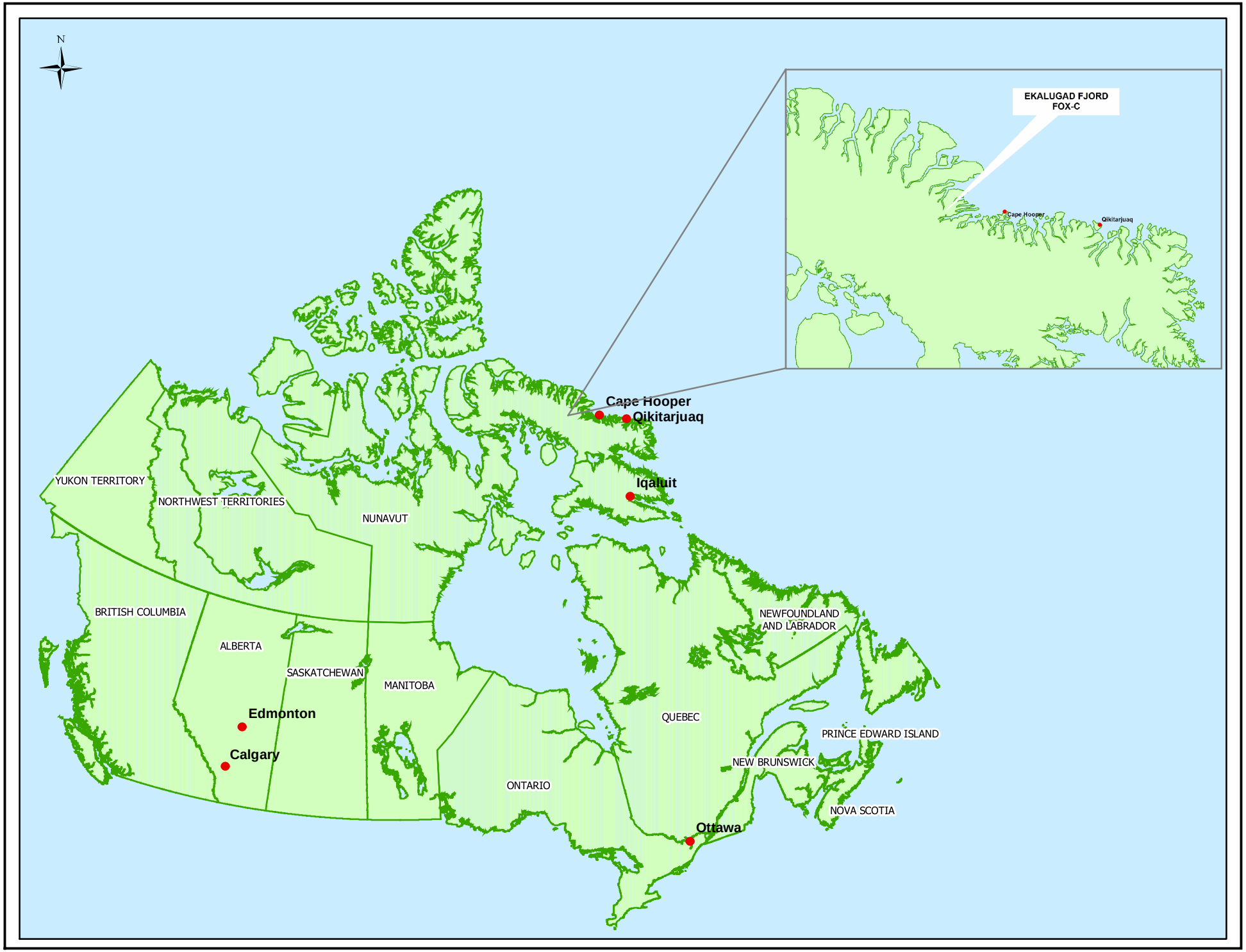
APPENDIX A

SITE DIAGRAMS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FOX-C
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YUKON TERRITORY
NORTHWEST TERRITORIES
NUNAVUT
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
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Calgary
Ottawa

APPENDIX B

TOXICITY PROFILES

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Jacques Whitford

LIST OF TABLES

GLOSSARY AND ACRONYMS

Absolute bioavailability	Absolute bioavailability is the fraction or percentage of an administered dose that reaches systemic circulation (blood) irrespective of via the gastrointestinal tract, skin or lungs
Ah	Aryl hydrocarbon
ATSDR	Agency for Toxic Substances and Disease Registry
Bioavailability	The degree to which a substance becomes available to the target tissue after administration or exposure.
CEPA	Canadian Environmental Protection Act
COPC	Contaminants of Potential Concern
ESOD	Erythrocyte Superoxide Dismutase
FAO	Food and Agriculture Organization. An organization of the United Nations.
IARC	International Agency for Research on Cancer. An organization of the WHO.
IOC	Intake of concern
IOM	Institute of Medicine
IPCS	International Programme on Chemical Safety
IRIS	Integrated Risk Information System. A database maintained by the US EPA.
LOAEL	Lowest-observed-effects-level. A term that describes the benchmark on a threshold dose-response curve at which the lowest dose results in observed adverse health effects. May be used in place of a NOAEL where a NOAEL cannot be determined.
MAC	Maximum Allowable Concentration
MADEP	Massachusetts Department of Environmental Protection

GLOSSARY AND ACRONYMS

MOE	Ontario Ministry of the Environment
MRL	Minimal Risk Level. A term used by the ATSDR to describe an estimate of daily human exposure to a hazardous substance that is likely to be without an appreciable risk of adverse noncancer health effects over a specified route and duration of exposure.
NATO	North Atlantic Treaty Organization
NCEA	National Center for Environmental Assessment
NIOSH	National Institute for Occupational Safety and Health
NOAEL	No-observed-effects-level. A term that describes the benchmark on a threshold dose-response curve at which the highest dose does not result in adverse effects.
NRC	National Research Council
OEHHA	Office of Environmental Health Hazard Assessment
ORD	Office of Research and Development
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PTWI	Provisional Tolerable Weekly Intake
RAF	Relative absorption factor
RDA	Recommended Dietary Allowance
REL	Reference Exposure Level is a NIOSH time-weighted average concentration for up to a 10-hour workday during a 40-hour work week.

GLOSSARY AND ACRONYMS

Relative bioavailability	A comparative fraction which predicts bioavailability in one medium or form in relation to the medium for which the TRV was derived.
RfC	Reference Concentration. The RfC is an estimate of lifetime daily exposure to a non-carcinogen in air for the general human population that appears to be without appreciable risk of deleterious effects expressed in mg chemical/kg body weight-day.
RfD	Reference Dose. The RfD is an estimate of lifetime daily exposure to a non-carcinogen for the general human population that appears to be without appreciable risk of deleterious effects expressed in mg chemical/kg body weight-day.
SF	Slope factor. The SF is a plausible upper bound estimate of the probability of a response per unit intake of a chemical over a lifetime expressed as (mg chemical/kg body weight-day)$^{-1}$ and is used to express carcinogenic effects.
STSC	Superfund Health Risk Technical Support Center
TC	Tolerable Concentration. A term used by Health Canada to describe concentrations in air that a person may be continuously exposed to over a lifetime without adverse effects. The TC is used to derive the TDI.
TC_{05}	Tumorigenic concentration that will induce a 5% increase in the incidence of tumors or deaths due to tumors following exposure to that chemical in air.
TD	Tumorigenic Dose. A term used to describe a dose that will induce an increase in the incidence of tumors or deaths due to tumours as calculated from a non-threshold dose-response curve.
TD_{05}	Tumorigenic Dose that will induce a 5% increase in the incidence of tumors or deaths due to tumors.
TDI	Tolerable Daily Intake. A term used by Health Canada in place of RfD.
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalent
TRV	Toxicity Reference Value

GLOSSARY AND ACRONYMS

UF	Uncertainty Factor. A factor that is applied to NOAELs or LOAELs to yield a RfC or RfD. For example, the UF can be used to account for intra-species and inter-species extrapolations.
UL	Tolerable upper intake level. A term used by the IOM to describe the highest daily nutrient intake that will not result in adverse health effects.
Unit Risk	Units risks estimate the upper bound probability of an individual developing cancer following exposure to a particular level (usually as 1 µg/L in water or 1 µg/m^3) of a potential carcinogen. For example, if the unit risk is 1.2 x 10^{-6} µg/L then it is expected that 1.2 excess tumours are expected to occur per 1,000,000 people exposed to 1 µg of that chemical in 1 L of drinking water.
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

1. INTRODUCTION

For the purpose of this assessment, toxicity reference values (TRVs) were obtained for each of the identified chemicals of potential concern (CoPC). Toxicological information was obtained, as necessary, from various sources including Health Canada, the US EPA Integrated Risk Information System (IRIS) database, the Agency for Toxic Substances and Disease Registry (ATSDR).

TRVs are values used to describe maximum acceptable doses of chemicals that will not result in the development of adverse health effects. TRVs can be used to describe non-carcinogenic and carcinogenic effects and can express effects in different terms based on magnitude of the dose, length of exposure and route of exposure.

1.1 Non-Carcinogenic TRVs

Non-carcinogenic chemicals exhibit threshold effects following exposure. Threshold effects are defined by the observation of adverse effects at a given dose or concentration. Given these threshold effects, two measures of interest can describe the dose-response curve: the no-adverse-effects-level (NOAEL) and lowest-adverse-effects-level (LOAEL). The NOAEL is the benchmark at which the highest dose does not result in observed adverse effects. The LOAEL may be used when a NOAEL is not available and is the lowest dose at which adverse effects are observed.

