_Average_Project_Adolescent_Copper	1.43E-05	2.78E-06	4.59E-04	2.04E-04	8.58E-01	1.09E-03	1.72E-03	8.61E-01	1.59E-04
Haul Road_Average	Project	Adolescent	Lead	Haul Road_Average_Project_Adolescent_Lead	4.59E-06	8.94E-07	6.18E-05	2.55E-05	7.32E-02	2.37E-05	1.52E-03	7.48E-02	2.09E-03
Haul Road_Average	Project	Adolescent	Manganese	Haul Road_Average_Project_Adolescent_Manganese	3.82E-04	7.45E-05	1.26E-02	2.77E-02	2.32E+00	2.67E-03	7.98E-02	2.44E+00	3.01E-04
Haul Road_Average	Project	Adolescent	Molybdenum	Haul Road_Average_Project_Adolescent_Molybdenum	3.25E-07	6.33E-08	9.19E-06	3.89E-06	1.80E-02	4.81E-04	1.60E-03	2.01E-02	1.46E-05
Haul Road_Average	Project	Adolescent	Nickel	Haul Road_Average_Project_Adolescent_Nickel	1.51E-05	2.94E-06	2.99E-04	1.18E-04	1.58E-01	4.27E-03	1.40E-02	1.76E-01	2.68E-04

Haul Road_Average	Project	Adolescent	Strontium	Haul Road_Average_Project_Adolescent_Strontium	1.32E-05	2.58E-06	1.06E-03	1.76E-03	0.00E+00	5.13E-05	0.00E+00	2.88E-03	8.05E-08
Haul Road_Average	Project	Adolescent	Vanadium	Haul Road_Average_Project_Adolescent_Vanadium	1.48E-05	2.88E-06	2.01E-04	8.13E-05	0.00E+00	2.53E-05	0.00E+00	3.25E-04	2.59E-06
Haul Road_Average	Project	Adolescent	Zinc	Haul Road_Average_Project_Adolescent_Zinc	3.57E-05	6.96E-06	1.14E-03	6.04E-04	4.20E+01	5.98E-05	1.20E-02	4.20E+01	1.47E-03
Haul Road_Average	Project	Child	Aluminum	Haul Road_Average_Project_Child_Aluminum	9.02E-03	1.63E-03	1.51E-01	1.68E-02	0.00E+00	6.67E-03	0.00E+00	1.85E-01	3.92E-05
Haul Road_Average	Project	Child	Arsenic	Haul Road_Average_Project_Child_Arsenic	9.69E-05	1.76E-05	9.96E-04	1.38E-04	6.13E-03	1.09E-05	2.97E-03	1.04E-02	1.05E-03
Haul Road_Average	Project	Child	Arsenic_cancer	Haul Road_Average_Project_Child_Arsenic_cancer	9.69E-05	1.76E-05	9.96E-04	1.38E-04	6.13E-03	1.09E-05	2.97E-03	1.04E-02	5.24E-02
Haul Road_Average	Project	Child	Barium	Haul Road_Average_Project_Child_Barium	2.46E-05	4.47E-06	7.70E-04	3.74E-04	0.00E+00	1.18E-05	0.00E+00	1.18E-03	1.80E-07
Haul Road_Average	Project	Child	Chromium	Haul Road_Average_Project_Child_Chromium	1.42E-05	2.57E-06	2.47E-04	2.65E-05	5.03E-03	6.23E-05	1.78E-04	5.56E-03	1.69E-04
Haul Road_Average	Project	Child	Cobalt	Haul Road_Average_Project_Child_Cobalt	6.94E-06	1.26E-06	1.19E-04	1.31E-05	1.34E-01	1.75E-03	3.50E-03	1.39E-01	3.02E-03
Haul Road_Average	Project	Child	Copper	Haul Road_Average_Project_Child_Copper	1.43E-05	2.59E-06	5.69E-04	6.79E-05	7.08E-01	7.76E-04	2.55E-03	7.12E-01	2.38E-04
Haul Road_Average	Project	Child	Lead	Haul Road_Average_Project_Child_Lead	4.59E-06	8.31E-07	7.66E-05	8.50E-06	6.04E-02	1.69E-05	2.25E-03	6.27E-02	3.18E-03
Haul Road_Average	Project	Child	Manganese	Haul Road_Average_Project_Child_Manganese	3.82E-04	6.92E-05	1.56E-02	9.22E-03	1.91E+00	1.91E-03	1.19E-01	2.06E+00	4.60E-04
Haul Road_Average	Project	Child	Molybdenum	Haul Road_Average_Project_Child_Molybdenum	3.25E-07	5.89E-08	1.14E-05	1.30E-06	1.49E-02	3.44E-04	2.37E-03	1.76E-02	2.32E-05
Haul Road_Average	Project	Child	Nickel	Haul Road_Average_Project_Child_Nickel	1.51E-05	2.73E-06	3.71E-04	3.92E-05	1.30E-01	3.05E-03	2.08E-02	1.54E-01	4.26E-04
Haul Road_Average	Project	Child	Strontium	Haul Road_Average_Project_Child_Strontium	1.32E-05	2.40E-06	1.31E-03	5.86E-04	0.00E+00	3.67E-05	0.00E+00	1.95E-03	9.88E-08
Haul Road_Average	Project	Child	Vanadium	Haul Road_Average_Project_Child_Vanadium	1.48E-05	2.68E-06	2.49E-04	2.71E-05	0.00E+00	1.81E-05	0.00E+00	3.12E-04	4.51E-06
Haul Road_Average	Project	Child	Zinc	Haul Road_Average_Project_Child_Zinc	3.57E-05	6.47E-06	1.42E-03	2.01E-04	3.47E+01	4.27E-05	1.78E-02	3.47E+01	2.20E-03
Haul Road_Average	Project	Toddler	Aluminum	Haul Road_Average_Project_Toddler_Aluminum	3.61E-02	9.35E-04	6.47E-02	1.68E-02	0.00E+00	4.54E-03	0.00E+00	1.23E-01	5.21E-05
Haul Road_Average	Project	Toddler	Arsenic	Haul Road_Average_Project_Toddler_Arsenic	3.88E-04	1.01E-05	4.28E-04	1.38E-04	3.71E-03	7.40E-06	2.77E-03	7.45E-03	1.51E-03
Haul Road_Average	Project	Toddler	Arsenic_cancer	Haul Road_Average_Project_Toddler_Arsenic_cancer	3.88E-04	1.01E-05	4.28E-04	1.38E-04	3.71E-03	7.40E-06	2.77E-03	7.45E-03	7.53E-02
Haul Road_Average	Project	Toddler	Barium	Haul Road_Average_Project_Toddler_Barium	9.86E-05	2.56E-06	3.31E-04	3.74E-04	0.00E+00	8.06E-06	0.00E+00	8.14E-04	2.47E-07
Haul Road_Average	Project	Toddler	Chromium	Haul Road_Average_Project_Toddler_Chromium	5.67E-05	1.47E-06	1.06E-04	2.65E-05	3.05E-03	4.23E-05	1.66E-04	3.45E-03	2.09E-04
Haul Road_Average	Project	Toddler	Cobalt	Haul Road_Average_Project_Toddler_Cobalt	2.78E-05	7.20E-07	5.12E-05	1.31E-05	8.11E-02	1.19E-03	3.27E-03	8.57E-02	3.71E-03
Haul Road_Average	Project	Toddler	Copper	Haul Road_Average_Project_Toddler_Copper	5.71E-05	1.48E-06	2.45E-04	6.79E-05	4.29E-01	5.28E-04	2.38E-03	4.32E-01	2.88E-04
Haul Road_Average	Project	Toddler	Lead	Haul Road_Average_Project_Toddler_Lead	1.83E-05	4.76E-07	3.29E-05	8.50E-06	3.66E-02	1.15E-05	2.10E-03	3.88E-02	3.92E-03
Haul Road_Average	Project	Toddler	Manganese	Haul Road_Average_Project_Toddler_Manganese	1.53E-03	3.96E-05	6.72E-03	9.22E-03	1.16E+00	1.30E-03	1.11E-01	1.29E+00	5.74E-04
Haul Road_Average	Project	Toddler	Molybdenum	Haul Road_Average_Project_Toddler_Molybdenum	1.30E-06	3.37E-08	4.90E-06	1.30E-06	9.00E-03	2.34E-04	2.21E-03	1.15E-02	3.02E-05
Haul Road_Average	Project	Toddler	Nickel	Haul Road_Average_Project_Toddler_Nickel	6.03E-05	1.56E-06	1.60E-04	3.92E-05	7.88E-02	2.08E-03	1.94E-02	1.00E-01	5.54E-04
Haul Road_Average	Project	Toddler	Strontium	Haul Road_Average_Project_Toddler_Strontium	5.29E-05	1.37E-06	5.64E-04	5.86E-04	0.00E+00	2.49E-05	0.00E+00	1.23E-03	1.24E-07
Haul Road_Average	Project	Toddler	Vanadium	Haul Road_Average_Project_Toddler_Vanadium	5.91E-05	1.53E-06	1.07E-04	2.71E-05	0.00E+00	1.23E-05	0.00E+00	2.07E-04	5.98E-06
Haul Road_Average	Project	Toddler	Zinc	Haul Road_Average_Project_Toddler_Zinc	1.43E-04	3.70E-06	6.10E-04	2.01E-04	2.10E+01	2.90E-05	1.66E-02	2.10E+01	2.65E-03
Haul Road_Max	Baseline	Infant	Aluminum	Haul Road_Max_Baseline_Infant_Aluminum	4.48E+02	1.23E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.60E+02	3.93E-01
Haul Road_Max	Baseline	Infant	Arsenic	Haul Road_Max_Baseline_Infant_Arsenic	2.00E-01	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01	8.35E-02
Haul Road_Max	Baseline	Infant	Arsenic_cancer	Haul Road_Max_Baseline_Infant_Arsenic_cancer	2.00E-01	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01	4.18E+00
Haul Road_Max	Baseline	Infant	Barium	Haul Road_Max_Baseline_Infant_Barium	7.00E-01	1.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.19E-01	4.39E-04
Haul Road_Max	Baseline	Infant	Chromium	Haul Road_Max_Baseline_Infant_Chromium	4.20E-01	1.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E-01	5.26E-02
Haul Road_Max	Baseline	Infant	Cobalt	Haul Road_Max_Baseline_Infant_Cobalt	2.04E-01	5.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-01	1.83E-02
Haul Road_Max	Baseline	Infant	Copper	Haul Road_Max_Baseline_Infant_Copper	2.00E-01	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01	2.75E-04
Haul Road_Max	Baseline	Infant	Lead	Haul Road_Max_Baseline_Infant_Lead	3.28E-01	9.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.37E-01	6.85E-02
Haul Road_Max	Baseline	Infant	Manganese	Haul Road_Max_Baseline_Infant_Manganese	1.60E+01	4.41E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E+01	1.48E-02
Haul Road_Max	Baseline	Infant	Molybdenum	Haul Road_Max_Baseline_Infant_Molybdenum	1.00E-02	2.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-02	5.45E-05
Haul Road_Max	Baseline	Infant	Nickel	Haul Road_Max_Baseline_Infant_Nickel	2.80E-01	7.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-01	3.19E-03
Haul Road_Max	Baseline	Infant	Strontium	Haul Road_Max_Baseline_Infant_Strontium	1.80E-01	4.95E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01	3.76E-05
Haul Road_Max	Baseline	Infant	Vanadium	Haul Road_Max_Baseline_Infant_Vanadium	7.00E-01	1.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.19E-01	4.18E-02
Haul Road_Max	Baseline	Infant	Zinc	Haul Road_Max_Baseline_Infant_Zinc	7.20E-01	1.98E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.40E-01	1.88E-04
Haul Road_Max	Project	Infant	Aluminum	Haul Road_Max_Project_Infant_Aluminum	3.61E-02	9.92E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-02	3.16E-05
Haul Road_Max	Project	Infant	Arsenic	Haul Road_Max_Project_Infant_Arsenic	3.88E-04	1.07E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-04	1.62E-04
Haul Road_Max	Project	Infant	Arsenic_cancer	Haul Road_Max_Project_Infant_Arsenic_cancer	3.88E-04	1.07E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-04	8.09E-03
Haul Road_Max	Project	Infant	Barium	Haul Road_Max_Project_Infant_Barium	9.86E-05	2.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-04	6.18E-08
Haul Road_Max	Project	Infant	Chromium	Haul Road_Max_Project_Infant_Chromium	5.67E-05	1.56E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.82E-05	7.10E-06
Haul Road_Max	Project	Infant	Cobalt	Haul Road_Max_Project_Infant_Cobalt	2.78E-05	7.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.85E-05	2.49E-06
Haul Road_Max	Project	Infant	Copper	Haul Road_Max_Project_Infant_Copper	5.71E-05	1.57E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E-05	7.87E-08
Haul Road_Max	Project	Infant	Lead	Haul Road_Max_Project_Infant_Lead	1.83E-05	5.05E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-05	3.83E-06
Haul Road_Max	Project	Infant	Manganese	Haul Road_Max_Project_Infant_Manganese	1.53E-03	4.20E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-03	1.41E-06
Haul Road_Max	Project	Infant	Molybdenum	Haul Road_Max_Project_Infant_Molybdenum	1.30E-06	3.57E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-06	7.08E-09
Haul Road_Max	Project	Infant	Nickel	Haul Road_Max_Project_Infant_Nickel	6.03E-05	1.66E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.19E-05	6.86E-07
Haul Road_Max	Project	Infant	Strontium	Haul Road_Max_Project_Infant_Strontium	5.29E-05	1.45E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.43E-05	1.10E-08
Haul Road_Max	Project	Infant	Vanadium	Haul Road_Max_Project_Infant_Vanadium	5.91E-05	1.63E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-05	3.53E-06
Haul Road_Max	Project	Infant	Zinc	Haul Road_Max_Project_Infant_Zinc	1.43E-04	3.92E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-04	3.72E-08
Haul Road_Average	Baseline	Infant	Aluminum	Haul Road_Average_Baseline_Infant_Aluminum	4.48E+02	1.23E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.60E+02	3.93E-01
Haul Road_Average	Baseline	Infant	Arsenic	Haul Road_Average_Baseline_Infant_Arsenic	2.00E-01	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01	8.35E-02
Haul Road_Average	Baseline	Infant	Arsenic_cancer	Haul Road_Average_Baseline_Infant_Arsenic_cancer	2.00E-01	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01	4.18E+00
Haul Road_Average	Baseline	Infant	Barium	Haul Road_Average_Baseline_Infant_Barium	7.00E-01	1.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.19E-01	4.39E-04
Haul Road_Average	Baseline	Infant	Chromium	Haul Road_Average_Baseline_Infant_Chromium	4.20E-01	1.15E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E-01	5.26E-02
Haul Road_Average	Baseline	Infant	Cobalt	Haul Road_Average_Baseline_Infant_Cobalt	2.04E-01	5.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-01	1.83E-02
Haul Road_Average	Baseline	Infant	Copper	Haul Road_Average_Baseline_Infant_Copper	2.00E-01	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-01	2.75E-04

Haul Road_Average	Baseline	Infant	Lead	Haul Road_Average_Baseline_Infant_Lead	3.28E-01	9.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.37E-01	6.85E-02
Haul Road_Average	Baseline	Infant	Manganese	Haul Road_Average_Baseline_Infant_Manganese	1.60E+01	4.41E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E+01	1.48E-02
Haul Road_Average	Baseline	Infant	Molybdenum	Haul Road_Average_Baseline_Infant_Molybdenum	1.00E-02	2.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-02	5.45E-05
Haul Road_Average	Baseline	Infant	Nickel	Haul Road_Average_Baseline_Infant_Nickel	2.80E-01	7.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-01	3.19E-03
Haul Road_Average	Baseline	Infant	Strontium	Haul Road_Average_Baseline_Infant_Strontium	1.80E-01	4.95E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01	3.76E-05
Haul Road_Average	Baseline	Infant	Vanadium	Haul Road_Average_Baseline_Infant_Vanadium	7.00E-01	1.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.19E-01	4.18E-02
Haul Road_Average	Baseline	Infant	Zinc	Haul Road_Average_Baseline_Infant_Zinc	7.20E-01	1.98E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.40E-01	1.88E-04
Haul Road_Average	Project	Infant	Aluminum	Haul Road_Average_Project_Infant_Aluminum	9.02E-03	2.48E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E-03	7.90E-06
Haul Road_Average	Project	Infant	Arsenic	Haul Road_Average_Project_Infant_Arsenic	9.69E-05	2.66E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.95E-05	4.05E-05
Haul Road_Average	Project	Infant	Arsenic_cancer	Haul Road_Average_Project_Infant_Arsenic_cancer	9.69E-05	2.66E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.95E-05	2.02E-03
Haul Road_Average	Project	Infant	Barium	Haul Road_Average_Project_Infant_Barium	2.46E-05	6.78E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E-05	1.54E-08
Haul Road_Average	Project	Infant	Chromium	Haul Road_Average_Project_Infant_Chromium	1.42E-05	3.90E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-05	1.78E-06
Haul Road_Average	Project	Infant	Cobalt	Haul Road_Average_Project_Infant_Cobalt	6.94E-06	1.91E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.13E-06	6.22E-07
Haul Road_Average	Project	Infant	Copper	Haul Road_Average_Project_Infant_Copper	1.43E-05	3.93E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-05	1.97E-08
Haul Road_Average	Project	Infant	Lead	Haul Road_Average_Project_Infant_Lead	4.59E-06	1.26E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.71E-06	9.58E-07
Haul Road_Average	Project	Infant	Manganese	Haul Road_Average_Project_Infant_Manganese	3.82E-04	1.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.92E-04	3.52E-07
Haul Road_Average	Project	Infant	Molybdenum	Haul Road_Average_Project_Infant_Molybdenum	3.25E-07	8.93E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.34E-07	1.77E-09
Haul Road_Average	Project	Infant	Nickel	Haul Road_Average_Project_Infant_Nickel	1.51E-05	4.14E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-05	1.72E-07
Haul Road_Average	Project	Infant	Strontium	Haul Road_Average_Project_Infant_Strontium	1.32E-05	3.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-05	2.76E-09
Haul Road_Average	Project	Infant	Vanadium	Haul Road_Average_Project_Infant_Vanadium	1.48E-05	4.07E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-05	8.82E-07
Haul Road_Average	Project	Infant	Zinc	Haul Road_Average_Project_Infant_Zinc	3.57E-05	9.81E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.67E-05	9.31E-09