The reference dose (RfD) is used for the assessment of non-carcinogenic endpoints. The RfD is the estimate of lifetime daily exposure to a non-carcinogenic substance for the general human population that appears to be without appreciable risk of deleterious effects. It is expressed as mg chemical/kg body weight/day (*e.g.,* mg/kg-day). The RfD is derived from either the NOAEL or the LOAEL determined in a laboratory study. Uncertainty factors (UF) are applied to the NOAEL or LOAEL to account for interspecies variability and intraspecies variability (*e.g.,* sensitive sub-populations). Additionally, uncertainty factors are applied to extrapolate from subchronic exposure to chronic exposure or where there is a paucity of data available for a chemical (*e.g.,* no data regarding effects on reproduction).

Other regulatory agencies have substituted the term RfD to be reflective of objectives and toxicological endpoints. Health Canada replaces the term RfD with tolerable daily intake (TDI), also expressed in mg/kg-day. Health Canada also uses a tolerable concentration (TC) to express concentrations in air that a person can be continuously exposed to over their lifetime without adverse effects. The Institute of Medicine (IOM) uses the tolerable upper intake level (UL)

expressed as mg chemical/day to describe the highest daily nutrient intake that will not result in adverse health effects. The ATSDR uses a minimal risk level (MRL) similar to the IOM's UL, that estimates daily human exposure to a substance that, over a specified duration, will not cause an appreciable risk of adverse effects.

The reference concentration (RfC) is also used as a non-carcinogenic endpoint specific to inhalation exposure. The RfC is typically reported as a concentration in air which can be converted to a RfD for inhaled dose expressed as mg/kg-day.

1.2 Carcinogenic TRVs

Carcinogenic chemicals exhibit non-threshold effects following exposure. Non-threshold effects are defined by the observation of adverse effects regardless of concentration and length of exposure. Primarily, two TRVs are used to describe carcinogenic effects: the slope factor and unit risk.

A slope factor (SF) is used for assessment of carcinogenic effects of a chemical. The SF is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime, expressed as $(mg/kg\ body\ weight/day)^{-1}$. It is used to estimate an upper bound probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen.

Unit risks are used to estimate an upper bound probability of an individual developing cancer as a result of exposure to a particular level (usually as 1 µg/L in water, or 1 $\mu g/m^3$ in air) of a potential carcinogen. Unit risks are calculated by dividing the SF by body weight and multiplying that product by the inhalation or drinking rate as applicable.

Health Canada uses tumorigenic doses and concentrations for substances that are considered to have non-threshold or carcinogenic effects. The potency is expressed as a dose or concentration that will induce a 5% increase in the incidence of tumours or deaths due to tumours as calculated from a dose-response curve. The TRVs that defined the 5% increased are tumorigenic concentration 05 (TC_{05}) primarily used as a benchmark for exposure to a certain chemical in air or tumorigenic dose 05 (TD_{05}).

1.3 Bioavailability

The definition of bioavailability varies with the source and context in which the term is used. The simplest and broadest definition of bioavailability describes the extent or rate that a chemical enters a receptor or is made available at the target site (*e.g.,* blood). The importance of

bioavailability in risk assessment is illustrated by comparison TRVs as toxicity measures that are usually defined by laboratory studies. The fraction of a dose which is absorbed during an animal study may differ from the fraction that is available to a receptor in the environment due to several factors including weathering.

There are two specific types of bioavailability that are applicable to risk assessment: absolute and relative bioavailability. Absolute bioavailability is the fraction or percentage of an administered dose that reaches systemic circulation (blood) irrespective of via the gastrointestinal tract, skin or lungs. Relative bioavailability is the absolute bioavailability in one medium divided by the absolute bioavailability of the chemical under the conditions used to derive the TRV. Therefore, the relative bioavailability is a comparative fraction which predicts bioavailability in one medium or form in relation to the medium for which the TRV was derived. Relative bioavailability can be expressed as a relative absorption fraction (RAF).

In the following toxicity profiles, both absolute and relative bioavailabilities have been provided, where applicable, with the relative bioavailability selected for use in the assessment.

2. BERYLLIUM

According to the ATSDR (2002), beryllium is a hard, grayish metal naturally found in mineral rocks, coal, soil, and volcanic dust. Beryllium compounds are commercially mined, and the beryllium is purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium ores are used to make speciality ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs and bicycle frames), and dental bridges.

2.1 Assessment of Carcinogenicity

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that beryllium is a human carcinogen. The U.S. EPA has determined that beryllium is a probable human carcinogen.

2.2 Susceptible Populations

There are no studies on the health effects of children exposed to beryllium. It is likely that the health effects seen in children exposed to beryllium will be similar to the effects seen in adults. We do not know whether children differ from adults in their susceptibility to beryllium (ATSDR, 2002).

It is not known if exposure to beryllium will result in birth defects or other developmental effects in people: the studies on developmental effects in animals are not conclusive.

2.3 Selection of Toxicity Values

2.3.1 Non-Cancer Oral Toxicity Reference Values

The oral reference dose (RfD) for beryllium published by the US EPA (1998) is 0.002 mg/kg-d. The US EPA oral RfD is based on a long-term study of dogs fed diets containing beryllium by Morgareidge et al (1976). The oral RfD is based on the development of intestinal lesions. A BMD_{10} (the lower 95% confidence limit on the dose from the maximum likelihood estimate [MLE] of a 10% relative change) of 0.46 mg/kg-day (MLE = 1.4 mg/kg-day) was derived for the lesions and used for further quantitation in this assessment in the US EPA's assessment. (U.S. EPA, 1995). An uncertainty factor of 300 was applied: 10 for extrapolation for interspecies differences, 10 for consideration of intraspecies variation, and 3 for database deficiencies. The USEPA has low to medium confidence in this RfD.

An oral RfD of 0.002 mg/kg-day has been adopted in this assessment based on the US EPA's recommended oral RfD.

2.3.2 Cancer Oral Toxicity Reference Values

The lack of suitable positive carcinogenic data precludes the derivation of an oral SF or unit risk for beryllium.

2.3.3 Non-Cancer Inhalation Toxicity Reference Values

The inhalation reference concentration (RfC) for beryllium published by the US EPA (1998) is 2E-2 $\mu g/m^3$. The RfC is based on beryllium sensitization and progression to chronic beryllium disease (CBD) identified in the co-principal studies by Kreiss *et al*. (1996) and Eisenbud *et al*. (1949). The Kreiss *et al.* (1996) occupational exposure study identified a lowest observed adverse effects level (LOAEL) for beryllium sensitization in workers exposed to 0.55 $\mu g/m^3$ (median of average concentrations). The Eisenbud *et al.* (1949) study, using relatively insensitive screening methods, suggests a no observed adverse effects level (NOAEL) of 0.01-0.1 $\mu g/m^3$ in community residents living near a beryllium plant. The LOAEL from the *Kreiss et al*. study was used for the operational derivation of the RfC because the screening method used in the Eisenbud *et al.* (1949) study was less sensitive than the method used in the Kreiss *et al*. (1996) study.

Because individuals developing beryllium sensitization and CBD are the most sensitive subpopulation, an uncertainty factor of 1 was used to account for human variability. An uncertainty factor of 1 was also used to adjust for the less-than-chronic exposure duration of the Kreiss et al. (1996) study; use of this uncertainty factor is supported by the evidence that the occurrence of CBD does not appear to be related to exposure duration. A database uncertainty factor of 3 was used to account for the poor quality of exposure monitoring in the co-principal studies and other epidemiology studies that assessed the incidence of beryllium sensitization and CBD among exposed workers and community residents. The US EPA has medium confidence in this RfD.

An RfD of 4.47E-6 mg/kg-d was then calculated based on the US EPA RfC, by dividing by an adult body weight of 70.7 kg and multiplying by an adult inhalation rate of 15.8 m^3/d, which was then used in this assessment.

2.3.4 Cancer Inhalation Toxicity Reference Values

The US EPA (1998) has published an inhalation unit risk for beryllium of 2.4E-3 $(\mu g/m^3)^{-1}$. The unit risk value is based on an occupational exposure epidemiological study by Wagoner et al. (1980) which was used to estimate the lifetime cancer risk from exposure to beryllium oxide based on the estimated lower and upper bounds of exposure estimated by the National Institute of Occupational Safety and Health (NIOSH); namely, 100 and 1,000 $\mu g/m^3$.

An inhalation slope factor of 10.9 $(mg/kg\text{-}d)^{-1}$ was then calculated by multiplying the US EPA inhalation unit risk, by an adult body weight of 70.7 kg and dividing by an adult inhalation rate of 15.8 m^3/d, which was then used in this assessment.

2.4 Bioavailability

The following section describes the bioavailabilities of beryllium.

2.4.1 Oral Bioavailability

The relative oral absorption factor for beryllium has been conservatively assumed to be 1.0.

2.4.2 Inhalation Bioavailability

The relative inhalation absorption factor for beryllium has been conservatively assumed to be 1.0.

2.4.3 Dermal Bioavailability

Health Canada (2003) recommends a relative dermal absorption factor of 0.03 for beryllium. Therefore, a relative dermal bioavailability of 0.03 was adopted for this assessment.

2.5 Conclusion

The following tables present the TRV and bioavailability summaries for beryllium.

Table 1: Selected Toxicity Reference Values for Beryllium

Route of Exposure	TRV	TRV Type	Source Agency
Non-Cancer Effects			
Ingestion	2.00E-03 mg/kg-day	RfD	US EPA, 1998
Inhalation	4.47E-06 mg/kg-day	RfC	US EPA, 1998
Cancer Effects			
Ingestion	NA	NA	NA
Inhalation	10.7 $(mg/kg\text{-}day)^{-1}$	Slope Factor	US EPA, 1998

NA – Not Applicable

Table 2: Selected Bioavailabilities for Beryllium

Route of Exposure	Relative Bioavailability	Reference
Ingestion	1.0	Assumed
Inhalation	1.0	Assumed
Dermal	0.03	Health Canada, 2003

2.6 References

ATSDR (Agency for Toxic Substances and Disease Registry), 2002. Toxicological Profile for Beryllium. September 2002. Available on-line at: http://www.atsdr.cdc.gov/toxpro2.html.