Predicted Media Concentrations

Area	Scenario	COPC	Abbreviation	Deposition	Soil Measured	Soil Deposition	Soil Total	Soil Measured	Surface Soil Deposition	Surface Soil Total	Berries Soil	Berries Deposition	Berries Total	Berries Total	Leaves Soil	Leaves Deposition	Leaves Total	Leaves Total	Dust	Water	Fish	Deer
				[mg/m2/yr]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg-DW]	[mg/kg-DW]	[mg/kg-DW]	[mg/kg-WW]	[mg/kg-DW]	[mg/kg-DW]	[mg/kg-DW]	[mg/kg-WW]	[ug/m3]	[mg/L]	[mg/kg-WW]	[mg/kg-WW]
Haul Road_Max	Baseline	Aluminum	Haul Road_Max_Baseline_Aluminum	0.00E+00	2.24E+04	0.00E+00	2.24E+04	2.24E+04	0.00E+00	2.24E+04	2.07E+01	0.00E+00	2.07E+01	3.10E+00	2.21E+02	0.00E+00	2.21E+02	7.06E+01	5.60E+00	2.10E-01	1.99E-01	2.19E+00
Haul Road_Max	Baseline	Arsenic	Haul Road_Max_Baseline_Arsenic	0.00E+00	1.00E+01	0.00E+00	1.00E+01	1.00E+01	0.00E+00	1.00E+01	6.33E-02	0.00E+00	6.33E-02	5.79E-03	3.13E-02	0.00E+00	3.13E-02	7.80E-03	2.50E-03	6.20E-03	1.02E-02	5.36E-05
Haul Road_Max	Baseline	Arsenic_cancer	Haul Road_Max_Baseline_Arsenic_cancer	0.00E+00	1.00E+01	0.00E+00	1.00E+01	1.00E+01	0.00E+00	1.00E+01	6.33E-02	0.00E+00	6.33E-02	5.79E-03	3.13E-02	0.00E+00	3.13E-02	7.80E-03	2.50E-03	6.20E-03	1.02E-02	5.36E-05
Haul Road_Max	Baseline	Barium	Haul Road_Max_Baseline_Barium	0.00E+00	3.50E+01	0.00E+00	3.50E+01	3.50E+01	0.00E+00	3.50E+01	1.70E+01	0.00E+00	1.70E+01	2.55E+00	1.17E+02	0.00E+00	1.17E+02	3.74E+01	8.75E-03	0.00E+00	0.00E+00	3.63E-02
Haul Road_Max	Baseline	Chromium	Haul Road_Max_Baseline_Chromium	0.00E+00	2.10E+01	0.00E+00	2.10E+01	2.10E+01	0.00E+00	2.10E+01	5.33E-01	0.00E+00	5.33E-01	8.00E-02	2.50E-01	0.00E+00	2.50E-01	8.00E-02	5.25E-03	5.50E-04	1.24E-02	8.66E-03
Haul Road_Max	Baseline	Cobalt	Haul Road_Max_Baseline_Cobalt	0.00E+00	1.02E+01	0.00E+00	1.02E+01	1.02E+01	0.00E+00	1.02E+01	1.60E-01	0.00E+00	1.60E-01	2.40E-02	1.66E-01	0.00E+00	1.66E-01	5.31E-02	2.55E-03	2.00E-04	6.11E-03	1.66E-02
Haul Road_Max	Baseline	Copper	Haul Road_Max_Baseline_Copper	0.00E+00	1.00E+01	0.00E+00	1.00E+01	1.00E+01	0.00E+00	1.00E+01	7.73E+00	0.00E+00	7.73E+00	1.16E+00	7.34E+00	0.00E+00	7.34E+00	2.35E+00	2.50E-03	7.70E-04	1.71E-01	1.71E-01
Haul Road_Max	Baseline	Lead	Haul Road_Max_Baseline_Lead	0.00E+00	1.64E+01	0.00E+00	1.64E+01	1.64E+01	0.00E+00	1.64E+01	2.00E-02	0.00E+00	2.00E-02	3.00E-03	1.41E-01	0.00E+00	1.41E-01	4.50E-02	4.10E-03	2.90E-04	6.21E-03	3.09E-04
Haul Road_Max	Baseline	Manganese	Haul Road_Max_Baseline_Manganese	0.00E+00	8.01E+02	0.00E+00	8.01E+02	8.01E+02	0.00E+00	8.01E+02	6.49E+02	0.00E+00	6.49E+02	9.73E+01	4.47E+03	0.00E+00	4.47E+03	1.43E+03	2.00E-01	6.70E-02	8.63E-01	3.69E+00
Haul Road_Max	Baseline	Molybdenum	Haul Road_Max_Baseline_Molybdenum	0.00E+00	5.00E-01	0.00E+00	5.00E-01	5.00E-01	0.00E+00	5.00E-01	3.07E-01	0.00E+00	3.07E-01	4.61E-02	2.72E-01	0.00E+00	2.72E-01	8.70E-02	1.25E-04	1.00E-03	5.00E-03	3.88E-03
Haul Road_Max	Baseline	Nickel	Haul Road_Max_Baseline_Nickel	0.00E+00	1.40E+01	0.00E+00	1.40E+01	1.40E+01	0.00E+00	1.40E+01	3.73E+00	0.00E+00	3.73E+00	5.60E-01	2.75E+00	0.00E+00	2.75E+00	8.80E-01	3.50E-03	1.00E-03	5.00E-03	4.23E-02
Haul Road_Max	Baseline	Strontium	Haul Road_Max_Baseline_Strontium	0.00E+00	9.00E+00	0.00E+00	9.00E+00	9.00E+00	0.00E+00	9.00E+00	2.48E+01	0.00E+00	2.48E+01	3.72E+00	9.56E+01	0.00E+00	9.56E+01	3.06E+01	2.25E-03	0.00E+00	0.00E+00	5.99E-02
Haul Road_Max	Baseline	Vanadium	Haul Road_Max_Baseline_Vanadium	0.00E+00	3.50E+01	0.00E+00	3.50E+01	3.50E+01	0.00E+00	3.50E+01	1.93E-01	0.00E+00	1.93E-01	2.89E-02	1.25E-01	0.00E+00	1.25E-01	4.00E-02	8.75E-03	0.00E+00	0.00E+00	4.68E-03
Haul Road_Max	Baseline	Zinc	Haul Road_Max_Baseline_Zinc	0.00E+00	3.60E+01	0.00E+00	3.60E+01	3.60E+01	0.00E+00	3.60E+01	2.77E+01	0.00E+00	2.77E+01	4.16E+00	3.44E+01	0.00E+00	3.44E+01	1.10E+01	9.00E-03	2.50E-03	3.89E+00	6.98E-03
Haul Road_Max	Project	Aluminum	Haul Road_Max_Project_Aluminum	2.25E+01	0.00E+00	4.51E-01	4.51E-01	0.00E+00	1.80E+00	1.80E+00	4.16E-04	2.51E-01	2.51E-01	3.76E-02	4.44E-03	2.05E-01	2.10E-01	6.70E-02	4.51E-04	0.00E+00	0.00E+00	8.43E-04
Haul Road_Max	Project	Arsenic	Haul Road_Max_Project_Arsenic	2.42E-01	0.00E+00	4.84E-03	4.84E-03	0.00E+00	1.94E-02	1.94E-02	3.07E-05	2.69E-03	2.72E-03	2.49E-04	1.51E-05	2.20E-03	2.22E-03	5.54E-04	4.84E-06	5.00E-04	8.25E-04	7.00E-07
Haul Road_Max	Project	Arsenic_cancer	Haul Road_Max_Project_Arsenic_cancer	2.42E-01	0.00E+00	4.84E-03	4.84E-03	0.00E+00	1.94E-02	1.94E-02	3.07E-05	2.69E-03	2.72E-03	2.49E-04	1.51E-05	2.20E-03	2.22E-03	5.54E-04	4.84E-06	5.00E-04	8.25E-04	7.00E-07
Haul Road_Max	Project	Barium	Haul Road_Max_Project_Barium	6.16E-02	0.00E+00	1.23E-03	1.23E-03	0.00E+00	4.93E-03	4.93E-03	5.98E-04	6.85E-04	1.28E-03	1.92E-04	4.11E-03	5.60E-04	4.68E-03	1.50E-03	1.23E-06	0.00E+00	0.00E+00	1.50E-06
Haul Road_Max	Project	Chromium	Haul Road_Max_Project_Chromium	3.54E-02	0.00E+00	7.08E-04	7.08E-04	0.00E+00	2.83E-03	2.83E-03	1.80E-05	3.94E-04	4.12E-04	6.18E-05	8.43E-06	3.22E-04	3.31E-04	1.06E-04	7.08E-07	3.00E-05	6.78E-04	5.64E-06
Haul Road_Max	Project	Cobalt	Haul Road_Max_Project_Cobalt	1.74E-02	0.00E+00	3.47E-04	3.47E-04	0.00E+00	1.39E-03	1.39E-03	5.45E-06	1.93E-04	1.98E-04	2.98E-05	5.65E-06	1.58E-04	1.64E-04	5.23E-05	3.47E-07	5.90E-04	1.80E-02	6.19E-05
Haul Road_Max	Project	Copper	Haul Road_Max_Project_Copper	3.57E-02	0.00E+00	7.14E-04	7.14E-04	0.00E+00	2.86E-03	2.86E-03	5.52E-04	3.97E-04	9.49E-04	1.42E-04	5.24E-04	3.25E-04	8.49E-04	2.72E-04	7.14E-07	4.30E-04	9.53E-02	4.00E-05
Haul Road_Max	Project	Lead	Haul Road_Max_Project_Lead	1.15E-02	0.00E+00	2.29E-04	2.29E-04	0.00E+00	9.17E-04	9.17E-04	2.80E-07	1.27E-04	1.28E-04	1.92E-05	1.97E-06	1.04E-04	1.06E-04	3.40E-05	2.29E-07	3.80E-04	8.13E-03	5.99E-07
Haul Road_Max	Project	Manganese	Haul Road_Max_Project_Manganese	9.55E-01	0.00E+00	1.91E-02	1.91E-02	0.00E+00	7.64E-02	7.64E-02	1.55E-02	1.06E-02	2.61E-02	3.91E-03	1.07E-01	8.69E-03	1.15E-01	3.69E-02	1.91E-05	2.00E-02	2.58E-01	1.33E-04
Haul Road_Max	Project	Molybdenum	Haul Road_Max_Project_Molybdenum	8.12E-04	0.00E+00	1.62E-05	1.62E-05	0.00E+00	6.50E-05	6.50E-05	9.97E-06	9.03E-06	1.90E-05	2.85E-06	8.83E-06	7.39E-06	1.62E-05	5.19E-06	1.62E-08	4.00E-04	2.00E-03	1.10E-05
Haul Road_Max	Project	Nickel	Haul Road_Max_Project_Nickel	3.77E-02	0.00E+00	7.53E-04	7.53E-04	0.00E+00	3.01E-03	3.01E-03	2.01E-04	4.19E-04	6.19E-04	9.29E-05	1.48E-04	3.43E-04	4.91E-04	1.57E-04	7.53E-07	3.50E-03	1.75E-02	1.02E-04
Haul Road_Max	Project	Strontium	Haul Road_Max_Project_Strontium	3.30E-02	0.00E+00	6.61E-04	6.61E-04	0.00E+00	2.64E-03	2.64E-03	1.82E-03	3.67E-04	2.19E-03	3.28E-04	7.02E-03	3.01E-04	7.32E-03	2.34E-03	6.61E-07	0.00E+00	0.00E+00	4.63E-06
Haul Road_Max	Project	Vanadium	Haul Road_Max_Project_Vanadium	3.70E-02	0.00E+00	7.39E-04	7.39E-04	0.00E+00	2.96E-03	2.96E-03	4.07E-06	4.11E-04	4.15E-04	6.22E-05	2.64E-06	3.36E-04	3.39E-04	1.08E-04	7.39E-07	0.00E+00	0.00E+00	2.28E-06
Haul Road_Max	Project	Zinc	Haul Road_Max_Project_Zinc	8.92E-02	0.00E+00	1.78E-03	1.78E-03	0.00E+00	7.13E-03	7.13E-03	1.37E-03	9.91E-04	2.37E-03	3.55E-04	1.70E-03	8.11E-04	2.52E-03	8.05E-04	1.78E-06	3.00E-03	4.67E+00	1.75E-06
Haul Road_Average	Baseline	Aluminum	Haul Road_Average_Baseline_Aluminum	0.00E+00	2.24E+04	0.00E+00	2.24E+04	2.24E+04	0.00E+00	2.24E+04	2.07E+01	0.00E+00	2.07E+01	3.10E+00	2.21E+02	0.00E+00	2.21E+02	7.06E+01	5.60E+00	2.10E-01	1.99E-01	2.19E+00
Haul Road_Average	Baseline	Arsenic	Haul Road_Average_Baseline_Arsenic	0.00E+00	1.00E+01	0.00E+00	1.00E+01	1.00E+01	0.00E+00	1.00E+01	6.33E-02	0.00E+00	6.33E-02	5.79E-03	3.13E-02	0.00E+00	3.13E-02	7.80E-03	2.50E-03	6.20E-03	1.02E-02	5.36E-05
Haul Road_Average	Baseline	Arsenic_cancer	Haul Road_Average_Baseline_Arsenic_cancer	0.00E+00	1.00E+01	0.00E+00	1.00E+01	1.00E+01	0.00E+00	1.00E+01	6.33E-02	0.00E+00	6.33E-02	5.79E-03	3.13E-02	0.00E+00	3.13E-02	7.80E-03	2.50E-03	6.20E-03	1.02E-02	5.36E-05
Haul Road_Average	Baseline	Barium	Haul Road_Average_Baseline_Barium	0.00E+00	3.50E+01	0.00E+00	3.50E+01	3.50E+01	0.00E+00	3.50E+01	1.70E+01	0.00E+00	1.70E+01	2.55E+00	1.17E+02	0.00E+00	1.17E+02	3.74E+01	8.75E-03	0.00E+00	0.00E+00	3.63E-02
Haul Road_Average	Baseline	Chromium	Haul Road_Average_Baseline_Chromium	0.00E+00	2.10E+01	0.00E+00	2.10E+01	2.10E+01	0.00E+00	2.10E+01	5.33E-01	0.00E+00	5.33E-01	8.00E-02	2.50E-01	0.00E+00	2.50E-01	8.00E-02	5.25E-03	5.50E-04	1.24E-02	8.66E-03
Haul Road_Average	Baseline	Cobalt	Haul Road_Average_Baseline_Cobalt	0.00E+00	1.02E+01	0.00E+00	1.02E+01	1.02E+01	0.00E+00	1.02E+01	1.60E-01	0.00E+00	1.60E-01	2.40E-02	1.66E-01	0.00E+00	1.66E-01	5.31E-02	2.55E-03	2.00E-04	6.11E-03	1.66E-02
Haul Road_Average	Baseline	Copper	Haul Road_Average_Baseline_Copper	0.00E+00	1.00E+01	0.00E+00	1.00E+01	1.00E+01	0.00E+00	1.00E+01	7.73E+00	0.00E+00	7.73E+00	1.16E+00	7.34E+00	0.00E+00	7.34E+00	2.35E+00	2.50E-03	7.70E-04	1.71E-01	1.71E-01
Haul Road_Average	Baseline	Lead	Haul Road_Average_Baseline_Lead	0.00E+00	1.64E+01	0.00E+00	1.64E+01	1.64E+01	0.00E+00	1.64E+01	2.00E-02	0.00E+00	2.00E-02	3.00E-03	1.41E-01	0.00E+00	1.41E-01	4.50E-02	4.10E-03	2.90E-04	6.21E-03	3.09E-04
Haul Road_Average	Baseline	Manganese	Haul Road_Average_Baseline_Manganese	0.00E+00	8.01E+02	0.00E+00	8.01E+02	8.01E+02	0.00E+00	8.01E+02	6.49E+02	0.00E+00	6.49E+02	9.73E+01	4.47E+03	0.00E+00	4.47E+03	1.43E+03	2.00E-01	6.70E-02	8.63E-01	3.69E+00
Haul Road_Average	Baseline	Molybdenum	Haul Road_Average_Baseline_Molybdenum	0.00E+00	5.00E-01	0.00E+00	5.00E-01	5.00E-01	0.00E+00	5.00E-01	3.07E-01	0.00E+00	3.07E-01	4.61E-02	2.72E-01	0.00E+00	2.72E-01	8.70E-02	1.25E-04	1.00E-03	5.00E-03	3.88E-03
Haul Road_Average	Baseline	Nickel	Haul Road_Average_Baseline_Nickel	0.00E+00	1.40E+01	0.00E+00	1.40E+01	1.40E+01	0.00E+00	1.40E+01	3.73E+00	0.00E+00	3.73E+00	5.60E-01	2.75E+00	0.00E+00	2.75E+00	8.80E-01	3.50E-03	1.00E-03	5.00E-03	4.23E-02
Haul Road_Average	Baseline	Strontium	Haul Road_Average_Baseline_Strontium	0.00E+00	9.00E+00	0.00E+00	9.00E+00	9.00E+00	0.00E+00	9.00E+00	2.48E+01	0.00E+00	2.48E+01	3.72E+00	9.56E+01	0.00E+00	9.56E+01	3.06E+01	2.25E-03	0.00E+00	0.00E+00	5.99E-02
Haul Road_Average	Baseline	Vanadium	Haul Road_Average_Baseline_Vanadium	0.00E+00	3.50E+01	0.00E+00	3.50E+01	3.50E+01	0.00E+00	3.50E+01	1.93E-01	0.00E+00	1.93E-01	2.89E-02	1.25E-01	0.00E+00	1.25E-01	4.00E-02	8.75E-03	0.00E+00	0.00E+00	4.68E-03
Haul Road_Average	Baseline	Zinc	Haul Road_Average_Baseline_Zinc	0.00E+00	3.60E+01	0.00E+00	3.60E+01	3.60E+01	0.00E+00	3.60E+01	2.77E+01	0.00E+00	2.77E+01	4.16E+00	3.44E+01	0.00E+00	3.44E+01	1.10E+01	9.00E-03	2.50E-03	3.89E+00	6.98E-03
Haul Road_Average	Project	Aluminum	Haul Road_Average_Project_Aluminum	5.64E+00	0.00E+00	1.13E-01	1.13E-01	0.00E+00	4.51E-01	4.51E-01	1.04E-04	6.26E-02	6.27E-02	9.41E-03	1.11E-03	5.13E-02	5.24E-02	1.68E-02	1.13E-04	0.00E+00	0.00E+00	2.11E-04
Haul Road_Average	Project	Arsenic	Haul Road_Average_Project_Arsenic	6.06E-02	0.00E+00	1.21E-03	1.21E-03	0.00E+00	4.84E-03	4.84E-03	7.67E-06	6.73E-04	6.81E-04	6.23E-05	3.78E-06	5.51E-04	5.55E-04	1.38E-04	1.21E-06	5.00E-04	8.25E-04	3.44E-07
Haul Road_Average	Project	Arsenic_cancer	Haul Road_Average_Project_Arsenic_cancer	6.06E-02	0.00E+00	1.21E-03	1.21E-03	0.00E+00	4.84E-03	4.84E-03	7.67E-06	6.73E-04	6.81E-04	6.23E-05	3.78E-06	5.51E-04	5.55E-04	1.38E-04	1.21E-06	5.00E-04	8.25E-04	3.44E-07
Haul Road_Average	Project	Barium	Haul Road_Average_Project_Barium	1.54E-02	0.00E+00	3.08E-04	3.08E-04	0.00E+00	1.23E-03	1.23E-03	1.50E-04	1.71E-04	3.21E-04	4.81E-05	1.03E-03	1.40E-04	1.17E-03	3.74E-04	3.08E-07	0.00E+00	0.00E+00	3.74E-07
Haul Road_Average	Project	Chromium	Haul Road_Average_Project_Chromium	8.86E-03	0.00E+00	1.77E-04	1.77E-04	0.00E+00	7.08E-04	7.08E-04	4.49E-06	9.84E-05	1.03E-04	1.54E-05	2.11E-06	8.06E-05	8.27E-05	2.65E-05	1.77E-07	3.00E-05	6.78E-04	1.97E-06
Haul Road_Average	Project	Cobalt	Haul Road_Average_Project_Cobalt	4.34E-03	0.00E+00	8.68E-05	8.68E-05	0.00E+00	3.47E-04	3.47E-04	1.36E-06	4.82E-05	4.96E-05	7.44E-06	1.41E-06	3.95E-05	4.09E-05	1.31E-05	8.68E-08	5.90E-04	1.80E-02	5.53E-05
Haul Road_Average	Project	Copper	Haul Road_Average_Project_Copper	8.93E-03	0.00E+00	1.79E-04	1.79E-04	0.00E+00	7.14E-04	7.14E-04	1.38E-04	9.92E-05	2.37E-04	3.56E-05	1.31E-04	8.12E-05	2.12E-04	6.79E-05	1.79E-07	4.30E-04	9.53E-02	2.45E-05
Haul Road_Average	Project	Lead	Haul Road_Average_Project_Lead	2.87E-03	0.00E+00	5.73E-05	5.73E-05	0.00E+00	2.29E-04	2.29E-04	6.99E-08	3.19E-05	3.19E-05	4.79E-06	4.91E-07	2.61E-05	2.66E-05	8.50E-06	5.73E-08	3.80E-04	8.13E-03	5.34E-07
Haul Road_Average	Project	Manganese	Haul Road_Average_Project_Manganese	2.39E-01	0.00E+00	4.77E-03	4.77E-03	0.00E+00	1.91E-02	1.91E-02	3.87E-03	2.65E-03	6.52E-03	9.78E-04	2.66E-02	2.17E-03	2.88E-02	9.22E-03	4.77E-06	2.00E-02	2.58E-01	6.03E-05
Haul Road_Average	Project	Molybdenum	Haul Road_Average_Project_Molybdenum	2.03E-04	0.00E+00	4.06E-06	4.06E-06	0.00E+00	1.62E-05	1.62E-05	2.49E-06	2.26E-06	4.75E-06	7.12E-07	2.21E-06	1.85E-06	4.06E-06	1.30E-06	4.06E-09	4.00E-04	2.00E-03	1.09E-05
Haul Road_Average	Project	Nickel	Haul Road_Average_Project_Nickel	9.42E-03	0.00E+00	1.88E-04	1.88E-04	0.00E+00	7.53E-04	7.53E-04	5.02E-05	1.05E-04	1.55E-04	2.32E-05	3.70E-05	8.57E-05	1.23E-04	3.92E-05	1.88E-07	3.50E-03	1.75E-02	9.64E-05
Haul Road_Average	Project	Strontium	Haul Road_Average_Project_Strontium	8.26E-03	0.00E+00	1.65E-04	1.65E-04	0.00E+00	6.61E-04	6.61E-04	4.55E-04	9.18E-05	5.47E-04	8.21E-05	1.75E-03	7.51E-05	1.83E-03	5.86E-04	1.65E-07	0.00E+00	0.00E+00	1.16E-06
Haul Road_Average	Project	Vanadium	Haul Road_Average_Project_Vanadium	9.24E-03	0.00E+00	1.85E-04	1.85E-04	0.00E+00	7.39E-04	7.39E-04	1.02E-06	1.03E-04	1.04E-04	1.56E-05	6.60E-07	8.41E-05	8.47E-05	2.71E-05	1.85E-07	0.00E+00	0.00E+00	5.70E-07
Haul Road_Average	Project	Zinc	Haul Road_Average_Project_Zinc	2.23E-02	0.00E+00	4.46E-04	4.46E-04	0.00E+00	1.78E-03	1.78E-03	3.44E-04	2.48E-04	5.91E-04	8.87E-05	4.26E-04	2.03E-04	6.29E-04	2.01E-04	4.46E-07	3.00E-03	4.67E+00	1.35E-06