Eisenbud, M; Wanta, RC; Dustan, C; et al., 1949. Non-occupational berylliosis. J Ind Hyg Toxicol 31:282-294. Cited In: US EPA, 1998.

Kreiss, K; Mroz, MM; Newman, LS; et al,. 1996. Machining risk of beryllium disease and sensitization with median exposures below 2 MU-G/M(3). Am J Ind Med 30(1):16-25. Cited In: US EPA, 1998.

Morgareidge, K; Cox, GE; Gallo, MA. 1976. Chronic feeding studies with beryllium in dogs. Food and Drug Research Laboratories, Inc. Submitted to the Aluminum Company of America, Alcan Research & Development, Ltd., Kawecki-Berylco Industries, Inc., and Brush-Wellman, Inc. Cited In: US EPA, 1998.

US EPA (United States Environmental Protection Agency), 1998. Integrated Risk Information System (IRIS) Database. Beryllium and compounds (inorganic). Confirmed current as of December 2004. Available on-line at: http://www.epa.gov/iris/

Wagoner, JK; Infante, PF; Bayliss, DL. (1980) Beryllium: an etiologic agent in the induction of lung caner, nonneoplastic respiratory disease, and heart disease among industrially exposed workers. Environ Res 21:15-34. Cited In: US EPA, 1998.

3. COPPER

Copper is widely distributed in nature and is an essential element. Copper deficiency is characterized by hypochromic, microcytic anemia which is a result of defect in hemoglobin synthesis. Many oxidative enzymes (*e.g.,* catalase, peroxidase, cytochrome oxides) require copper. The importance of copper in human nutrition has been reviewed in detail (IPCS, 1998; IOM, 2001).

3.1 Assessment of Carcinogenicity

The toxicity of copper has been the subject of several comprehensive reviews (US EPA, 1991; IPCS, 1998; ATSDR, 2002). Copper is classified as Group D – not classifiable as a human carcinogen due to a lack of human data, inadequate animal data from assays of copper compounds, and equivocal mutagenicity data (US EPA, 1991). Health Canada also does not consider copper to be carcinogenic to humans (CCME, 1999).

3.2 Susceptible Populations

Infants and children under 1 year old are unusually susceptible to copper toxicity because they have not developed the homeostatic mechanism to remove copper from the body (ATSDR, 2002). Wilson's Disease is a genetic disorder associated with impaired transport of copper from the liver to the bile, thereby resulting in increased copper concentrations in the liver as they are not able to maintain homeostasis (ATSDR, 2002). Another genetic condition which increases the susceptibility to copper toxicity is a deficiency in the enzyme glucose-6-phosphate dehydrogenase (ATSDR, 2002). Individuals with liver disease are also susceptible to copper toxicity because of the critical role the liver plays in eliminating copper from the body (ATSDR, 2002).

3.3 Toxicity Reference Values

As copper is considered an essential element for humans, there are two types of toxicity values that are considered: (a) the minimal daily intake so that a person will not suffer from copper deficiency and (b) the maximal permissible daily intake so that a person will not suffer from copper toxicity. Major non-carcinogenic effects observed in humans after exposure to excessive amounts of copper include diarrhea, vomiting, hypotension, skin irritation, lung disease, kidney damage and liver damage.

3.3.1 Non-Cancer Oral Toxicity Reference Values

The Recommended Dietary Allowance (RDA) for US adults is 0.900 mg/day or about 0.13 mg/kg-day (IOM, 2001). This RDA is a combination of indicators, including plasma copper and ceruloplasmin concentrations, erythrocyte superoxide dismutase (ESOD) activity and platelet copper concentration in controlled human depletion/repletion studies. The US Reference Daily Intake (RDI) (a term which replaces RDA) for copper is 2.0 mg/day or about 0.030 mg/kg-day for adults (US FDA, 1999).

The tolerable upper intake level for US adults is 10 mg/day or about 0.140 mg/kg-day, and is based on protection from liver damage (IOM, 2001). A reference dose (RfD) for elemental copper has not been developed by the US EPA (1991).

Health Canada has developed lower and upper bound tolerable daily intake (TDI) values for copper of 0.050 mg/kg-day and 0.500 mg/kg-day respectively. The lower limit is comparable to that set by the WHO for a young child. The upper limit set by Health Canada is appreciably higher (more than 3-fold) than the tolerable limit set in the US. Health Canada and Environment Canada have also developed TDIs of 0.100 mg/kg-day and 0.030 mg/kg-day for toddlers and adults, respectively as part of the CCME soil quality guideline development process (CCME, 1999).

ATSDR (2002) has developed a minimal risk level (MRL) for acute duration oral exposure to copper. The MRL of 20 µg/kg-day is based on a no observable adverse effects level (NOAEL) of 27.2 µg/kg-day copper administered as copper sulphate in drinking water (Pizzaro *et al*. 1999). The total copper exposure was estimated at 53.8 µg/kg-day by adding estimated daily dietary intake of copper. An uncertainty factor of 3 was used for human variability. A statistically significant difference was seen between the reported NOAEL and a lowest observable adverse effects level (LOAEL) of 73.1 µg/kg-day (total intake of about 100 µg/kg-day) for gastrointestinal effects in women. The Pizzaro *et al*. study was also reviewed by the Food and Nutrition Board (IOM, 2001).

The Food and Nutrition Board (IOM, 2001) of the US National Academy of Sciences Institute of Medicine, in a joint activity with Health Canada, has published a series of tolerable upper limits of copper for various life stages. The tolerable upper limit is the highest level of daily intake of a nutrient (over a lifetime) likely not to result in an adverse health effect to almost all individuals. The UL for copper were based on a NOAEL of 10 mg/day of copper. A double blind study, conducted over 12 weeks, involved administering seven adults 10 mg of copper gluconate capsules daily. The resulting liver function tests were normal in all cases.

The World Health Organization (WHO, 1996) proposed 12 mg copper/day as a safe upper level of intake for a 65 kg adult.

The Food and Nutrition Board (IOM, 2001) also recommended a "safe range" for oral intake of copper between 10 and 130 µg/kg-day for chronic ingestion by a 76 kg adult. Age specific upper limits (UL) are recommended based on extrapolation by body weight:

- Child 1-3 years, UL of 1,000 µg/day
- Child 4-8 years, UL of 3,000 µg/day
- Child 9-13 years, UL of 5,000 µg/day
- Adolescents 14-18 years, UL of 8,000 µg/day
- Adult 19 years and older, UL of 10,000 µg/day

Tolerable upper intake levels are considered to be the highest level of daily intake of a nutrient likely to not pose an adverse health effect to almost all individuals. These were developed through a risk approach, using a NOAEL for copper of 10 mg/day.

The Health Canada and Environment Canada TDIs for toddlers and adults of 1.0×10^{-1} and 3.0×10^{-2}, respectively have been selected for this assessment.

3.3.2 Cancer Oral Toxicity Reference Values

The carcinogenic potential of copper has not been adequately assessed, therefore an oral SF or unit risk is not available.

3.3.3 Non-Cancer Inhalation Toxicity Reference Values

The California Air Resources Board approved a risk assessment health value of 0.0024 mg/m^3 (CARB, 1998, last reviewed 01/1992) for chronic inhalation of copper based on respiratory effects. This value was derived from the ACGIH (1992) threshold limit value (TLV) of 1 mg/m^3 by dividing by a factor 420. This factor is made up of a conversion from a 40 hour work week (4.2), a factor to protect sensitive individuals (10) and a factor to account for the deficiency of using a TLV rather than a NOAEL (10) (CAPCOA, 1993).

Due to insufficient data, a non-cancer TRV for inhalation of copper has not been selected for this assessment.

3.3.4 Cancer Inhalation Toxicity Reference Values

The carcinogenic potential of copper has not been adequately assessed, therefore an inhalation slope factor or unit risk is not available.

3.4 Bioavailability

The following sections describe the oral, inhalation and dermal bioavailabilities of copper.

3.4.1 Oral Bioavailability

Oral bioavailability of copper in humans depends on dietary intake of copper, as this is regulated by homeostasis mechanisms in the body. A range of 25 to 40% bioavailability from the diet was estimated (CCME, 1999). Venugopal and Luckey (1978) report and oral absorption of 30% for dietary intake.

In the gastrointestinal tract, all copper is present as the cupric ion or bound to amino acids and is absorbed as such (ATSDR, 2002). The absorption of ingested dietary copper (bioavailability) in humans is subject to strict homeostatic control and varies widely according to the daily oral intake (IPCS, 1998). It has been reported (IOM, 2001) that the bioavailability of copper is over 50% at daily intakes less than 1 mg/day and less than 20% at daily intakes above 5 mg/day. About 35% of a 2 mg/day intake is absorbed (near the upper range of daily intakes of copper in North America).

The selected toxicity reference value is based on copper gluconate capsules. Insufficient information are available to determine whether the oral bioavailability of copper in this form would be greater than copper from dietary intakes, so no adjustment for this will be made in this assessment.

For this study, the relative oral bioavailability of copper in soil was assumed to be 1.0.

3.4.2 Inhalation Bioavailability

The relative inhalation absorption factor for copper has been conservatively assumed to be 1.0.

3.4.3 Dermal Bioavailability

No information was identified regarding dermal absorption of copper. Health Canada (2003) recommends a relative dermal absorption factor of 0.1 for copper. The Health Canada relative dermal bioavailability has been adopted for this assessment.

3.5 Conclusion

The following tables present the TRV and bioavailability summaries for copper.

Table 3: Selected Toxicity Reference Values for Copper

Route of Exposure	TRV	TRV Type	Source Agency
Non-Cancer Effects			
Ingestion – toddler	1.0×10^{-1} mg/kg-day	RfD	CCME, 1999
Ingestion – adult	3.0×10^{-2} mg/kg-day	RfD	CCME, 1999
Inhalation	NA	NA	NA
Cancer Effects			
Ingestion	NA	NA	NA
Inhalation	NA	NA	NA

NA – Not Applicable

Table 4: Selected Bioavailabilities for Copper

Route of Exposure	Relative Bioavailability	Reference
Ingestion	1.0	Assumed
Inhalation	1.0	Assumed
Dermal	0.1	Health Canada, 2003

3.6 References

ACGIH (American Conference of Governmental and Industrial Hygienists), 1992. Threshold Limit Values. Cincinnatti, OH.

ATSDR (Agency for Toxic Substances and Disease Registry), 2002. Toxicological Profile for Copper. September 2002. Available on-line at: http://www.atsdr.cdc.gov/toxpro2.html

CAPCOA (California Air Pollution Control Officers Association), 1993. *Revised 1992 Risk Assessment Guidelines.* Air Toxics "Hot spots" Program, October.

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CCME (Canadian Council of Ministers of the Environment), 1999. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: Copper. Winnipeg, MN, Canada.

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IPCS (International Programme on Chemical Safety), 1998. Copper. Geneva: International Programme on Chemical Safety. World Health Organization Environmental Health Criteria 200. Available on-line at: http://www.inchem.org/documents/ehc/ehc/ehc200.htm

Pizzaro F, Olivares M and Uauy R, 1999. Acute gastrointestinal effects of graded levels of copper in drinking water. *Environmental Health Perspectives* 107(2): 117-121. Cited in: ATSDR, 2002.

US EPA (United States Environmental Protection Agency) Region III, 1995. Preliminary Remediation Goals Database.

US EPA (United States Environmental Protection Agency), 1991. Integrated Risk Information System (IRIS) Database: Copper. Confirmed current as of December 2004. Available on-line at: http://www.epa.gov/iris/

US FDA (United States Food and Drug Administration), 1999. Center for Food Safety and Applied Nutrition. A Food Labeling Guide. September, 1994 (Editorial revisions June, 1999).

WHO (World Health Organization), 1996. "Copper:" In: *Trace Elements in Human Nutrition and Health.* Geneva, pp. 123-143.

Venugopal B and Luckey TD, 1978. Metal Toxicity in Mammals – 2. Chemical Toxicity of Metals and Metalloids. Plenum Press. pp. 104-112.

4. LEAD

Lead is a naturally occurring element found in the earth's crust. Exposure to lead can lead to effects to the central nervous system. In adults, exposure can result in decreased performance, weakness and anemia. Kidney damage and brain damage may also occur at high exposures. In children exposed to lead, central nervous system effects occur at blood lead levels so low as to indicate that there is no threshold level below which effects do not occur (ATSDR, 1999).

4.1 Assessment of Carcinogenicity

Epidemiological studies of occupationally exposed adults were not able to demonstrate an increase in cancers among an exposed population compared to a control group. The US EPA (2004) lists lead as a Group 2B, probable human carcinogen, based on sufficient animal evidence but did not recommend derivation of a quantitative estimate of oral carcinogenic risk due to a lack of understanding of the toxicological and pharmacokinetic characteristics of lead. Neurobehavioural effects of lead in children were considered to be the most relevant endpoints in determining a toxicity value.

Health Canada (1996) classified lead as Group IIIB – possibly carcinogenic to man (inadequate data in humans, limited evidence in animals) according to the classification scheme of the Environmental Health Directorate of Health and Welfare Canada. Chemicals classified in Group IIIB are treated as non-carcinogens and are evaluated against a tolerable daily intake (TDI), based on a no observed adverse effects level (NOAEL).

The International Agency for Research on Cancer (IARC) (1987) lists lead and inorganic lead compounds as Group 2B, possibly carcinogenic to humans. The IARC states that there is inadequate evidence of carcinogenicity in humans.

4.2 Susceptible Populations

There is a very large database that documents the effects of acute and chronic lead exposure in adults and children. Extensive summaries of the human health effects of lead are available from a number of sources including Health Canada (1996) and the Agency for Toxic Substances and Disease Registry (ATSDR, 1999). These reviews show that infants, young children up to the age of six, and pregnant women (developing fetuses) are the most susceptible.

4.3 Selection of Toxicity Values

4.3.1 Non-Cancer Oral Toxicity Reference Values

The oral reference dose (RfD) for lead used by Health Canada (1996), is the same as the provisional tolerable weekly intake (PTWI) for children of 25 µg/kg, equivalent to approximately 3.57 µg/kg/day from all sources, established by the World Health Organization (WHO) (1986). The PTWI is considered sufficiently low to protect against effects on the central nervous system and blood (*e.g.,* neurobehavioural effects and anemia). This PTWI was based on the results of metabolic studies in infants and was used to establish Canadian drinking water standards for lead (CCME, 1987). WHO (1993) has more recently extended this PTWI to all age groups to protect other sensitive population groups, such as women of child-bearing age. The PTWI of 0.025 mg/kg was maintained at the fifty-third meeting of the Joint FAO/WHO Expert Committee on Food Additives (WHO, 1999).

The MOE (1994) developed an intake of concern (IOC_{pop}) of 1.85 µg/kg-day based on a lowest observed adverse effects level (LOAEL) of 10 µg/dL blood lead level. A transfer factor of 0.21 µg lead per dL blood level per µg/day was applied for a 13kg child aged 6 months to 4 years. An uncertainty factor of 2 was applied. The LOAEL is based on a convergence of data on blood levels of 10 to 15 µg/dL as the level of concern for impairment of neurological behaviour.

An oral RfD of 3.57×10^{-3} mg/kg-day has been adopted in this assessment based on Health Canada's recommended oral RfD.

4.3.2 Cancer Oral Toxicity Reference Values

The lack of suitable positive carcinogenic data precludes the derivation of an oral slope factor or unit risk for lead.

4.3.3 Non-Cancer Inhalation Toxicity Reference Values

Inhalation toxicity values for lead have not been developed by the US EPA or Health Canada and therefore, due to insufficient data, a non-cancer inhalation TRV has not been selected for this assessment.

4.3.4 Cancer Inhalation Toxicity Reference Values

The lack of suitable positive carcinogenic data precludes the derivation of an inhalation slope factor or unit risk for lead.

4.4 Bioavailability

The following section describes the bioavailabilities of lead.

4.4.1 Oral Bioavailability

Adult humans absorb 10-15% of ingested lead; however, children absorb up to 50% of ingested lead (ORNL, 1994). Gastrointestinal absorption may vary depending on dietary factors and the chemical form of the lead. Lead is more readily absorbed in fasting individuals (up to 45% for adults) than when ingested with food. Absorption is also increased in children suffering from iron or calcium deficiencies. Gastrointestinal absorption in children may be only 30% for lead present in dust and dirt and 17% for lead in paint chips, compared with 50% for lead in food and beverages (US EPA, 2004).

Oral bioavailability for lead assuming normal feeding habits are 42 to 53% in children (Hrudey *et al.*, 1996) and 4 to 13% in adults (CCME, 1996; Hrudey *et al.*, 1996). Other studies for estimating lead oral bioavailability assuming normal feeding habits are 40 to 50% in children (Alexander *et al*., 1974; Ziegler *et al*., 1978) and 4 to 13% in adults (Harrison *et al*., 1969; Rabinowitz *et al*., 1980; Blake *et al*., 1983; Chamberlain, 1985). The oral bioavailability is assumed to be 53% since the RfD is based on oral exposure that is protective of children. The absorption of lead in soil and dust by children has been estimated at 30% (CCME, 1996). For the purpose of this assessment, the relative oral bioavailability from soil exposure was assumed to be 100%.

4.4.2 Inhalation Bioavailability

The relative inhalation absorption factor for lead has been conservatively assumed to be 1.0.

4.4.3 Dermal Bioavailability

The dermal bioavailability factor of 0.01 is recommended by US EPA Region III (1995). Health Canada (2003) recommends a relative dermal absorption factor of 0.006 for lead. Therefore, a relative dermal bioavailability of 0.006 was adopted for this assessment.

4.5 Conclusion

The following tables present the TRV and bioavailability summaries for lead.

Table 5: Selected Toxicity Reference Values for Lead

Route of Exposure	TRV	TRV Type	Source Agency
Non-Cancer Effects			
Ingestion	3.57×10^{-3} mg/kg-day	RfD	Health Canada, 1996
Inhalation	NA	NA	NA
Cancer Effects			
Ingestion	NA	NA	NA
Inhalation	NA	NA	NA

NA – Not Applicable

Table 6: Selected Bioavailabilities for Lead

Route of Exposure	Relative Bioavailability	Reference
Ingestion	1.0	Assumed
Inhalation	1.0	Assumed
Dermal	0.006	Health Canada, 2003

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5. PETROLEUM HYDROCARBONS CWS FRACTION F3

Petroleum hydrocarbons are mixtures of organic compounds that are derived from naturally occurring geological formations such as coal or oil. Common mixtures include gasoline, diesel and jet fuels. The lighter range petroleum hydrocarbons (C_6-C_{16}) tend to float on water, forming sheens or slicks, and tend to be relatively volatile, mobile and toxic (TPHCWG, 1997). These compounds may evaporate from the water surface, dissolve and disperse, and are readily degraded by natural weathering or microbial processes. Heavier oils have lower volatility and tend to be denser, and may clump or sink, becoming incorporated into sediments. Heavier PHCs ($C_{>16}$-$C_{>34}$) pose problems with their persistence in the environment and are less volatile (TPHCWG, 1997).

Fractionation of petroleum hydrocarbon mixtures is based upon the number of carbon atoms (lighter and heavier molecular weight chains), volatility, as well as aromatic or aliphatic structural comparisons. In general, petroleum hydrocarbons pose aesthetic problems such as unpleasant taste and odour. Some health effects that are associated with PHC exposure include neuropathy and degeneration of neural axons.