Notes:
Adjusted for chemical apportionment

Guidelines and Exposure Limits

Chemical	Exposure Limit Type	Nova Scotia EQS [mg/kg]	CCME SQG [mg/kg]	Human Oral Exposure Limit [µg/kg/day]
Aluminum	RfD	15400	n/a	143
Arsenic	RfD	31	12	0.3
Arsenic_cancer	RsD	n/a	n/a	0.006
Barium	RfD	10000	750	200
Chromium	RfD	220	64	1
Cobalt	RfD	22	40	1.4
Copper	RfD	1100	63	91
Lead	RfD	140	70	0.6
Manganese	RfD	n/a	n/a	136
Molybdenum	RfD	110	5	23
Nickel	RfD	330	45	11
Strontium	RfD	9400	n/a	600
Vanadium	RfD	39	130	2.1
Zinc	RfD	5600	250	480

Notes:

n/a - guideline value was not available

Nova Scotia Environmental Quality Standards (EQS) are the soil contact/ingestion values for coarse/fine-textured soil in an agricultural land use from Nova Scotia Environment (2014)

CCME Soil Quality Guidelines (SQG) are the SQG for the Protection of Environmental and Human Health for the agricultural land use from CCME (2019)

Human Receptor Exposure Variables

Receptor	Variable	Abbreviation	Value	Units	Reference/Comment
Adolescent	AIR	Adolescent_AIR	15.6	m3/d	Health Canada (2012); air inhalation rate
Adult	AIR	Adult_AIR	16.6	m3/d	Health Canada (2012); air inhalation rate
Child	AIR	Child_AIR	14.5	m3/d	Health Canada (2012); air inhalation rate
Toddler	AIR	Toddler_AIR	8.3	m3/d	Health Canada (2012); air inhalation rate
Infant	AIR	Infant_AIR	2.2	m3/d	Health Canada (2012); air inhalation rate
Adolescent	Berries	Adolescent_Berries	6.4	g/d	Calculated based on ingestion ratio for strawberries and blueberries combined for adolescent:adult from Health Canada (1994)
Adult	Berries	Adult_Berries	9.1	g/d	Chan et al. (2017); Heavy consumer total for berries/plants (Table 9a) - assumed receptors collecting 1/2 of annual berry consumption from MPOI
Child	Berries	Child_Berries	8.0	g/d	Calculated based on ingestion ratio for strawberries and blueberries combined for child:adult from Health Canada (1994)
Toddler	Berries	Toddler_Berries	3.4	g/d	Calculated based on ingestion ratio for strawberries and blueberries combined for toddler:adult from Health Canada (1994)
Infant	Berries	Infant_Berries	0	g/d	assumed, diet entirely breast milk
Adolescent	Berries_All	Adolescent_Berries_All	12.9	g/d	Calculated based on ingestion ratio for strawberries and blueberries combined for adolescent:adult from Health Canada (1994)
Adult	Berries_All	Adult_Berries_All	18.2	g/d	Chan et al. (2017); Heavy consumer total for berries/plants (Table 9a)
Child	Berries_All	Child_Berries_All	16.0	g/d	Calculated based on ingestion ratio for strawberries and blueberries combined for child:adult from Health Canada (1994)
Toddler	Berries_All	Toddler_Berries_All	6.9	g/d	Calculated based on ingestion ratio for strawberries and blueberries combined for toddler:adult from Health Canada (1994)
Infant	Berries_All	Infant_Berries_All	0	g/d	assumed, diet entirely breast milk
Adolescent	Berries_ratio	Adolescent_Berries_ratio	0.71	Unitless	Health Canada (1994); Ingestion rate ratio adolescent:adult for strawberries and blueberries combined
Child	Berries_ratio	Child_Berries_ratio	0.88	Unitless	Health Canada (1994); Ingestion rate ratio child:adult for strawberries and blueberries combined
Toddler	Berries_ratio	Toddler_Berries_ratio	0.38	Unitless	Health Canada (1994); Ingestion rate ratio toddler:adult for strawberries and blueberries combined
Infant	Berries_ratio	Infant_Berries_ratio	0.068788501	Unitless	Health Canada (1994); Ingestion rate ratio infant:adult for strawberries and blueberries combined
Adolescent	BW	Adolescent_BW	59.7	kg	Health Canada (2012); body weight
Adult	BW	Adult_BW	70.7	kg	Health Canada (2012); body weight
Child	BW	Child_BW	32.9	kg	Health Canada (2012); body weight
Toddler	BW	Toddler_BW	16.5	kg	Health Canada (2012); body weight
Infant	BW	Infant_BW	8.2	kg	Health Canada (2012); body weight
Adolescent	LAF	Adolescent_LAF	0.1	yr-lifestage/yr-total	Health Canada (2012); lifetime adjustment factor for gen. pop.
Adult	LAF	Adult_LAF	0.75	yr-lifestage/yr-total	Health Canada (2012); lifetime adjustment factor for gen. pop.
Child	LAF	Child_LAF	0.0875	yr-lifestage/yr-total	Health Canada (2012); lifetime adjustment factor for gen. pop.
Toddler	LAF	Toddler_LAF	0.05625	yr-lifestage/yr-total	Health Canada (2012); lifetime adjustment factor for gen. pop.
Infant	LAF	Infant_LAF	0.00625	yr-lifestage/yr-total	Health Canada (2012); lifetime adjustment factor for gen. pop.
Adolescent	Leaves	Adolescent_Leaves	1.5	g/d	Wein (1989); AHW (2007) - assumed receptors collecting 1/2 of annual leaf consumption from MPOI
Adult	Leaves	Adult_Leaves	1.5	g/d	Wein (1989); AHW (2007) - assumed receptors collecting 1/2 of annual leaf consumption from MPOI
Child	Leaves	Child_Leaves	0.5	g/d	Wein (1989); AHW (2007) - assumed receptors collecting 1/2 of annual leaf consumption from MPOI
Toddler	Leaves	Toddler_Leaves	0.5	g/d	Wein (1989); AHW (2007) - assumed receptors collecting 1/2 of annual leaf consumption from MPOI
Infant	Leaves	Infant_Leaves	0	g/d	assumed, diet entirely breast milk
Adolescent	Leaves_All	Adolescent_Leaves_All	3.0	g/d	Wein (1989); AHW (2007)
Adult	Leaves_All	Adult_Leaves_All	3.0	g/d	Wein (1989); AHW (2007)
Child	Leaves_All	Child_Leaves_All	1.0	g/d	Wein (1989); AHW (2007)
Toddler	Leaves_All	Toddler_Leaves_All	1.0	g/d	Wein (1989); AHW (2007)
Infant	Leaves_All	Infant_Leaves_All	0	g/d	assumed, diet entirely breast milk
Adolescent	Leaves_ratio	Adolescent_Leaves_ratio	0.88	Unitless	Health Canada (2012); Ingestion ratio adolescent:adult for other vegetable for general population
Child	Leaves_ratio	Child_Leaves_ratio	0.72	Unitless	Health Canada (2012); Ingestion ratio child:adult for other vegetable for general population
Toddler	Leaves_ratio	Toddler_Leaves_ratio	0.49	Unitless	Health Canada (2012); Ingestion ratio toddler:adult for other vegetable for general population
Infant	Leaves_ratio	Infant_Leaves_ratio	0.525547445	Unitless	Health Canada (2012); Ingestion ratio infant:adult for other vegetable for general population
Adolescent	SIR	Adolescent_SIR	0.02	g/d	Health Canada (2012); soil ingestion rate
Adult	SIR	Adult_SIR	0.02	g/d	Health Canada (2012); soil ingestion rate
Child	SIR	Child_SIR	0.02	g/d	Health Canada (2012); soil ingestion rate
Toddler	SIR	Toddler_SIR	0.08	g/d	Health Canada (2012); soil ingestion rate
Infant	SIR	Infant_SIR	0.02	g/d	Health Canada (2012); soil ingestion rate
Adolescent	Fish	Adolescent_Fish	9	g/d	Calculated based on ingestion ratio in Health Canada (2007) and adult ingestion rate
Adult	Fish	Adult_Fish	9	g/d	Chan et al. (2017) FNFNES for Atlantic Region; adult average consumer Table 9b - limited fishing in Anti Dam Flowage and limited fish captured
Child	Fish	Child_Fish	7.425	g/d	Calculated based on ingestion ratio in Health Canada (2007) and adult ingestion rate
Toddler	Fish	Toddler_Fish	4.5	g/d	Calculated based on ingestion ratio in Health Canada (2007) and adult ingestion rate
Infant	Fish	Infant_Fish	0	g/d	Calculated based on ingestion ratio in Health Canada (2007) and adult ingestion rate
Adolescent	Fish_ratio	Adolescent_Fish_ratio	1	Unitless	Fish ingestion ratio from Health Canada (2007)
Child	Fish_ratio	Child_Fish_ratio	0.825	Unitless	Fish ingestion ratio from Health Canada (2007)
Toddler	Fish_ratio	Toddler_Fish_ratio	0.5	Unitless	Fish ingestion ratio from Health Canada (2007)
Infant	Fish_ratio	Infant_Fish_ratio	0	Unitless	Fish ingestion ratio from Health Canada (2007)
Adolescent	Deer	Adolescent_Deer	44.3	g/d	Calculated based on ingestion ratio in Health Canada (2012) and adult ingestion rate
Adult	Deer	Adult_Deer	68.4	g/d	Chan et al. (2017) FNFNES for Atlantic Region; adult heavy consumer (95th percentile) Table 9b
Child	Deer	Child_Deer	31.7	g/d	Calculated based on ingestion ratio in Health Canada (2012) and adult ingestion rate
Toddler	Deer	Toddler_Deer	21.5	g/d	Calculated based on ingestion ratio in Health Canada (2012) and adult ingestion rate
Infant	Deer	Infant_Deer	0	g/d	Calculated based on ingestion ratio in Health Canada (2012) and adult ingestion rate
Adolescent	Deer_ratio	Adolescent_Deer_ratio	0.648	Unitless	Wild game ratio from Health Canada (2012)
Child	Deer_ratio	Child_Deer_ratio	0.463	Unitless	Wild game ratio from Health Canada (2012)
Toddler	Deer_ratio	Toddler_Deer_ratio	0.315	Unitless	Wild game ratio from Health Canada (2012)
Infant	Deer_ratio	Infant_Deer_ratio	0	Unitless	Wild game ratio from Health Canada (2012)
Adolescent	SAT	Adolescent_SAT	15470	cm^2	Health Canada (2012); surface area total
Adult	SAT	Adult_SAT	17640	cm^2	Health Canada (2012); surface area total
Child	SAT	Child_SAT	10140	cm^2	Health Canada (2012); surface area total
Infant	SAT	Infant_SAT	3620	cm^2	Health Canada (2012); surface area total
Toddler	SAT	Toddler_SAT	6130	cm^2	Health Canada (2012); surface area total
Adolescent	SEF	Adolescent_SEF	9.86E-02	hr/d	Assumed: 1hr/day for 3 days/week over 3 months in a year; swim exposure factor
Adult	SEF	Adult_SEF	9.86E-02	hr/d	Assumed: 1hr/day for 3 days/week over 3 months in a year; swim exposure factor
Child	SEF	Child_SEF	9.86E-02	hr/d	Assumed: 1hr/day for 3 days/week over 3 months in a year; swim exposure factor
Infant	SEF	Infant_SEF	0.00E+00	hr/d	Assumed not to be swimming
Toddler	SEF	Toddler_SEF	9.86E-02	hr/d	Assumed: 1hr/day for 3 days/week over 3 months in a year; swim exposure factor
Adolescent	SW_IR	Adolescent_SW_IR	0.025	L/d	US EPA 2003; Assumed 1hr / day; swim ingestion rate
Adult	SW_IR	Adult_SW_IR	0.025	L/d	US EPA 2003; Assumed 1hr / day; swim ingestion rate
Child	SW_IR	Child_SW_IR	0.05	L/d	US EPA 2003; Assumed 1hr / day; swim ingestion rate
Infant	SW_IR	Infant_SW_IR	0	L/d	US EPA 2003; Assumed 1hr / day; swim ingestion rate
Toddler	SW_IR	Toddler_SW_IR	0.05	L/d	US EPA 2003; Assumed 1hr / day; swim ingestion rate

Wildlife Receptor Exposure Variables

Receptor	Variable	Abbreviation	Value	Units	Reference/Comment
Deer	AIR	Deer_AIR	17.3	m^3/day	Allometric equation for mammals 3-20; US EPA (1993)
Deer	BW	Deer_BW	75	kg-WW	White-tailed deer; GOC 2012
Deer	Per_SIR	Deer_Per_SIR	2%	% of Diet	White-tailed deer; <2.0% of dry food ingestion rate; GOC 2012
Deer	SIR	Deer_SIR	0.045	kg-soil/day	Calculated; See estimation of Soil Ingestion Rate
Deer	WIR	Deer_WIR	4.5	L/day	White-tailed deer; GOC 2012
Deer	FIR	Deer_FIR	2.25	kg-DW/day	White-tailed deer; GOC 2012

Predicted Soil Ingestion Rates for Wildlife [kg/day]

Receptor	Variable Name	Soil Ingestion Rate [kg/day]	Per_SIR	FIR [kg-DW/kg-BW/day]	Diet [%] Berries	Leaves
Deer	Deer_SIR	0.045	2%	0.03	10%	90%

Receptor Dietary Composition [media % of diet]

Receptor	Media	Abbreviation	Value
Deer	Berries	Deer_Berries	10%
Deer	Leaves	Deer_Leaves	90%

Exposure Point Concentrations Assumed for the Assessment

ID	Area	Scenario	Media	COPC	Abbreviation	Value	Units	Comment
1	Haul Road_Max	Baseline	Soil	Aluminum	Haul Road_Max_Baseline_Soil_Aluminum	22400	mg/kg	90th percentile of samples
2	Haul Road_Max	Baseline	Soil	Arsenic	Haul Road_Max_Baseline_Soil_Arsenic	10	mg/kg	90th percentile of samples
3	Haul Road_Max	Baseline	Soil	Arsenic_cancer	Haul Road_Max_Baseline_Soil_Arsenic_cancer	10	mg/kg	90th percentile of samples
4	Haul Road_Max	Baseline	Soil	Barium	Haul Road_Max_Baseline_Soil_Barium	35	mg/kg	90th percentile of samples
5	Haul Road_Max	Baseline	Soil	Chromium	Haul Road_Max_Baseline_Soil_Chromium	21	mg/kg	90th percentile of samples
6	Haul Road_Max	Baseline	Soil	Cobalt	Haul Road_Max_Baseline_Soil_Cobalt	10.2	mg/kg	90th percentile of samples
7	Haul Road_Max	Baseline	Soil	Copper	Haul Road_Max_Baseline_Soil_Copper	10	mg/kg	90th percentile of samples
8	Haul Road_Max	Baseline	Soil	Lead	Haul Road_Max_Baseline_Soil_Lead	16.4	mg/kg	90th percentile of samples
9	Haul Road_Max	Baseline	Soil	Manganese	Haul Road_Max_Baseline_Soil_Manganese	801	mg/kg	90th percentile of samples
10	Haul Road_Max	Baseline	Soil	Molybdenum	Haul Road_Max_Baseline_Soil_Molybdenum	0.5	mg/kg	90th percentile of samples
11	Haul Road_Max	Baseline	Soil	Nickel	Haul Road_Max_Baseline_Soil_Nickel	14	mg/kg	90th percentile of samples
12	Haul Road_Max	Baseline	Soil	Strontium	Haul Road_Max_Baseline_Soil_Strontium	9	mg/kg	90th percentile of samples
13	Haul Road_Max	Baseline	Soil	Vanadium	Haul Road_Max_Baseline_Soil_Vanadium	35	mg/kg	90th percentile of samples
14	Haul Road_Max	Baseline	Soil	Zinc	Haul Road_Max_Baseline_Soil_Zinc	36	mg/kg	90th percentile of samples
15	Haul Road_Max	Project	Soil	Aluminum	Haul Road_Max_Project_Soil_Aluminum	0	mg/kg	
16	Haul Road_Max	Project	Soil	Arsenic	Haul Road_Max_Project_Soil_Arsenic	0	mg/kg	
17	Haul Road_Max	Project	Soil	Arsenic_cancer	Haul Road_Max_Project_Soil_Arsenic_cancer	0	mg/kg	
18	Haul Road_Max	Project	Soil	Barium	Haul Road_Max_Project_Soil_Barium	0	mg/kg	
19	Haul Road_Max	Project	Soil	Chromium	Haul Road_Max_Project_Soil_Chromium	0	mg/kg	
20	Haul Road_Max	Project	Soil	Cobalt	Haul Road_Max_Project_Soil_Cobalt	0	mg/kg	
21	Haul Road_Max	Project	Soil	Copper	Haul Road_Max_Project_Soil_Copper	0	mg/kg	
22	Haul Road_Max	Project	Soil	Lead	Haul Road_Max_Project_Soil_Lead	0	mg/kg	
23	Haul Road_Max	Project	Soil	Manganese	Haul Road_Max_Project_Soil_Manganese	0	mg/kg	
24	Haul Road_Max	Project	Soil	Molybdenum	Haul Road_Max_Project_Soil_Molybdenum	0	mg/kg	
25	Haul Road_Max	Project	Soil	Nickel	Haul Road_Max_Project_Soil_Nickel	0	mg/kg	
26	Haul Road_Max	Project	Soil	Strontium	Haul Road_Max_Project_Soil_Strontium	0	mg/kg	
27	Haul Road_Max	Project	Soil	Vanadium	Haul Road_Max_Project_Soil_Vanadium	0	mg/kg	
28	Haul Road_Max	Project	Soil	Zinc	Haul Road_Max_Project_Soil_Zinc	0	mg/kg	
29	Haul Road_Max	Baseline	Berries	Aluminum	Haul Road_Max_Baseline_Berries_Aluminum	20.667	mg/kg-DW	90th percentile of samples
30	Haul Road_Max	Baseline	Berries	Arsenic	Haul Road_Max_Baseline_Berries_Arsenic	0.0667	mg/kg-DW	90th percentile of samples
31	Haul Road_Max	Baseline	Berries	Arsenic_cancer	Haul Road_Max_Baseline_Berries_Arsenic_cancer	0.0667	mg/kg-DW	90th percentile of samples
32	Haul Road_Max	Baseline	Berries	Barium	Haul Road_Max_Baseline_Berries_Barium	17	mg/kg-DW	90th percentile of samples
33	Haul Road_Max	Baseline	Berries	Chromium	Haul Road_Max_Baseline_Berries_Chromium	0.533	mg/kg-DW	90th percentile of samples
34	Haul Road_Max	Baseline	Berries	Cobalt	Haul Road_Max_Baseline_Berries_Cobalt	0.16	mg/kg-DW	90th percentile of samples
35	Haul Road_Max	Baseline	Berries	Copper	Haul Road_Max_Baseline_Berries_Copper	7.73	mg/kg-DW	90th percentile of samples
36	Haul Road_Max	Baseline	Berries	Lead	Haul Road_Max_Baseline_Berries_Lead	0.02	mg/kg-DW	90th percentile of samples
37	Haul Road_Max	Baseline	Berries	Manganese	Haul Road_Max_Baseline_Berries_Manganese	648.7	mg/kg-DW	90th percentile of samples
38	Haul Road_Max	Baseline	Berries	Molybdenum	Haul Road_Max_Baseline_Berries_Molybdenum	0.307	mg/kg-DW	90th percentile of samples
39	Haul Road_Max	Baseline	Berries	Nickel	Haul Road_Max_Baseline_Berries_Nickel	3.73	mg/kg-DW	90th percentile of samples
40	Haul Road_Max	Baseline	Berries	Strontium	Haul Road_Max_Baseline_Berries_Strontium	24.8	mg/kg-DW	90th percentile of samples
41	Haul Road_Max	Baseline	Berries	Vanadium	Haul Road_Max_Baseline_Berries_Vanadium	0.0667	mg/kg-DW	90th percentile of samples
42	Haul Road_Max	Baseline	Berries	Zinc	Haul Road_Max_Baseline_Berries_Zinc	27.733	mg/kg-DW	90th percentile of samples
43	Haul Road_Max	Project	Berries	Aluminum	Haul Road_Max_Project_Berries_Aluminum	0	mg/kg-DW	
44	Haul Road_Max	Project	Berries	Arsenic	Haul Road_Max_Project_Berries_Arsenic	0	mg/kg-DW	
45	Haul Road_Max	Project	Berries	Arsenic_cancer	Haul Road_Max_Project_Berries_Arsenic_cancer	0	mg/kg-DW	
46	Haul Road_Max	Project	Berries	Barium	Haul Road_Max_Project_Berries_Barium	0	mg/kg-DW	
47	Haul Road_Max	Project	Berries	Chromium	Haul Road_Max_Project_Berries_Chromium	0	mg/kg-DW	
48	Haul Road_Max	Project	Berries	Cobalt	Haul Road_Max_Project_Berries_Cobalt	0	mg/kg-DW	
49	Haul Road_Max	Project	Berries	Copper	Haul Road_Max_Project_Berries_Copper	0	mg/kg-DW	
50	Haul Road_Max	Project	Berries	Lead	Haul Road_Max_Project_Berries_Lead	0	mg/kg-DW	
51	Haul Road_Max	Project	Berries	Manganese	Haul Road_Max_Project_Berries_Manganese	0	mg/kg-DW	
52	Haul Road_Max	Project	Berries	Molybdenum	Haul Road_Max_Project_Berries_Molybdenum	0	mg/kg-DW	
53	Haul Road_Max	Project	Berries	Nickel	Haul Road_Max_Project_Berries_Nickel	0	mg/kg-DW	
54	Haul Road_Max	Project	Berries	Strontium	Haul Road_Max_Project_Berries_Strontium	0	mg/kg-DW	
55	Haul Road_Max	Project	Berries	Vanadium	Haul Road_Max_Project_Berries_Vanadium	0	mg/kg-DW	
56	Haul Road_Max	Project	Berries	Zinc	Haul Road_Max_Project_Berries_Zinc	0	mg/kg-DW	
57	Haul Road_Max	Baseline	Leaves	Aluminum	Haul Road_Max_Baseline_Leaves_Aluminum	220.6	mg/kg-DW	90th percentile of samples
58	Haul Road_Max	Baseline	Leaves	Arsenic	Haul Road_Max_Baseline_Leaves_Arsenic	0.03125	mg/kg-DW	90th percentile of samples
59	Haul Road_Max	Baseline	Leaves	Arsenic_cancer	Haul Road_Max_Baseline_Leaves_Arsenic_cancer	0.03125	mg/kg-DW	90th percentile of samples
60	Haul Road_Max	Baseline	Leaves	Barium	Haul Road_Max_Baseline_Leaves_Barium	117	mg/kg-DW	90th percentile of samples
61	Haul Road_Max	Baseline	Leaves	Chromium	Haul Road_Max_Baseline_Leaves_Chromium	0.250	mg/kg-DW	90th percentile of samples
62	Haul Road_Max	Baseline	Leaves	Cobalt	Haul Road_Max_Baseline_Leaves_Cobalt	0.166	mg/kg-DW	90th percentile of samples
63	Haul Road_Max	Baseline	Leaves	Copper	Haul Road_Max_Baseline_Leaves_Copper	7.34	mg/kg-DW	90th percentile of samples
64	Haul Road_Max	Baseline	Leaves	Lead	Haul Road_Max_Baseline_Leaves_Lead	0.141	mg/kg-DW	90th percentile of samples
65	Haul Road_Max	Baseline	Leaves	Manganese	Haul Road_Max_Baseline_Leaves_Manganese	4469	mg/kg-DW	90th percentile of samples
66	Haul Road_Max	Baseline	Leaves	Molybdenum	Haul Road_Max_Baseline_Leaves_Molybdenum	0.272	mg/kg-DW	90th percentile of samples
67	Haul Road_Max	Baseline	Leaves	Nickel	Haul Road_Max_Baseline_Leaves_Nickel	2.750	mg/kg-DW	90th percentile of samples
68	Haul Road_Max	Baseline	Leaves	Strontium	Haul Road_Max_Baseline_Leaves_Strontium	95.6	mg/kg-DW	90th percentile of samples
69	Haul Road_Max	Baseline	Leaves	Vanadium	Haul Road_Max_Baseline_Leaves_Vanadium	0.125	mg/kg-DW	90th percentile of samples
70	Haul Road_Max	Baseline	Leaves	Zinc	Haul Road_Max_Baseline_Leaves_Zinc	34.4	mg/kg-DW	90th percentile of samples
71	Haul Road_Max	Project	Leaves	Aluminum	Haul Road_Max_Project_Leaves_Aluminum	0	mg/kg-DW	
72	Haul Road_Max	Project	Leaves	Arsenic	Haul Road_Max_Project_Leaves_Arsenic	0	mg/kg-DW	
73	Haul Road_Max	Project	Leaves	Arsenic_cancer	Haul Road_Max_Project_Leaves_Arsenic_cancer	0	mg/kg-DW	
74	Haul Road_Max	Project	Leaves	Barium	Haul Road_Max_Project_Leaves_Barium	0	mg/kg-DW	
75	Haul Road_Max	Project	Leaves	Chromium	Haul Road_Max_Project_Leaves_Chromium	0	mg/kg-DW	
76	Haul Road_Max	Project	Leaves	Cobalt	Haul Road_Max_Project_Leaves_Cobalt	0	mg/kg-DW	
77	Haul Road_Max	Project	Leaves	Copper	Haul Road_Max_Project_Leaves_Copper	0	mg/kg-DW	
78	Haul Road_Max	Project	Leaves	Lead	Haul Road_Max_Project_Leaves_Lead	0	mg/kg-DW	
79	Haul Road_Max	Project	Leaves	Manganese	Haul Road_Max_Project_Leaves_Manganese	0	mg/kg-DW	
80	Haul Road_Max	Project	Leaves	Molybdenum	Haul Road_Max_Project_Leaves_Molybdenum	0	mg/kg-DW	
81	Haul Road_Max	Project	Leaves	Nickel	Haul Road_Max_Project_Leaves_Nickel	0	mg/kg-DW	
82	Haul Road_Max	Project	Leaves	Strontium	Haul Road_Max_Project_Leaves_Strontium	0	mg/kg-DW	
83	Haul Road_Max	Project	Leaves	Vanadium	Haul Road_Max_Project_Leaves_Vanadium	0	mg/kg-DW	
84	Haul Road_Max	Project	Leaves	Zinc	Haul Road_Max_Project_Leaves_Zinc	0	mg/kg-DW	
85	Haul Road_Average	Baseline	Soil	Aluminum	Haul Road_Average_Baseline_Soil_Aluminum	22400	mg/kg	90th percentile of samples
86	Haul Road_Average	Baseline	Soil	Arsenic	Haul Road_Average_Baseline_Soil_Arsenic	10	mg/kg	90th percentile of samples
87	Haul Road_Average	Baseline	Soil	Arsenic_cancer	Haul Road_Average_Baseline_Soil_Arsenic_cancer	10	mg/kg	90th percentile of samples
88	Haul Road_Average	Baseline	Soil	Barium	Haul Road_Average_Baseline_Soil_Barium	35	mg/kg	90th percentile of samples
89	Haul Road_Average	Baseline	Soil	Chromium	Haul Road_Average_Baseline_Soil_Chromium	21	mg/kg	90th percentile of samples
90	Haul Road_Average	Baseline	Soil	Cobalt	Haul Road_Average_Baseline_Soil_Cobalt	10.2	mg/kg	90th percentile of samples
91	Haul Road_Average	Baseline	Soil	Copper	Haul Road_Average_Baseline_Soil_Copper	10	mg/kg	90th percentile of samples
92	Haul Road_Average	Baseline	Soil	Lead	Haul Road_Average_Baseline_Soil_Lead	16.4	mg/kg	90th percentile of samples
93	Haul Road_Average	Baseline	Soil	Manganese	Haul Road_Average_Baseline_Soil_Manganese	801	mg/kg	90th percentile of samples
94	Haul Road_Average	Baseline	Soil	Molybdenum	Haul Road_Average_Baseline_Soil_Molybdenum	0.5	mg/kg	90th percentile of samples
95	Haul Road_Average	Baseline	Soil	Nickel	Haul Road_Average_Baseline_Soil_Nickel	14	mg/kg	90th percentile of samples
96	Haul Road_Average	Baseline	Soil	Strontium	Haul Road_Average_Baseline_Soil_Strontium	9	mg/kg	90th percentile of samples
97	Haul Road_Average	Baseline	Soil	Vanadium	Haul Road_Average_Baseline_Soil_Vanadium	35	mg/kg	90th percentile of samples
98	Haul Road_Average	Baseline	Soil	Zinc	Haul Road_Average_Baseline_Soil_Zinc	36	mg/kg	90th percentile of samples
99	Haul Road_Average	Project	Soil	Aluminum	Haul Road_Average_Project_Soil_Aluminum	0	mg/kg	
100	Haul Road_Average	Project	Soil	Arsenic	Haul Road_Average_Project_Soil_Arsenic	0	mg/kg	
101	Haul Road_Average	Project	Soil	Arsenic_cancer	Haul Road_Average_Project_Soil_Arsenic_cancer	0	mg/kg	
102	Haul Road_Average	Project	Soil	Barium	Haul Road_Average_Project_Soil_Barium	0	mg/kg	
103	Haul Road_Average	Project	Soil	Chromium	Haul Road_Average_Project_Soil_Chromium	0	mg/kg	
104	Haul Road_Average	Project	Soil	Cobalt	Haul Road_Average_Project_Soil_Cobalt	0	mg/kg	
105	Haul Road_Average	Project	Soil	Copper	Haul Road_Average_Project_Soil_Copper	0	mg/kg	
106	Haul Road_Average	Project	Soil	Lead	Haul Road_Average_Project_Soil_Lead	0	mg/kg	
107	Haul Road_Average	Project	Soil	Manganese	Haul Road_Average_Project_Soil_Manganese	0	mg/kg	
108	Haul Road_Average	Project	Soil	Molybdenum	Haul Road_Average_Project_Soil_Molybdenum	0	mg/kg	
109	Haul Road_Average	Project	Soil	Nickel	Haul Road_Average_Project_Soil_Nickel	0	mg/kg	
110	Haul Road_Average	Project	Soil	Strontium	Haul Road_Average_Project_Soil_Strontium	0	mg/kg	
111	Haul Road_Average	Project	Soil	Vanadium	Haul Road_Average_Project_Soil_Vanadium	0	mg/kg	
112	Haul Road_Average	Project	Soil	Zinc	Haul Road_Average_Project_Soil_Zinc	0	mg/kg	
113	Haul Road_Average	Baseline	Berries	Aluminum	Haul Road_Average_Baseline_Berries_Aluminum	20.667	mg/kg-DW	90th percentile of samples
114	Haul Road_Average	Baseline	Berries	Arsenic	Haul Road_Average_Baseline_Berries_Arsenic	0.0667	mg/kg-DW	90th percentile of samples
115	Haul Road_Average	Baseline	Berries	Arsenic_cancer	Haul Road_Average_Baseline_Berries_Arsenic_cancer	0.0667	mg/kg-DW	90th percentile of samples
116	Haul Road_Average	Baseline	Berries	Barium	Haul Road_Average_Baseline_Berries_Barium	17	mg/kg-DW	90th percentile of samples
117	Haul Road_Average	Baseline	Berries	Chromium	Haul Road_Average_Baseline_Berries_Chromium	0.533	mg/kg-DW	90th percentile of samples
118	Haul Road_Average	Baseline	Berries	Cobalt	Haul Road_Average_Baseline_Berries_Cobalt	0.16	mg/kg-DW	90th percentile of samples
119	Haul Road_Average	Baseline	Berries	Copper	Haul Road_Average_Baseline_Berries_Copper	7.73	mg/kg-DW	90th percentile of samples
120	Haul Road_Average	Baseline	Berries	Lead	Haul Road_Average_Baseline_Berries_Lead	0.02	mg/kg-DW	90th percentile of samples
121	Haul Road_Average	Baseline	Berries	Manganese	Haul Road_Average_Baseline_Berries_Manganese	648.7	mg/kg-DW	90th percentile of samples
122	Haul Road_Average	Baseline	Berries	Molybdenum	Haul Road_Average_Baseline_Berries_Molybdenum	0.307	mg/kg-DW	90th percentile of samples
123	Haul Road_Average	Baseline	Berries	Nickel	Haul Road_Average_Baseline_Berries_Nickel	3.73	mg/kg-DW	90th percentile of samples
124	Haul Road_Average	Baseline	Berries	Strontium	Haul Road_Average_Baseline_Berries_Strontium	24.8	mg/kg-DW	90th percentile of samples
125	Haul Road_Average	Baseline	Berries	Vanadium	Haul Road_Average_Baseline_Berries_Vanadium	0.0667	mg/kg-DW	90th percentile of samples
126	Haul Road_Average	Baseline	Berries	Zinc	Haul Road_Average_Baseline_Berries_Zinc	27.733	mg/kg-DW	90th percentile of samples
127	Haul Road_Average	Project	Berries	Aluminum	Haul Road_Average_Project_Berries_Aluminum	0	mg/kg-DW	
128	Haul Road_Average	Project	Berries	Arsenic	Haul Road_Average_Project_Berries_Arsenic	0	mg/kg-DW	
129	Haul Road_Average	Project	Berries	Arsenic_cancer	Haul Road_Average_Project_Berries_Arsenic_cancer	0	mg/kg-DW	
130	Haul Road_Average	Project	Berries	Barium	Haul Road_Average_Project_Berries_Barium	0	mg/kg-DW	
131	Haul Road_Average	Project	Berries	Chromium	Haul Road_Average_Project_Berries_Chromium	0	mg/kg-DW	
132	Haul Road_Average	Project	Berries	Cobalt	Haul Road_Average_Project_Berries_Cobalt	0	mg/kg-DW	
133	Haul Road_Average	Project	Berries	Copper	Haul Road_Average_Project_Berries_Copper	0	mg/kg-DW	