The quantification of petroleum hydrocarbon mixtures has historically been accomplished by a variety of methods where the petroleum mixture is extracted using solvents such as hexane or cyclohexane. Fractionation of the total petroleum hydrocarbon (TPH) compounds according to their volatility, number of carbon atoms, and whether they are aromatic or aliphatic compounds, is common. These aliphatic and aromatic sub-fractions play an important role in toxicity to humans and ecological receptors. In general, aromatics are more water soluble and less volatile than aliphatics. Out of these fractions, the aromatic C_5-C_8 fraction contains the indicator compounds benzene, toluene, ethylbenzene and xylenes, collectively referred to as BTEX. Total petroleum hydrocarbons (excluding the BTEX compounds) are generally evaluated as a group due to similar toxicity end points. The BTEX compounds are generally evaluated individually (CCME, 2000).

The toxicity of petroleum hydrocarbon compounds varies widely as a consequence of the variability in the chemical composition of mixtures. The light compounds (particularly aromatics) tend to be most toxic because these compounds are most likely to penetrate and disrupt cell membranes (TPHCWG, 1997). Thus, gasoline and light fuel oils are considerably more toxic than heavy oils, Bunker C, or crude oils. The potency estimates for chemicals of concern are based on the values reported by Health Canada, the U.S. Environmental Protection Agency (US EPA) or the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG).

The TPH model characterizes the toxicity of TPH by dividing these grouped chemicals into separate fractions based upon molecular structure and carbon size, as per TPHCWG (1997) and CCME (2000) methodology. These fractions are treated as threshold toxicants. The toxicity values employed for each of the fractions were chosen from representative indicator compounds in the specific fraction, upon which toxicity data and studies were available. The toxicity data were chosen to representative of that fraction, whether by arbitrary reference dose (RfD) selection, or by RfD weighting, etc. The specific toxicity data employed in the assessment are detailed in the sections that follow.

5.1 Assessment of Carcinogenicity

TPHCWG (1997) and CCME (2000) do not consider this fraction carcinogenic.

5.2 Susceptible Populations

There is no information readily available on susceptible populations.

5.3 Selection of Toxicity Reference Values

Calculations for individual petroleum hydrocarbon sub-fractions are combined to form the Canada Wide Standard (CWS) PHC Fraction F3 on a weight percent basis. The composition of CWS Fraction F3 is presented below.

Table 7: Composition of Petroleum Hydrocarbon CWS Fraction F3

TPH Sub-fraction	Percentage (%)	Reference
Aliphatics		
$C_{>16}$-C_{21}	56	CCME, 2000
$C_{>21}$-C_{34}	24	CCME, 2000
Aromatics		
$C_{>16}$-C_{21}	14	CCME, 2000
$C_{>21}$-C_{34}	6	CCME, 2000

5.3.1 Non-Cancer Oral Toxicity Reference Value

5.3.1.1 Aromatic Fractions >C_{16}-C_{21}, >C_{21}-C_{35}

The TPHCWG (1997) found that there were no previously developed RfDs for aromatic chemicals in the C_{16}-C_{35} range. It was also found that there were insufficient data available to develop a RfD. After reviewing the existing information the TPHCWG adopted the oral RfD for

pyrene (C_{16}) (0.03 mg/kg-d) as a surrogate for this fraction. This was considered to be conservative because it has a lower carbon number than any of the compounds in this fraction.

5.3.1.2 Aliphatic Fraction >C_{16}-C_{21}, >C_{21}-C_{35}

White mineral oils were employed to derive the RfD values for these fractions. Subchronic oral studies utilizing F/344 rats were employed in the toxicity evaluation. A no observable adverse effects limit (NOAEL) of 200 mg/kg-day was observed. A safety factor of 100 was applied to the NOAEL (3 for animal to human extrapolation, 10 for individual susceptibility, and 3 for subchronic to chronic extrapolation) to calculate the RfD of 2.0 mg/kg-day.

5.3.2 Cancer Oral Toxicity Reference Value

The lack of suitable positive carcinogenic data precludes the derivation of SFs for oral exposures.

5.3.3 Non-Cancer Inhalation Toxicity Reference Value

TPHCWG (1997) and CCME (2000) have not established an inhalation reference toxicity value for these fractions.

5.3.4 Cancer Inhalation Toxicity Reference Value

The lack of suitable positive carcinogenic data precludes the derivation of SFs for inhalation exposures.

5.4 Bioavailability

The following section describes the bioavailabilities of Petroleum Hydrocarbon CWS Fraction F3.

5.4.1 Oral Bioavailability

The Canada Wide Standards for Petroleum Hydrocarbons in Soil: Scientific Rationale (CCME, 2000) employs an Oral Absorption Factor of 1.0.

5.4.2 Inhalation Bioavailability

The Canada Wide Standards for Petroleum Hydrocarbons in Soil: Scientific Rationale (CCME, 2000) employs an Inhalation Absorption Factor of 1.0.

5.4.3 Dermal Bioavailability

The Canada Wide Standards for Petroleum Hydrocarbons in Soil: Scientific Rationale (CCME, 2000) employs a Dermal Absorption Factor of 0.2.

5.5 Conclusion

The following tables present the TRV and bioavailability summaries for Petroleum Hydrocarbon CWS Fraction F3.

Table 8: Selected Toxicity Reference Values for Petroleum Hydrocarbons CWS Fraction F3

TPH Sub-fraction	Route of Exposure	Toxicity Reference Value	TRV Type	Source Agency
Non-Cancer Effects				
Aliphatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Ingestion	2.0 mg/kg-day	RfD	CCME, 2000
Aromatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Ingestion	0.3 mg/kg-day	RfD	CCME, 2000
Aliphatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Inhalation	NA	RfD	NA
Aromatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Inhalation	NA	RfD	NA
Cancer Effects				
Aliphatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Ingestion	NA	NA	NA
Aromatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Ingestion	NA	NA	NA
Aliphatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Inhalation	NA	NA	NA
Aromatic, $C_{>16}$-C_{21}, $C_{>21}$-C_{34}	Inhalation	NA	NA	NA

NA – Not Applicable

Table 9: Selected Bioavailabilities for Petroleum Hydrocarbons CWS Fraction F3

Route of Exposure	Relative Bioavailability	Reference
Oral	1.0	CCME, 2000
Dermal	0.2	CCME, 2000
Inhalation	1.0	CCME, 2000

5.6 References

CCME, 2000. Canada Wide Standards for Petroleum Hydrocarbons in Soil: Scientific Rationale. Canadian Council for Ministers of the Environment.

TPHCWG. 1997. Total Petroleum Hydrocarbon Criteria Working Group. Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH), Volume 4. Amherst Scientific

6. POLYCHLORINATED BIPHENYLS (PCBS)

Polychlorinated biphenyls (PCBs) were previously manufactured for use as dielectric and heat-exchange fluids, as well as other various applications (IPCS, 1993). PCBs have been manufactured as mixtures under various trade names such as Aroclor, Pyranol, Pyroclor, Phenoclor, Pyralene, Clophen, Elaol, Kanechlor, Santotherm, Fenchlor, Apirolio and Sovol (WHO, 2003).

Although no longer manufactured since 1977, PCBs are ubiquitous and persistent in the environment with food being the primary route of exposure for the general population (IPCS, 1993; ATSDR, 2000). Studies have demonstrated the carcinogenic potential of PCBs and furthermore, the potential for PCBs to promoted the carcinogenicity of other chemicals (IPCS, 1993). Commercial PCBs may contain polychlorinated dibenzofurans (PCDFs) as impurities but do not contain polychlorinated dibenzo-p-dioxins (PCDDs) (IPCS, 1993).

There are 209 PCB potential congeners, however, only 130 congeners have been identified in commercial products (IPCS, 1993; WHO, 2000). Congeners with the same number of chlorines are referred to as isomers. The number and position of chlorine atoms predicts environmental fate and toxicity. In general, PCBs with a higher degree of chlorination are more lipophilic, less volatile, less readily absorbed and less water-soluble (WHO, 2000).

6.1 Assessment of Carcinogenicity

Human studies provide inconclusive, yet suggestive evidence of an association between exposure to PCBs and liver cancer; however, the studies are inconclusive due to confounding exposures and lack of exposure quantification (US EPA, 1997; ATSDR, 2000). Oral exposure studies in animals show an increase in liver tumors in rats and mice as well as thyroid tumours in male rats (US EPA, 1997; ATSDR, 2000). No animal inhalation studies are available on the health effects of PCBs; however, PCBs are absorbed through inhalation indicating that there may be a concern for this exposure route (ATSDR, 2000).

The US EPA (1997) has classified PCBs as group B2, probable human carcinogen. The International Agency for Research on Cancer (IARC, 1987) has classified PCBs as Group 2A, probably carcinogenic to humans.

6.2 Susceptible Populations

Two susceptible populations were identified by the Agency for Toxic Substances and Disease Registry (ATSDR) (2000). The first was children and the second, populations with incompletely developed conjugation mechanisms such as those with Gilbert's syndrome, a congenital liver disorder which occurs in approximately 3 to 7% of the adult population. These individuals are considered susceptible because of their diminished capacity to detoxify and excrete PCBs. Others with decreased hepatic activity like individuals with hepatitis B or liver cirrhosis may also be susceptible to PCB toxicity (ATSDR, 2000).

Children are considered susceptible to PCB toxicity because of the strong evidence that PCBs may be transferred across the placenta in pregnant women. This in combination with transfer in breast milk, and the more common routes of exposure such as consumption of contaminated foods, may potentially contribute to altered development, specifically neurobehaviroual alterations (ATSDR, 2000).

6.3 Selection of Toxicity Values

Since PCBs usually occur as mixtures with varying degrees of chlorination, toxicity data must be based on the mixtures to predict potential health effects. Information on PCB exposure, however, is primarily from occupational studies and accidental exposures that may be contaminated with other chemicals.

The most documented case of human exposure to PCDFs are the Yusho (Japan, 1968) and Yucheng (Taiwan, 1979) incidents where people were accidentally exposed to PCDF and PCB contaminated food supply (IARC, 1978; IARC, 1987). From these incidences contradicting results were observed, an increase in liver cancer in Japanese men was observed while no excess of liver mortality in the affected Taiwanese population was observed (IARC, 1978; IARC, 1987).

6.3.1 Non-Cancer Oral Toxicity Reference Values

The US EPA provides toxicity reference values for PCB mixtures such as Aroclor 1254 and 1016. The US EPA (1996a) established an oral reference dose (RfD) for Aroclor 1254 of 2×10^{-5} mg/kg-day based on immunological effects in monkeys. The RfD was calculated from a lowest observable adverse effect limit (LOAEL) of 0.005 mg/kg/day. The US EPA (1996b) has also developed a RfD for Aroclor 1016 of 7×10^{-5} mg/kg-day based on a no observable adverse effect level (NOAEL) of 0.007 mg/kg-day and LOAEL of 0.028 mg/kg-day. Aroclor 1016 is a commercial PCB mixture that is devoid of chlorinated dibenzofurans (US EPA, 1996b). The RfDs and effects are summarized below.

Table 10: PCB Congener Oral RfDs

Congener	TRV	TRV Type	Agency	Effects
Aroclor 1254	2×10^{-5} mg/kg-day	RfD	IRIS, US EPA	Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased IgG and IgM response to sheep erythrocytes.
Aroclor 1016	7×10^{-5} mg/kg-day	RfD	IRIS, US EPA	Reduced birth weights

The ATSDR (2000) provides oral minimal risk levels (MRLs) for intermediate and chronic exposure to PCBs. These MRLs, presented in Table 25 were derived to reflect exposure to PCB mixtures and are based on studies that involved Aroclor 1254.

Table 11: ATSDR (2000) MRLs for Oral Exposure to PCBs

Exposure	TRV	Basis	Effects
Intermediate (15-364 days)	0.03 µg/kg-day	LOAEL (0.0075 mg/kg-day)	Neurobehavioral alterations in infant monkeys that were exposed to a PCB congener mixture representing 80% of the congeners typically found in human breast milk
Chronic (365 days or more)	0.02 µg/kg-day	LOAEL (0.005 mg/kg-day)	Immunological effects in adult monkeys that were evaluated after 23 and 55 months of exposure to Aroclor 1254

The chronic MRL corresponds with the US EPA RfD for Aroclor 1254. However, Health Canada (2003) provides a TDI of 0.001 mg/kg-d, which was used in this assessment.

6.3.2 Cancer Oral Toxicity Reference Values

The US EPA (1997) established oral slope factors for PCB mixtures using a tiered approach that depends on the information available. Slope factors for high risk and persistence are considered appropriate for food chain exposure, sediment and soil ingestion, inhalation of dust or aerosol, dermal exposure (if an absorption factor has been applied) and all early life exposure. Slope factors for low risk and persistence are considered appropriate for inhalation of evaporated congeners. Central and upper bound-bound estimates are provided; central estimates describe a typical individual's risk, while upper bounds provide assurance that this risk is not likely to be underestimated. Based on the above, the upper-bound slope factor of 2.0 $(mg/kg/day)^{-1}$ for high risk and persistence was used to assess the potential for carcinogenic effects via oral exposure pathways.

6.3.3 Non-Cancer Inhalation Toxicity Reference Values

Chronic inhalation exposure of workers to PCBs has been reported to result in respiratory tract symptoms (ATSDR, 2000). Despite these observed effects, non-cancer inhalation TRVs were not found.

6.3.4 Cancer Inhalation Toxicity Reference Values

The US EPA (1997) established inhalation slope factors for PCB mixtures using a tiered approach that depends on the information available. Slope factors for high risk and persistence are considered appropriate for food chain exposure, sediment and soil ingestion, inhalation of dust or aerosol, dermal exposure (if an absorption factor has been applied) and all early life exposure. Slope factors for low risk and persistence are considered appropriate for inhalation of evaporated congeners. Central and upper bound-bound estimates are provided; central estimates describe a typical individual's risk, while upper bounds provide assurance that this risk is not likely to be underestimated. Based on the above, the upper-bound slope factor of 0.4 $(mg/kg/day)^{-1}$ was used to assess the potential for carcinogenic effects via inhalation exposure.

6.4 Bioavailability

PCBs are well absorbed after oral, inhalation, or dermal exposure and transported similarly through circulation (US EPA, 1997; ATSDR, 2000). Initially absorbed PCBs are transported to the liver and muscle, subsequently PCBs are stored in fat and skin (US EPA, 1996c).

6.4.1 Oral Bioavailability

Animal studies have shown that PCBs are readily absorbed by the gastrointestinal tract with the degree of absorption ranging from 66 to 96% (ATSDR, 2000; WHO, 2000).

Specific information concerning absorption of Aroclor 1254 is limited. Pregnant ferrets administered a single oral dose of 0.06 mg/kg Aroclor 1254 absorbed 85% of the administered dose (Bleavins *et al*., 1984). Rats, mice, and monkeys absorb between 75 to >90% of orally administered doses of PCBs (US EPA, 1996a). Oral exposure through consumption of contaminated food (including breast milk) is the major route of exposure to PCBs for the general population.

The oral relative bioavailability for PCBs used in this assessment was 1.0.

6.4.2 Inhalation Bioavailability

Inhalation is considered to be a major occupational route of exposure (ATSDR, 2000). However, quantitative data concerning inhalation exposure to PCBs is scarce (ATSDR, 2000). Following the inhalation of PCBs, absorption and distribution similar to orally administered PCBs is witnessed in rats (WHO, 2000), this evidence is supported by the US EPA (1997). Furthermore, a study reported by the International Programme on Chemical Safety (IPCS) (1993) administered a PCB mixture in an aerosol to rats that was readily absorbed, resulting in 50% of the maximum applied concentration in the liver, 2 hours following administration.

The ATSDR summarized a study by Wolff (1985) where a maximum of 80% of the PCB levels in adipose tissue of exposed capacitor workers may have been absorbed by the inhalation route. A maximum of 20% would have been derived from dermal or oral exposure (ATSDR, 2000).
The relative inhalation bioavailability factor used in this assessment was 1.0.

6.4.3 Dermal Bioavailability

Dermal absorption has been observed in animal species ranging from 20 to 60% (WHO, 2000). Given the previously mentioned study by Wolff (1985), where a maximum of 20% of PCB levels in adipose tissue may have been attributed to oral and dermal exposure. The US EPA Region III (1995) recommends a dermal bioavailability factor of 0.06 based on the dermal absorption of 3,3',4,4'-tetrachlorobiphenyl.

The US EPA (2001) recommends an absorption factor of 0.14 based on *in vitro* human and monkey testing. Based on findings in animal studies reported by the World Health Organization (WHO), a conservative 0.60 relative dermal bioavailability factor has been adopted.

6.5 Conclusion

The following tables summarize the selected TRVs and relative bioavailabilities of PCBs.

Table 12: Selected Toxicity Reference Values for PCBs

Route of Exposure	TRV	TRV Type	Source Agency
Non-Cancer Effects			
Ingestion	0.01 mg/kg-day	TDI	Health Canada, 2003
Inhalation	NA	NA	NA
Cancer Effects			
Ingestion	2.0 $(mg/kg/day)^{-1}$	Slope Factor	US EPA, 1997
Inhalation	0.4 $(mg/kg/day)^{-1}$	Slope Factor	US EPA, 1997

Notes:
NA: Not Applicable

Table 13: Selected Bioavailabilities for PCBs

Route of Exposure	Relative Bioavailability	Reference
Ingestion	1.0	Assumed
Inhalation	1.0	Assumed
Dermal	0.60	WHO (2000)

6.6 References

ATSDR (Agency for Toxic Substances and Disease Registry), 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). November, 2000.

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US EPA (United States Environmental Protection Agency), 1996b. Integrated Risk Information System (IRIS) Database – Aroclor 1016. Confirmed current as of December 2004. Available on-line at: http://www.epa.gov/iris.

US EPA (United States Environmental Protection Agency), 1996c. PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. September 1996. Available at: http://www.epa.gov/opptintr/pcb/pcb.pdf.

US EPA (United States Environmental Protection Agency), 1997. Integrated Risk Information System (IRIS) Database - Polychlorinated Biphenyls (PCBs). Confirmed current as of December 2004. Available on-line at: http://www.epa.gov/iris.