134	Haul Road_Average	Project	Berries	Lead	Haul Road_Average_Project_Berries_Lead	0	mg/kg-DW	
135	Haul Road_Average	Project	Berries	Manganese	Haul Road_Average_Project_Berries_Manganese	0	mg/kg-DW	
136	Haul Road_Average	Project	Berries	Molybdenum	Haul Road_Average_Project_Berries_Molybdenum	0	mg/kg-DW	
137	Haul Road_Average	Project	Berries	Nickel	Haul Road_Average_Project_Berries_Nickel	0	mg/kg-DW	
138	Haul Road_Average	Project	Berries	Strontium	Haul Road_Average_Project_Berries_Strontium	0	mg/kg-DW	
139	Haul Road_Average	Project	Berries	Vanadium	Haul Road_Average_Project_Berries_Vanadium	0	mg/kg-DW	
140	Haul Road_Average	Project	Berries	Zinc	Haul Road_Average_Project_Berries_Zinc	0	mg/kg-DW	
141	Haul Road_Average	Baseline	Leaves	Aluminum	Haul Road_Average_Baseline_Leaves_Aluminum	220.6	mg/kg-DW	90th percentile of samples
142	Haul Road_Average	Baseline	Leaves	Arsenic	Haul Road_Average_Baseline_Leaves_Arsenic	0.03125	mg/kg-DW	90th percentile of samples
143	Haul Road_Average	Baseline	Leaves	Arsenic_cancer	Haul Road_Average_Baseline_Leaves_Arsenic_cancer	0.03125	mg/kg-DW	90th percentile of samples
144	Haul Road_Average	Baseline	Leaves	Barium	Haul Road_Average_Baseline_Leaves_Barium	116.9	mg/kg-DW	90th percentile of samples
145	Haul Road_Average	Baseline	Leaves	Chromium	Haul Road_Average_Baseline_Leaves_Chromium	0.25	mg/kg-DW	90th percentile of samples
146	Haul Road_Average	Baseline	Leaves	Cobalt	Haul Road_Average_Baseline_Leaves_Cobalt	0.166	mg/kg-DW	90th percentile of samples
147	Haul Road_Average	Baseline	Leaves	Copper	Haul Road_Average_Baseline_Leaves_Copper	7.34	mg/kg-DW	90th percentile of samples
148	Haul Road_Average	Baseline	Leaves	Lead	Haul Road_Average_Baseline_Leaves_Lead	0.1406	mg/kg-DW	90th percentile of samples
149	Haul Road_Average	Baseline	Leaves	Manganese	Haul Road_Average_Baseline_Leaves_Manganese	4469	mg/kg-DW	90th percentile of samples
150	Haul Road_Average	Baseline	Leaves	Molybdenum	Haul Road_Average_Baseline_Leaves_Molybdenum	0.272	mg/kg-DW	90th percentile of samples
151	Haul Road_Average	Baseline	Leaves	Nickel	Haul Road_Average_Baseline_Leaves_Nickel	2.75	mg/kg-DW	90th percentile of samples
152	Haul Road_Average	Baseline	Leaves	Strontium	Haul Road_Average_Baseline_Leaves_Strontium	95.6	mg/kg-DW	90th percentile of samples
153	Haul Road_Average	Baseline	Leaves	Vanadium	Haul Road_Average_Baseline_Leaves_Vanadium	0.125	mg/kg-DW	90th percentile of samples
154	Haul Road_Average	Baseline	Leaves	Zinc	Haul Road_Average_Baseline_Leaves_Zinc	34.4	mg/kg-DW	90th percentile of samples
155	Haul Road_Average	Project	Leaves	Aluminum	Haul Road_Average_Project_Leaves_Aluminum	0	mg/kg-DW	
156	Haul Road_Average	Project	Leaves	Arsenic	Haul Road_Average_Project_Leaves_Arsenic	0	mg/kg-DW	
157	Haul Road_Average	Project	Leaves	Arsenic_cancer	Haul Road_Average_Project_Leaves_Arsenic_cancer	0	mg/kg-DW	
158	Haul Road_Average	Project	Leaves	Barium	Haul Road_Average_Project_Leaves_Barium	0	mg/kg-DW	
159	Haul Road_Average	Project	Leaves	Chromium	Haul Road_Average_Project_Leaves_Chromium	0	mg/kg-DW	
160	Haul Road_Average	Project	Leaves	Cobalt	Haul Road_Average_Project_Leaves_Cobalt	0	mg/kg-DW	
161	Haul Road_Average	Project	Leaves	Copper	Haul Road_Average_Project_Leaves_Copper	0	mg/kg-DW	
162	Haul Road_Average	Project	Leaves	Lead	Haul Road_Average_Project_Leaves_Lead	0	mg/kg-DW	
163	Haul Road_Average	Project	Leaves	Manganese	Haul Road_Average_Project_Leaves_Manganese	0	mg/kg-DW	
164	Haul Road_Average	Project	Leaves	Molybdenum	Haul Road_Average_Project_Leaves_Molybdenum	0	mg/kg-DW	
165	Haul Road_Average	Project	Leaves	Nickel	Haul Road_Average_Project_Leaves_Nickel	0	mg/kg-DW	
166	Haul Road_Average	Project	Leaves	Strontium	Haul Road_Average_Project_Leaves_Strontium	0	mg/kg-DW	
167	Haul Road_Average	Project	Leaves	Vanadium	Haul Road_Average_Project_Leaves_Vanadium	0	mg/kg-DW	
168	Haul Road_Average	Project	Leaves	Zinc	Haul Road_Average_Project_Leaves_Zinc	0	mg/kg-DW	
169	Haul Road_Max	Baseline	Water	Aluminum	Haul Road_Max_Baseline_Water_Aluminum	0.21	mg/L	EMZ-2 mean baseline
170	Haul Road_Max	Baseline	Water	Arsenic	Haul Road_Max_Baseline_Water_Arsenic	0.0062	mg/L	EMZ-2 mean baseline
171	Haul Road_Max	Baseline	Water	Arsenic_cancer	Haul Road_Max_Baseline_Water_Arsenic_cancer	0.0062	mg/L	EMZ-2 mean baseline
172	Haul Road_Max	Baseline	Water	Barium	Haul Road_Max_Baseline_Water_Barium	0	mg/L	not measured
173	Haul Road_Max	Baseline	Water	Chromium	Haul Road_Max_Baseline_Water_Chromium	0.00055	mg/L	EMZ-2 mean baseline
174	Haul Road_Max	Baseline	Water	Cobalt	Haul Road_Max_Baseline_Water_Cobalt	0.0002	mg/L	EMZ-2 mean baseline
175	Haul Road_Max	Baseline	Water	Copper	Haul Road_Max_Baseline_Water_Copper	0.00077	mg/L	EMZ-2 mean baseline
176	Haul Road_Max	Baseline	Water	Lead	Haul Road_Max_Baseline_Water_Lead	0.00029	mg/L	EMZ-2 mean baseline
177	Haul Road_Max	Baseline	Water	Manganese	Haul Road_Max_Baseline_Water_Manganese	0.067	mg/L	EMZ-2 mean baseline
178	Haul Road_Max	Baseline	Water	Molybdenum	Haul Road_Max_Baseline_Water_Molybdenum	0.001	mg/L	EMZ-2 mean baseline
179	Haul Road_Max	Baseline	Water	Nickel	Haul Road_Max_Baseline_Water_Nickel	0.001	mg/L	EMZ-2 mean baseline
180	Haul Road_Max	Baseline	Water	Strontium	Haul Road_Max_Baseline_Water_Strontium	0	mg/L	not measured
181	Haul Road_Max	Baseline	Water	Vanadium	Haul Road_Max_Baseline_Water_Vanadium	0	mg/L	not measured
182	Haul Road_Max	Baseline	Water	Zinc	Haul Road_Max_Baseline_Water_Zinc	0.0025	mg/L	EMZ-2 mean baseline
183	Haul Road_Max	Project	Water	Aluminum	Haul Road_Max_Project_Water_Aluminum	0	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
184	Haul Road_Max	Project	Water	Arsenic	Haul Road_Max_Project_Water_Arsenic	0.0005	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
185	Haul Road_Max	Project	Water	Arsenic_cancer	Haul Road_Max_Project_Water_Arsenic_cancer	0.0005	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
186	Haul Road_Max	Project	Water	Barium	Haul Road_Max_Project_Water_Barium	0	mg/L	not measured
187	Haul Road_Max	Project	Water	Chromium	Haul Road_Max_Project_Water_Chromium	0.00003	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
188	Haul Road_Max	Project	Water	Cobalt	Haul Road_Max_Project_Water_Cobalt	0.00059	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
189	Haul Road_Max	Project	Water	Copper	Haul Road_Max_Project_Water_Copper	0.00043	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
190	Haul Road_Max	Project	Water	Lead	Haul Road_Max_Project_Water_Lead	0.00038	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
191	Haul Road_Max	Project	Water	Manganese	Haul Road_Max_Project_Water_Manganese	0.02	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
192	Haul Road_Max	Project	Water	Molybdenum	Haul Road_Max_Project_Water_Molybdenum	0.0004	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
193	Haul Road_Max	Project	Water	Nickel	Haul Road_Max_Project_Water_Nickel	0.0035	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
194	Haul Road_Max	Project	Water	Strontium	Haul Road_Max_Project_Water_Strontium	0	mg/L	not measured
195	Haul Road_Max	Project	Water	Vanadium	Haul Road_Max_Project_Water_Vanadium	0	mg/L	not measured
196	Haul Road_Max	Project	Water	Zinc	Haul Road_Max_Project_Water_Zinc	0.003	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
197	Haul Road_Average	Baseline	Water	Aluminum	Haul Road_Average_Baseline_Water_Aluminum	0.21	mg/L	EMZ-2 mean baseline
198	Haul Road_Average	Baseline	Water	Arsenic	Haul Road_Average_Baseline_Water_Arsenic	0.0062	mg/L	EMZ-2 mean baseline
199	Haul Road_Average	Baseline	Water	Arsenic_cancer	Haul Road_Average_Baseline_Water_Arsenic_cancer	0.0062	mg/L	EMZ-2 mean baseline
200	Haul Road_Average	Baseline	Water	Barium	Haul Road_Average_Baseline_Water_Barium	0	mg/L	not measured
201	Haul Road_Average	Baseline	Water	Chromium	Haul Road_Average_Baseline_Water_Chromium	0.00055	mg/L	EMZ-2 mean baseline
202	Haul Road_Average	Baseline	Water	Cobalt	Haul Road_Average_Baseline_Water_Cobalt	0.0002	mg/L	EMZ-2 mean baseline
203	Haul Road_Average	Baseline	Water	Copper	Haul Road_Average_Baseline_Water_Copper	0.00077	mg/L	EMZ-2 mean baseline
204	Haul Road_Average	Baseline	Water	Lead	Haul Road_Average_Baseline_Water_Lead	0.00029	mg/L	EMZ-2 mean baseline
205	Haul Road_Average	Baseline	Water	Manganese	Haul Road_Average_Baseline_Water_Manganese	0.067	mg/L	EMZ-2 mean baseline
206	Haul Road_Average	Baseline	Water	Molybdenum	Haul Road_Average_Baseline_Water_Molybdenum	0.001	mg/L	EMZ-2 mean baseline
207	Haul Road_Average	Baseline	Water	Nickel	Haul Road_Average_Baseline_Water_Nickel	0.001	mg/L	EMZ-2 mean baseline
208	Haul Road_Average	Baseline	Water	Strontium	Haul Road_Average_Baseline_Water_Strontium	0	mg/L	not measured
209	Haul Road_Average	Baseline	Water	Vanadium	Haul Road_Average_Baseline_Water_Vanadium	0	mg/L	not measured
210	Haul Road_Average	Baseline	Water	Zinc	Haul Road_Average_Baseline_Water_Zinc	0.0025	mg/L	EMZ-2 mean baseline
211	Haul Road_Average	Project	Water	Aluminum	Haul Road_Average_Project_Water_Aluminum	0	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
212	Haul Road_Average	Project	Water	Arsenic	Haul Road_Average_Project_Water_Arsenic	0.0005	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
213	Haul Road_Average	Project	Water	Arsenic_cancer	Haul Road_Average_Project_Water_Arsenic_cancer	0.0005	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
214	Haul Road_Average	Project	Water	Barium	Haul Road_Average_Project_Water_Barium	0	mg/L	not measured
215	Haul Road_Average	Project	Water	Chromium	Haul Road_Average_Project_Water_Chromium	0.00003	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
216	Haul Road_Average	Project	Water	Cobalt	Haul Road_Average_Project_Water_Cobalt	0.00059	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
217	Haul Road_Average	Project	Water	Copper	Haul Road_Average_Project_Water_Copper	0.00043	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
218	Haul Road_Average	Project	Water	Lead	Haul Road_Average_Project_Water_Lead	0.00038	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
219	Haul Road_Average	Project	Water	Manganese	Haul Road_Average_Project_Water_Manganese	0.02	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
220	Haul Road_Average	Project	Water	Molybdenum	Haul Road_Average_Project_Water_Molybdenum	0.0004	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
221	Haul Road_Average	Project	Water	Nickel	Haul Road_Average_Project_Water_Nickel	0.0035	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline
222	Haul Road_Average	Project	Water	Strontium	Haul Road_Average_Project_Water_Strontium	0	mg/L	not measured
223	Haul Road_Average	Project	Water	Vanadium	Haul Road_Average_Project_Water_Vanadium	0	mg/L	not measured
224	Haul Road_Average	Project	Water	Zinc	Haul Road_Average_Project_Water_Zinc	0.003	mg/L	EMZ-2 during operations (upper case); Project value is 95th percentile baseline + project minus mean baseline