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APPENDIX C

HHRA MODELEQUATIONS, INPUTS AND OUTPUTS

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1.0 HUMAN HEALTH INTAKE EQUATIONS

1.1 Oral/Dermal Exposure

1.1.1 Soil Ingestion

$$\text{Intake}_{SING} = \frac{C_{soil} \times IR_{soil} \times RAF_{ing} \times ET_{ing} \times EF_{ing} \times ED \times CF_1}{BW \times AT}$$

Where:			**Units**
Intake_{SING}	=	daily intake from ingestion of soil/dust	mg/kg-day
C_{soil}	=	concentration of chemical in soil	mg/kg
IR_{soil}	=	ingestion rate of soil	mg/hour
RAF_{ing}	=	relative absorption factor - ingestion	unitless
ET_{ing}	=	exposure time - ingestion	hours/day
EF_{ing}	=	exposure frequency - ingestion	days/year
ED	=	exposure duration	years
CF_1	=	conversion factor	1E-06 kg/mg
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.1.2 Soil Dermal

$$\text{Intake}_{\text{SDERM}} = \frac{C_{soil} \times \left(\left(SA_{body} \times SAF_{body}\right) + \left(SA_{hand} \times SAF_{hand}\right)\right) \times RAF_{derm} \times ET_{derm} \times EF_{derm} \times ED \times CF_1 \times CF_2}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{SDERM}}$	=	daily intake from dermal contact with soil	mg/kg-day
C_{soil}	=	concentration of chemical in soil	mg/kg
SA_{body}	=	exposed surface area - body	cm^2
SAF_{body}	=	soil adherence factor - body	mg/cm^2-day
SA_{hand}	=	exposed surface area - hand	cm^2
SAF_{hand}	=	soil adherence factor - hand	mg/cm^2-day
RAF_{derm}	=	relative absorption factor - dermal	unitless
ET_{derm}	=	exposure time	hours/day
EF_{derm}	=	exposure frequency	days/year
ED	=	exposure duration	years
CF_1	=	conversion factor	1E-06 kg/mg
CF_2	=	conversion factor	0.042 days/hour
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.1.3 Soil/Dust Inhalation

$$\text{Intake}_{\text{SDINHAL}} = \frac{C_{soil} \times P_{air} \times IR_{air} \times RAF_{inh} \times ET_{inh} \times EF_{inh} \times ED \times CF_2}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{SDINHAL}}$	=	daily intake from inhalation of soil/dust	mg/kg-day
C_{soil}	=	concentration of chemical in soil	mg/kg
P_{air}	=	particulate concentration in air	kg/m^3
RAF_{inh}	=	relative absorption factor - inhalation	unitless
IR_{air}	=	inhalation rate of air	m^3/hour
ET_{inh}	=	exposure time - inhalation	hours/day
EF_{inh}	=	exposure frequency - inhalation	days/year
ED	=	exposure duration	years
CF_2	=	conversion factor	0.042 days/hour
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2 Food Ingestion

1.2.1 Caribou Ingestion

$$\text{Intake}_{\text{caribou}} = \frac{C_{\text{caribou}} \times IR_{\text{game}} \times F_{\text{caribou}} \times F_{\text{site}} \times RAF_{\text{ing}} \times EF_{\text{game}} \times ED}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{caribou}}$	=	daily intake from the ingestion of caribou	mg/kg-day
C_{caribou}	=	concentration in caribou	mg/kg
IR_{game}	=	ingestion rate of wild game	kg/day
F_{site}	=	fraction of wild game consumed from site	unitless
F_{caribou}	=	fraction of wild game that is caribou	unitless
RAF_{ing}	=	relative absorption factor - oral	unitless
EF_{game}	=	exposure frequency – wild game ingestion	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2.2 Arctic Hare Ingestion

$$\text{Intake}_{\text{hare}} = \frac{C_{\text{hare}} \times IR_{\text{game}} \times F_{\text{hare}} \times F_{\text{site}} \times RAF_{\text{ing}} \times EF_{\text{game}} \times ED}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{hare}}$	=	daily intake from the ingestion of arctic hare	mg/kg-day
C_{hare}	=	concentration in arctic hare	mg/kg
IR_{game}	=	ingestion rate of wild game	kg/day
F_{game}	=	fraction of wild game consumed from site	unitless
F_{hare}	=	fraction of wild game that is arctic hare	unitless
RAF_{ing}	=	relative absorption factor - oral	unitless
EF_{game}	=	exposure frequency – wild game ingestion	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2.3 Fish Ingestion

$$\text{Intake}_{\text{fish}} = \frac{C_{\text{fish}} \times IR_{\text{fish}} \times F_{\text{fish}} \times F_{cf} \times RAF_{\text{ing}} \times EF_{\text{fish}} \times ED}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{fish}}$	=	daily intake from the ingestion of fish	mg/kg-day
C_{fish}	=	concentration in fish	mg/kg
IR_{fish}	=	ingestion rate of fish	kg/day
F_{fish}	=	fraction of fish caught from site	unitless
F_{cf}	=	fraction fish that are contaminated	unitless
RAF_{ing}	=	relative absorption factor - oral	unitless
EF_{fish}	=	exposure frequency – fish ingestion	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.2.4 Water Ingestion

$$\text{Intake}_{\text{WATER}} = \frac{C_{\text{water}} \times IR_{\text{water}} \times F_{\text{water}} \times RAF_{\text{ing}} \times EF_{\text{water}} \times ED}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{WATER}}$	=	daily intake from the ingestion of water	mg/kg-day
C_{water}	=	concentration in water	mg/L
IR_{water}	=	ingestion rate of water	L/day
F_{water}	=	fraction of water consumed from site	unitless
RAF_{ing}	=	relative absorption factor - oral	unitless
EF_{water}	=	exposure frequency – drinking water	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

1.3 Water Exposure

1.3.1 Dermal Exposure

$$\text{Intake}_{\text{dermwater}} = \frac{DA_{\text{event}} \times SA_{\text{water}} \times ET_{\text{dwater}} \times EF_{\text{dwater}} \times ED}{BW \times AT}$$

Where:			**Units**
$\text{Intake}_{\text{dermwater}}$	=	daily intake from the dermal contact with surface water	mg/kg-day
DA_{event}	=	absorbed dose per event	mg/cm2-event
SA_{water}	=	exposed surface area – dermal water	cm^2
ET_{dwater}	=	exposure time – dermal water	hours/day
EF_{dwater}	=	exposure frequency – dermal water	days/year
ED	=	exposure duration	years
BW	=	body weight of receptor	kg
AT_c	=	averaging time carcinogen = (365 days/year) x (75 years)	27375 days
AT_{nc}	=	averaging time non-carcinogen = (365 days/year) x (exposure duration)	days

$$DA_{\text{event}} = K_p \times C_{\text{water}} \times t_{\text{event}}$$

Where:			**Units**
DA_{event}	=	absorbed dose per event	mg/cm^2-event
K_p	=	dermal permeability coefficient of compound in water	cm/hr
C_{water}	=	concentration of chemical in water	mg/cm^3
t_{event}	=	event duration	hour/event

1.4 Risk Characterization

After the various intakes are derived, the final step is the calculation of the incremental excess lifetime cancer risks (IELCR) and non-carcinogenic hazard quotient (HQ) values for each of the pathways and receptors identified. IELCRs and HQs are then summed for individual receptors, across all applicable exposure pathways to obtain an estimate of the total individual IELCRs and HQs for specific receptors.

1.4.1 Carcinogenic Chemicals

For carcinogenic chemicals, risk estimates represent the incremental probability that an individual will develop cancer over a lifetime as a result of a specific exposure to that chemical (US EPA OW, 1998). Since carcinogenic risk estimates are over a lifetime of exposure, a composite receptor comprising five separate lifestages (infant, toddler, child, teen, adult) was used to evaluate carcinogenic intakes.

An intake value was derived for each exposure and each pathway. These values were then summed to get a pathway specific cancer intake.

$$IELCR_x = Intake_x \times CSF_x$$

Where:		**Units**
$IELCR_x$ =	incremental lifetime cancer risk for pathway x	unitless
$Intake_x$ =	chemical specific intake for pathway x	mg/kg-day
CSF_x =	chemical specific cancer slope factor for pathway x	$(mg/kg\text{-}day)^{-1}$

$$IELCR_{O/D} = Intake_{O/D} \times CSF_{O/D}$$

Where:		**Units**
$IELCR_{O/D}$ =	incremental lifetime cancer risk for oral/dermal exposure	unitless
$Intake_{O/D}$ =	chemical specific intake for oral/dermal pathway	mg/kg-day
$CSF_{O/D}$ =	chemical specific oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$

$$IELCR_{FOOD} = Intake_{FOOD} \times CSF_{O/D}$$

Where:		**Units**
$IELCR_{FOOD}$ =	incremental lifetime cancer risk for food ingestion exposure	unitless
$Intake_{FOOD}$ =	chemical specific intake for food intake pathway	mg/kg-day
$CSF_{O/D}$ =	chemical specific oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$

1.4.2 Non-carcinogenic Chemicals

The potential for non-carcinogenic health effects resulting from exposure to a chemical is generally assessed by comparing an exposure estimate to a reference dose (RfD). A RfD is a daily oral intake rate that is estimated to pose no appreciable risk of adverse health effects, even to sensitive populations (US EPA OW, 1998).

$$HQ_x = \frac{Intake_x}{RfD_x}$$

Where:		**Units**
HQ_x =	hazard quotient for pathway x	unitless
$Intake_x$ =	chemical specific intake for pathway x	mg/kg-day
RfD_x =	chemical specific reference dose for pathway x	mg/kg-day

The total non-carcinogenic hazard attributable to exposure to all chemicals through a single exposure pathway is known as a hazard index (HI) (US EPA OW, 1998). The HI is calculated as follows:

$$HI = \sum_i HQ_x$$

Where:			**Units**
HI	=	hazard index for a specific exposure pathway	unitless
HQ_x	=	hazard quotient for chemical x	unitless

A receptor's total hazard is considered to be the sum of all the HI values for each of the specific exposure pathways.