Bio-concentration Factors (BCFs)

Media	COPC	Abbreviation	Uptake Factor	Units	Comment
Berries	Aluminum	Berries_Aluminum	0.000922634	DW Basis	Based on site-specific data
Berries	Arsenic	Berries_Arsenic	0.00633	DW Basis	COPC 100% ND in berries; BCF based on US EPA OSW 2005
Berries	Arsenic_cancer	Berries_Arsenic_cancer	0.00633	DW Basis	COPC 100% ND in berries; BCF based on US EPA OSW 2005
Berries	Barium	Berries_Barium	0.485714286	DW Basis	Based on site-specific data
Berries	Chromium	Berries_Chromium	0.025380952	DW Basis	Based on site-specific data
Berries	Cobalt	Berries_Cobalt	0.015686275	DW Basis	Based on site-specific data
Berries	Copper	Berries_Copper	0.773	DW Basis	Based on site-specific data
Berries	Lead	Berries_Lead	0.001219512	DW Basis	Based on site-specific data
Berries	Manganese	Berries_Manganese	0.809862672	DW Basis	Based on site-specific data
Berries	Molybdenum	Berries_Molybdenum	0.614	DW Basis	Based on site-specific data
Berries	Nickel	Berries_Nickel	0.266428571	DW Basis	Based on site-specific data
Berries	Strontium	Berries_Strontium	2.755555556	DW Basis	Based on site-specific data
Berries	Vanadium	Berries_Vanadium	0.0055	DW Basis	COPC 100% ND in berries; BCF based on Baes et al. 1984
Berries	Zinc	Berries_Zinc	0.770361111	DW Basis	Based on site-specific data
Leaves	Aluminum	Leaves_Aluminum	0.009848214	DW Basis	Based on site-specific data
Leaves	Arsenic	Leaves_Arsenic	0.003125	DW Basis	Based on site-specific data
Leaves	Arsenic_cancer	Leaves_Arsenic_cancer	0.003125	DW Basis	Based on site-specific data
Leaves	Barium	Leaves_Barium	3.34	DW Basis	Based on site-specific data
Leaves	Chromium	Leaves_Chromium	0.011904762	DW Basis	Based on site-specific data
Leaves	Cobalt	Leaves_Cobalt	0.01627451	DW Basis	Based on site-specific data
Leaves	Copper	Leaves_Copper	0.734	DW Basis	Based on site-specific data
Leaves	Lead	Leaves_Lead	0.008573171	DW Basis	Based on site-specific data
Leaves	Manganese	Leaves_Manganese	5.579275905	DW Basis	Based on site-specific data
Leaves	Molybdenum	Leaves_Molybdenum	0.544	DW Basis	Based on site-specific data
Leaves	Nickel	Leaves_Nickel	0.196428571	DW Basis	Based on site-specific data
Leaves	Strontium	Leaves_Strontium	10.62222222	DW Basis	Based on site-specific data
Leaves	Vanadium	Leaves_Vanadium	0.003571429	DW Basis	Based on site-specific data
Leaves	Zinc	Leaves_Zinc	0.955555556	DW Basis	Based on site-specific data
Fish	Aluminum	Fish_Aluminum	0.949519231	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Arsenic	Fish_Arsenic	82.5	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Arsenic_cancer	Fish_Arsenic_cancer	82.5	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Barium	Fish_Barium	8.018623482	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Chromium	Fish_Chromium	22.6	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Cobalt	Fish_Cobalt	30.55	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Copper	Fish_Copper	221.7	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Lead	Fish_Lead	21.4	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Manganese	Fish_Manganese	12.88064171	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Molybdenum	Fish_Molybdenum	5	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Nickel	Fish_Nickel	5	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Strontium	Fish_Strontium	81.04498695	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Vanadium	Fish_Vanadium	10	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake
Fish	Zinc	Fish_Zinc	1556	L/kg-WW	Site-specific BCFs based on surrogate data from Scraggy Lake

Bio transfer factors [day/kg FW]

Receptor	Chemical	Abbreviation	Value	Comment
Deer	Aluminum	Deer_Aluminum	0.0015	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Arsenic	Deer_Arsenic	0.002	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Arsenic_cancer	Deer_Arsenic_cancer	0.002	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Barium	Deer_Barium	0.00015	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Chromium	Deer_Chromium	0.0055	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Cobalt	Deer_Cobalt	0.02	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Copper	Deer_Copper	0.01	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Lead	Deer_Lead	0.0003	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Manganese	Deer_Manganese	0.0004	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Molybdenum	Deer_Molybdenum	0.006	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Nickel	Deer_Nickel	0.006	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Strontium	Deer_Strontium	0.0003	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Vanadium	Deer_Vanadium	0.0025	Literature based BTF (US EPA 2005; Baes et al 1984)
Deer	Zinc	Deer_Zinc	0.00009	Literature based BTF (US EPA 2005; Baes et al 1984)

Site-Specific BCF Calculation

		Measured Concentrations [mg/kg-DW]			Site-specific BCFs	
Area	**Chemical**	**Soil**	**Berries**	**Leaves**	**Berries**	**Leaves**
Haul Road_Max	Aluminum	22400	20.667	220.6	0.000922634	0.009848214
Haul Road_Max	Arsenic	10	0.0667	0.03125	0.00667	0.003125
Haul Road_Max	Arsenic_cancer	10	0.0667	0.03125	0.00667	0.003125
Haul Road_Max	Barium	35	17	116.9	0.485714286	3.34
Haul Road_Max	Chromium	21	0.533	0.25	0.025380952	0.011904762
Haul Road_Max	Cobalt	10.2	0.16	0.166	0.015686275	0.01627451
Haul Road_Max	Copper	10	7.73	7.34	0.773	0.734
Haul Road_Max	Lead	16.4	0.02	0.1406	0.001219512	0.008573171
Haul Road_Max	Manganese	801	648.7	4469	0.809862672	5.579275905
Haul Road_Max	Molybdenum	0.5	0.307	0.272	0.614	0.544
Haul Road_Max	Nickel	14	3.73	2.75	0.266428571	0.196428571
Haul Road_Max	Strontium	9	24.8	95.6	2.755555556	10.62222222
Haul Road_Max	Vanadium	35	0.0667	0.125	0.001905714	0.003571429
Haul Road_Max	Zinc	36	27.733	34.4	0.770361111	0.955555556
Haul Road_Average	Aluminum	22400	20.667	220.6	0.000922634	0.009848214
Haul Road_Average	Arsenic	10	0.0667	0.03125	0.00667	0.003125
Haul Road_Average	Arsenic_cancer	10	0.0667	0.03125	0.00667	0.003125
Haul Road_Average	Barium	35	17	116.9	0.485714286	3.34
Haul Road_Average	Chromium	21	0.533	0.25	0.025380952	0.011904762
Haul Road_Average	Cobalt	10.2	0.16	0.166	0.015686275	0.01627451
Haul Road_Average	Copper	10	7.73	7.34	0.773	0.734
Haul Road_Average	Lead	16.4	0.02	0.1406	0.001219512	0.008573171
Haul Road_Average	Manganese	801	648.7	4469	0.809862672	5.579275905
Haul Road_Average	Molybdenum	0.5	0.307	0.272	0.614	0.544
Haul Road_Average	Nickel	14	3.73	2.75	0.266428571	0.196428571
Haul Road_Average	Strontium	9	24.8	95.6	2.755555556	10.62222222
Haul Road_Average	Vanadium	35	0.0667	0.125	0.001905714	0.003571429
Haul Road_Average	Zinc	36	27.733	34.4	0.770361111	0.955555556

Predicted Total Dust Deposition Rates

Area	Scenario	Abbreviation	Value [mg/m2/yr]	Value [g/m2/yr]	Comment
Haul Road_Max	Baseline	Haul Road_Max_Baseline	0	0	
Haul Road_Max	Project	Haul Road_Max_Project	1400	1.4	Maximum annual deposition at site boundary
Haul Road_Average	Baseline	Haul Road_Average_Baseline	0	0	
Haul Road_Average	Project	Haul Road_Average_Project	350	0.35	Maximum annual deposition at 1 km from the site

Site-specific Metal Composition of Dust [%]

Area	COPC	Abbreviation	Value	Comment / Reference
Haul Road_Max	Aluminum	Haul Road_Max_Aluminum	1.610000%	Based on geomean of dust samples
Haul Road_Max	Arsenic	Haul Road_Max_Arsenic	0.017300%	Based on geomean of dust samples
Haul Road_Max	Arsenic_cancer	Haul Road_Max_Arsenic_cancer	0.017300%	Based on geomean of dust samples
Haul Road_Max	Barium	Haul Road_Max_Barium	0.004400%	Based on geomean of dust samples
Haul Road_Max	Chromium	Haul Road_Max_Chromium	0.002530%	Based on geomean of dust samples
Haul Road_Max	Cobalt	Haul Road_Max_Cobalt	0.001240%	Based on geomean of dust samples
Haul Road_Max	Copper	Haul Road_Max_Copper	0.002550%	Based on geomean of dust samples
Haul Road_Max	Lead	Haul Road_Max_Lead	0.000819%	Based on geomean of dust samples
Haul Road_Max	Manganese	Haul Road_Max_Manganese	0.068200%	Based on geomean of dust samples
Haul Road_Max	Molybdenum	Haul Road_Max_Molybdenum	0.000058%	Based on geomean of dust samples
Haul Road_Max	Nickel	Haul Road_Max_Nickel	0.002690%	Based on geomean of dust samples
Haul Road_Max	Strontium	Haul Road_Max_Strontium	0.002360%	Based on geomean of dust samples
Haul Road_Max	Vanadium	Haul Road_Max_Vanadium	0.002640%	Based on geomean of dust samples
Haul Road_Max	Zinc	Haul Road_Max_Zinc	0.006370%	Based on geomean of dust samples
Haul Road_Average	Aluminum	Haul Road_Average_Aluminum	1.610000%	Based on geomean of dust samples
Haul Road_Average	Arsenic	Haul Road_Average_Arsenic	0.017300%	Based on geomean of dust samples
Haul Road_Average	Arsenic_cancer	Haul Road_Average_Arsenic_cancer	0.017300%	Based on geomean of dust samples
Haul Road_Average	Barium	Haul Road_Average_Barium	0.004400%	Based on geomean of dust samples
Haul Road_Average	Chromium	Haul Road_Average_Chromium	0.002530%	Based on geomean of dust samples
Haul Road_Average	Cobalt	Haul Road_Average_Cobalt	0.001240%	Based on geomean of dust samples
Haul Road_Average	Copper	Haul Road_Average_Copper	0.002550%	Based on geomean of dust samples
Haul Road_Average	Lead	Haul Road_Average_Lead	0.000819%	Based on geomean of dust samples
Haul Road_Average	Manganese	Haul Road_Average_Manganese	0.068200%	Based on geomean of dust samples
Haul Road_Average	Molybdenum	Haul Road_Average_Molybdenum	0.000058%	Based on geomean of dust samples
Haul Road_Average	Nickel	Haul Road_Average_Nickel	0.002690%	Based on geomean of dust samples
Haul Road_Average	Strontium	Haul Road_Average_Strontium	0.002360%	Based on geomean of dust samples
Haul Road_Average	Vanadium	Haul Road_Average_Vanadium	0.002640%	Based on geomean of dust samples
Haul Road_Average	Zinc	Haul Road_Average_Zinc	0.006370%	Based on geomean of dust samples

Soil Degradation Loss Constant [yr^{-1}]

COPC	Value	Half-life [Days]	Reference / Comment
Aluminum	2.53E-02	1.00E+04	Assumed
Arsenic	2.53E-02	1.00E+04	Assumed
Arsenic_cancer	2.53E-02	1.00E+04	Assumed
Barium	2.53E-02	1.00E+04	Assumed
Chromium	2.53E-02	1.00E+04	Assumed
Cobalt	2.53E-02	1.00E+04	Assumed
Copper	2.53E-02	1.00E+04	Assumed
Lead	2.53E-02	1.00E+04	Assumed
Manganese	2.53E-02	1.00E+04	Assumed
Molybdenum	2.53E-02	1.00E+04	Assumed
Nickel	2.53E-02	1.00E+04	Assumed
Strontium	2.53E-02	1.00E+04	Assumed
Vanadium	2.53E-02	1.00E+04	Assumed
Zinc	2.53E-02	1.00E+04	Assumed

Dermal permeability coefficient in water [cm/hr]

Chemical	Value	Reference
Aluminum	0.001	US EPA 2004; used all inorganics value
Arsenic	0.001	US EPA 2004; used all inorganics value
Arsenic_cancer	0.001	US EPA 2004; used all inorganics value
Barium	0.001	US EPA 2004; used all inorganics value
Chromium	0.001	US EPA 2004; used all inorganics value
Cobalt	0.001	US EPA 2004; used all inorganics value
Copper	0.001	US EPA 2004; used all inorganics value
Lead	0.001	US EPA 2004; used all inorganics value
Manganese	0.001	US EPA 2004; used all inorganics value
Molybdenum	0.001	US EPA 2004; used all inorganics value
Nickel	0.001	US EPA 2004; used all inorganics value
Strontium	0.001	US EPA 2004; used all inorganics value
Vanadium	0.001	US EPA 2004; used all inorganics value
Zinc	0.001	US EPA 2004; used all inorganics value

Chemical Apportionment Assumed for Berries and Leaves

Media	Chemical	Value	Reference / Comment
Berries	Aluminum	100%	Assumed most conservative value
Berries	Arsenic	61%	Schoof et al. 1999; 95UCLM of fruits
Berries	Arsenic_cancer	61%	Schoof et al. 1999; 95UCLM of fruits
Berries	Barium	100%	Assumed most conservative value
Berries	Chromium	100%	Assumed most conservative value
Berries	Cobalt	100%	Assumed most conservative value
Berries	Copper	100%	Assumed most conservative value
Berries	Lead	100%	Assumed most conservative value
Berries	Manganese	100%	Assumed most conservative value
Berries	Molybdenum	100%	Assumed most conservative value
Berries	Nickel	100%	Assumed most conservative value
Berries	Strontium	100%	Assumed most conservative value
Berries	Vanadium	100%	Assumed most conservative value
Berries	Zinc	100%	Assumed most conservative value
Leaves	Aluminum	100%	Assumed most conservative value
Leaves	Arsenic	78%	Schoof et al. 1999; 95UCLM of vegetables
Leaves	Arsenic_cancer	78%	Schoof et al. 1999; 95UCLM of vegetables
Leaves	Barium	100%	Assumed most conservative value
Leaves	Chromium	100%	Assumed most conservative value
Leaves	Cobalt	100%	Assumed most conservative value
Leaves	Copper	100%	Assumed most conservative value
Leaves	Lead	100%	Assumed most conservative value
Leaves	Manganese	100%	Assumed most conservative value
Leaves	Molybdenum	100%	Assumed most conservative value
Leaves	Nickel	100%	Assumed most conservative value
Leaves	Strontium	100%	Assumed most conservative value
Leaves	Vanadium	100%	Assumed most conservative value
Leaves	Zinc	100%	Assumed most conservative value
Fish	Aluminum	100%	Assumed most conservative value
Fish	Arsenic	2%	Schoof et al. 1999
Fish	Arsenic_cancer	2%	Schoof et al. 1999
Fish	Barium	100%	Assumed most conservative value
Fish	Chromium	100%	Assumed most conservative value
Fish	Cobalt	100%	Assumed most conservative value
Fish	Copper	100%	Assumed most conservative value
Fish	Lead	100%	Assumed most conservative value
Fish	Manganese	100%	Assumed most conservative value
Fish	Molybdenum	100%	Assumed most conservative value
Fish	Nickel	100%	Assumed most conservative value
Fish	Strontium	100%	Assumed most conservative value
Fish	Vanadium	100%	Assumed most conservative value
Fish	Zinc	100%	Assumed most conservative value
Deer	Aluminum	100%	Assumed most conservative value
Deer	Arsenic	5%	Schoof et al. 1999
Deer	Arsenic_cancer	5%	Schoof et al. 1999

Deer	Barium	100%	Assumed most conservative value
Deer	Chromium	100%	Assumed most conservative value
Deer	Cobalt	100%	Assumed most conservative value
Deer	Copper	100%	Assumed most conservative value
Deer	Lead	100%	Assumed most conservative value
Deer	Manganese	100%	Assumed most conservative value
Deer	Molybdenum	100%	Assumed most conservative value
Deer	Nickel	100%	Assumed most conservative value
Deer	Strontium	100%	Assumed most conservative value
Deer	Vanadium	100%	Assumed most conservative value
Deer	Zinc	100%	Assumed most conservative value

Time Period of Deposition [years]

Variable	Value	Comment
Time	6	Life of facility

Moisture Content

Variable	Value	Comment
Berries	85%	Project specific average
Leaves	68%	Project specific average

Soil Mixing Depth for Deposition

Variable	Value	Units	Reference
Surface Soil Mixing Depth = Depth1	0.05	m	Public Health Layer
Soil Mixing Depth for Plants = Depth2	0.2	m	US EPA OSW 2005
Soil Bulk Density	1500	kg/m^3	US EPA OSW 2005

Parameters Used to Predict Deposition for Vegetation

Parameter	Abbreviation	Value	Units	Reference/Comment
Yield or Standing Biomass for berries	Yp	0.25	kg-dw/m2	US EPA OSW 2005; exposed fruits
Yield or Standing Biomass for leaves	Yp	5.66	kg-dw/m2	US EPA OSW 2005; exposed vegetables
Plant Surface Loss Coefficient	Kp	18	$year^{-1}$	US EPA OSW 2005
Period of Exposure	Tp	0.164	years	US EPA OSW 2005
Intercept Fraction of the Edible Portion of Plant for berries	Rp	0.053	unitless	US EPA OSW 2005; exposed fruits
Intercept Fraction of the Edible Portion of Plant for leaves	Rp	0.982	unitless	US EPA OSW 2005; exposed vegetables

Food Preparation

Variable	Value	Units
Washing and peeling factor (WPF)	100%	%

Mean measured water concentration at Scraggy Lake [ug/L]

Parameter	SGL-001	SGL-003
Aluminum	160	130
Arsenic	0.5	0.5
Barium	3.8	3.25
Chromium	0.5	0.5
Cobalt	0.2	0.2
Copper	1	1
Lead	0.25	0.25
Manganese	44	42.5
Molybdenum	1	1
Nickel	1	1
Strontium	8.35	5.85
Vanadium	1	1
Zinc	2.5	2.5

Fish Tissue Concentration (muscle fillet) [mg/kg]

		Fork	Sample	Parameter and Detection Limit (below)													
Sample ID	Area	Length (cm)	Weight (g)	Crude Fat (%)	Moisture (%)	Aluminum	Arsenic	Barium	Chromium	Cobalt	Copper	Lead	Manganese	Molybdenum	Nickel	Strontium	Vanadium	Zinc
SGL-001-YLPR-01A/B	Nearfield	20.2	20.23	0.25	N/A	0.21	0.0701	0.065	0.014	0.0065	0.211	0.0118	0.933	0.005	0.005	1.19	0.01	3.79
SGL-001-YLPR-02A/B	Nearfield	17.1	22.97	0.25	N/A	0.1	0.0387	0.017	0.012	0.0051	0.197	0.0037	0.306	0.005	0.005	0.344	0.01	3.5
SGL-001-YLPR-03A/B	Nearfield	19	25.29	0.25	N/A	0.1	0.0443	0.02	0.005	0.0051	0.172	0.0025	0.378	0.005	0.005	0.445	0.01	4.17
SGL-001-YLPR-12A/B	Nearfield	16	18.33	0.25	N/A	0.1	0.048	0.032	0.01	0.0105	0.284	0.0071	0.839	0.005	0.005	0.746	0.01	3.99
SGL-003-YLPR-05A/B	Farfield	16.8	23.07	0.25	N/A	0.1	0.034	0.027	0.011	0.0051	0.214	0.0032	0.374	0.005	0.005	0.31	0.01	3.69
SGL-003-YLPR-06A/B	Farfield	18	21.89	0.25	N/A	0.1	0.0339	0.019	0.012	0.0051	0.193	0.0028	0.396	0.005	0.005	0.41	0.01	3.7
SGL-003-YLPR-07A/B	Farfield	17.4	21.3	0.25	N/A	0.1	0.0525	0.022	0.005	0.0059	0.215	0.0046	0.602	0.005	0.005	0.546	0.01	3.53
SGL-003-YLPR-08A/B	Farfield	17	21.81	0.25	N/A	0.22	0.0283	0.02	0.011	0.0055	0.216	0.0046	0.507	0.005	0.005	0.41	0.01	3.64
SGL-003-YLPR-09A/B	Farfield	15.5	18.31	0.5	N/A	0.1	0.0233	0.031	0.013	0.0048	0.258	0.0046	0.556	0.005	0.005	0.641	0.01	4.46
SGL-003-YLPR-11A/B	Farfield	15	19.67	0.25	N/A	0.2	0.0394	0.027	0.02	0.0075	0.257	0.0086	0.667	0.005	0.005	0.515	0.01	4.43

Red text indicates that parameter was less than the detection limit. Value presented is the **1/2 the** detection limit (consistent with water quality results)

BCF Calculation

Sample ID	Area					Aluminum	Arsenic	Barium	Chromium	Cobalt	Copper	Lead	Manganese	Molybdenum	Nickel	Strontium	Vanadium	Zinc
SGL-001-YLPR-01A/B						0.0013125	0.1402	0.017105263	0.028	0.0325	0.211	0.0472	0.021204545	0.005	0.005	0.14251497	0.01	1.516
SGL-001-YLPR-02A/B						0.000625	0.0774	0.004473684	0.024	0.0255	0.197	0.0148	0.006954545	0.005	0.005	0.041197605	0.01	1.4
SGL-001-YLPR-03A/B						0.000625	0.0886	0.005263158	0.01	0.0255	0.172	0.01	0.008590909	0.005	0.005	0.053293413	0.01	1.668
SGL-001-YLPR-12A/B	Nearfield					0.000625	0.096	0.008421053	0.02	0.0525	0.284	0.0284	0.019068182	0.005	0.005	0.089341317	0.01	1.596
SGL-003-YLPR-05A/B						0.0007692	0.068	0.008307692	0.022	0.0255	0.214	0.0128	0.0088	0.005	0.005	0.052991453	0.01	1.476
SGL-003-YLPR-06A/B						0.0007692	0.0678	0.005846154	0.024	0.0255	0.193	0.0112	0.009317647	0.005	0.005	0.07008547	0.01	1.48
SGL-003-YLPR-07A/B						0.0007692	0.105	0.006769231	0.01	0.0295	0.215	0.0184	0.014164706	0.005	0.005	0.093333333	0.01	1.412
SGL-003-YLPR-08A/B						0.0016923	0.0566	0.006153846	0.022	0.0275	0.216	0.0184	0.011929412	0.005	0.005	0.07008547	0.01	1.456
SGL-003-YLPR-09A/B						0.0007692	0.0466	0.009538462	0.026	0.024	0.258	0.0184	0.013082353	0.005	0.005	0.10957265	0.01	1.784
SGL-003-YLPR-11A/B	Farfield					0.0015385	0.0788	0.008307692	0.04	0.0375	0.257	0.0344	0.015694118	0.005	0.005	0.088034188	0.01	1.772
					MEAN BCF	9.50E-01	8.25E+01	8.02E+00	2.26E+01	3.06E+01	2.22E+02	2.14E+01	1.29E+01	5.00E+00	5.00E+00	8.10E+01	1.00E+01	1.56E+03

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