Table 1 Parameter Definitions and Receptor Exposure Assumptions

Parameter Definitions		Exposure Assumptions	
		Lower Site	**Upper Site**
TDI =	reference dose (mg/kg bw-day)	chemical specific	chemical specific
EDI =	estimated daily intake (multimedia exposure assessment) (mg/kg bw-day)	chemical specific	chemical specific
SAF =	soil allocation factor (unitless)	chemical specific	chemical specific
BW =	body weight (kg)	16.5	16.5
BSC =	background soil concentration (mg/kg)	chemical specific	chemical specific
RAF_{ing} =	relative absorption factor for gut (unitless)	chemical specific	chemical specific
RAF_{derm} =	relative absorption factor skin (unitless)	chemical specific	chemical specific
C_{soil} =	concentration of chemical in soil (mg/kg)	site specific	site specific
$C_{caribou}$ =	concentration of chemical in caribou (mg/kg)	site specific	site specific
C_{hare} =	concentration of chemical in hare (mg/kg)	site specific	site specific
C_{fish} =	concentration of chemical in fish (mg/kg)	site specific	site specific
C_{water} =	concentration of chemical in water (mg/L)	site specific	site specific
DA_{event}=	absorbed dose per event (mg/cm^2-event)	chemical specific	chemical specific
IR_{soil} =	soil ingestion rate (mg/hr)	3.33	3.33
IR_{air} =	air inhalation rate (m^3/hr)	0.39	0.3875
IR_{game} =	wild game ingestion rate (mg/day)	85000.00	85000
IR_{fish} =	fish ingestion rate (mg/day)	95000.00	95000
IR_{water} =	water ingestion rate (L/day)	0.60	0.6
P_{air}=	particulate concentration in air (kg/m^3)	7.60E-10	7.6E-10
SA_{body}=	exposed receptor surface area - body (cm^2)	2580	2580
SA_{hand}=	exposed receptor surface area - hand (cm^2)	430	430
SA_{water}=	exposed receptor surface area - dermal water (cm^2)	430	430
SAF_{body}=	soil adherance factor - body (mg/cm^2-day)	0.01	0.01
SAF_{hand}=	soil adherance factor - hand (mg/cm^2-day)	0.10	0.1
$ETerm_{ing}$ =	exposure term for soil ingestion pathway (unitless - event driven)	0.247	0.0384
$ETerm_{derm}$ =	exposure term for soil dermal contact pathway (unitless - event driven)	0.247	0.0384
$ETerm_{inh}$ =	exposure term for soil dust inhalation pathway (unitless - event driven)	0.247	0.0384
ET_{ing} =	exposure time for soil ingestion pathway (hour/day)	24	24
ET_{derm} =	exposure time for soil dermal contact pathway (hour/day)	24	24
ET_{inh} =	exposure time for soil dust inhalation pathway (hour/day)	24	24
ET_{dwater} =	exposure frequency for surface water dermal contact pathway (event/day)	3	3
EF_{ing}=	exposure frequency for soil ingestion pathway (days/year)	90	14
EF_{derm}=	exposure frequency for soil dermal contact pathway (days/year)	90	14
EF_{inh}=	exposure frequency for soil dust inhalation pathway (days/year)	90	14
EF_{game}=	exposure frequency for wild game ingestion pathway (days/year)	90	14
EF_{fish}=	exposure frequency for fish ingestion pathway (days/year)	90	14
EF_{water}=	exposure frequency for water ingestion pathway (days/year)	90	14
EF_{dwater}=	exposure frequency for water dermal contact pathway (days/year)	90	14
ED=	exposure duration (years)	4.5	4.5
F_{site}=	fraction of wild game caught from the site (unitless)	1.00	1
$F_{caribou}$=	fraction of wild game that is caribou (unitless)	0.90	0.9
F_{hare}=	fraction of wild game that is hare (unitless)	0.10	0.1
F_{fish}=	fraction of fish caught from site (unitless)	1.00	1
F_{cf}=	fraction of fish contaminated (unitless)	1.00	1
F_{water}=	fraction of drinking water from site (unitless)	1.00	1
CF_1=	conversion factor (kg/mg)	1.00E-06	0.000001
CF_2=	conversion factor (days/hour)	4.20E-02	0.042
AT=	averaging time (non-cancer/cancer days)	1642.5/27375	1642.5/27375

Table 2 Summary Toxicological Reference Values and Relative Absorption Factors

Compound	Non-carcinogenic		Carcinogenic		SAF	RAF_{ing}	RAF_{inh}	RAF_{derm}
	TDI (oral) mg/kg-d	TDI (inhal.) mg/kg-d	SFo (oral) $(mg/kg\text{-}d)^{-1}$	SFi (oral) $(mg/kg\text{-}d)^{-1}$				
Inorganics								
Beryllium	0.002	4.75E-6	--	10.1	0.2	1	1	0.03
Copper	1.0E-2	--	--	--	0.2	1	1	0.1
Lead	0.00357	--	--	--	0.2	1	1	0.006
TPH - CCME CWS								
Aliph>C06-C08 - F1	5	--	--	--	0.2	1	1	0.2
Aliph>C08-C10 -F1	0.1	--	--	--	0.2	1	1	0.2
Arom>C08-C10 -F1	0.04	--	--	--	0.2	1	1	0.2
F1 - Total								
Aliph>C10-C12 -F2	0.1	--	--	--	0.2	1	1	0.2
Aliph>C12-C16 -F2	0.1	--	--	--	0.2	1	1	0.2
Arom>C10-C12 -F2	0.04	--	--	--	0.2	1	1	0.2
Arom>C12-C16 -F2	0.04	--	--	--	0.2	1	1	0.2
F2 - Total								
Aliph>C16-C21-F3	2	--	--	--	0.2	1	1	0.2
Aliph>C21-C34 -F3	2	--	--	--	0.2	1	1	0.2
Arom>C16-C21 -F3	0.03	--	--	--	0.2	1	1	0.2
Arom>C21-C34 -F3	0.03	--	--	--	0.2	1	1	0.2
F3 - Total		--	--	--				
Aliph>C34-C50 -F4	20	--	--	--	0.2	1	1	0.2
Arom>C34-C50 -F4	0.03	--	--	--	0.2	1	1	0.2
F4 - Total								
Organics								
Total PCBs	0.001	0.001	--	--	na[a]	1	na[a]	na[a]

a- PCBs were only assessed for risk from ingestion of fish

-- not available: where separate inhalation TRVs are not available, the inhalation dose is summed with the dermal/ingestion dose and then compared to the oral TRV.

Table 3 Lower Site CoPC Concentrations Used in HHRA

Compound	C_{soil} (mg/kg)	$C_{caribou}$ (mg/kg)	C_{hare} (mg/kg)	C_{fish} (mg/kg)	C_{water} (mgL)
Inorganics					
Beryllium	5.80E-01	9.40E-05	9.40E-05	--	5.00E-05
Copper	--	6.60E-01	3.79E+00	4.60E-01	--
Lead	--	7.44E-03	1.02E+00	2.80E-02	--
TPH - CCME CWS					
Aliph>C16-C21-F3	1.01E+04	2.88E-01	2.88E-01	--	--
Aliph>C21-C34 -F3	4.32E+03	1.23E-01	1.23E-01	--	--
Arom>C16-C21 -F3	2.52E+03	7.20E-02	7.20E-02	--	--
Arom>C21-C34 -F3	1.08E+03	3.08E-02	3.08E-02	--	--
F3 - Total	1.80E+04	5.14E-01	5.14E-01	--	--
Organics					
Total PCBs	--	1.46E-1	1.46E-1	2.60E-03	

-- = Parameter not evaluated for this pathway

Table 4 Upper Site CoPC Concentrations Used in HHRA

Compound	C_{soil} (mg/kg)	$C_{caribou}$ (mg/kg)	C_{hare} (mg/kg)	C_{fish} (mg/kg)	C_{water} (mgL)
Inorganics					
Beryllium	7.80E-01	9.40E-05	9.40E-05		
Copper	3.81E+02	6.60E-01	3.79E+00	4.60E-01	2.00E-03
Lead	1.06E+03	7.44E-03	1.02E+00	2.80E-02	
TPH - CCME CWS					
Aliph>C10-C12 -F2	3.17E+03	4.24E-02	4.14E-02	--	--
Aliph>C12-C16 -F2	3.87E+03	5.18E-02	5.06E-02	--	--
Arom>C10-C12 -F2	7.92E+02	1.06E-02	1.04E-02	--	--
Arom>C12-C16 -F2	9.68E+02	1.29E-02	1.27E-02	--	--
F2 - Total	8.80E+03	1.18E-01	1.15E-01	--	--
Aliph>C16-C21-F3	1.79E+04	2.88E-01	2.88E-01	--	--
Aliph>C21-C34 -F3	7.66E+03	1.23E-01	1.23E-01	--	--
Arom>C16-C21 -F3	4.47E+03	7.20E-02	7.20E-02	--	--
Arom>C21-C34 -F3	1.91E+03	3.09E-02	3.09E-02	--	--
F3 - Total	3.19E+04	5.14E-01	5.14E-01	--	--
Aliph>C34-C50 -F4	4.58E+04	3.73E-02	3.73E-02	--	--
Arom>C34-C50 -F4	1.15E+04	9.33E-03	9.33E-03	--	--
F4 - Total	5.73E+04	4.66E-02	4.66E-02	--	--
Organics					
Total PCBs	2.20E+00	5.84E-3	5.84E-3	2.60E-03	--

-- = Parameter not evaluated for this pathway

Table 5 Exposure Pathway Specific Hazard Quotients for Lower Site Exposure

Compound	HQ Soil Ingestion	HQ Soil Dermal	HQ Soil Dust Inhalation	HQ Site Soil	HQ Caribou Ingestion	HQ Hare Ingestion	HQ Fish Ingestion	HQ Water Ingestion	HQ Food Intake	HQ Water Dermal
Inorganics										
Beryllium	3.5E-04	9.0E-06	1.3E-05	3.7E-04	5.4E-05	6.0E-06	--	2.2E-04	2.8E-04	2.4E-05
TPH - CCME CWS										
Aliph>C16-C21-F3	6.0E-03	1.0E-03	5.3E-07	7.1E-03	1.6E-04	1.8E-05	--	--	1.8E-04	--
Aliph>C21-C34 -F3	2.6E-03	4.5E-04	2.3E-07	3.0E-03	7.1E-05	7.8E-06	--	--	7.8E-05	--
Arom>C16-C21 -F3	1.0E-01	1.7E-02	8.9E-06	1.2E-01	2.7E-03	3.0E-04	--	--	3.0E-03	--
Arom>C21-C34 -F3	4.3E-02	7.5E-03	3.8E-06	5.1E-02	1.2E-03	1.3E-04	--	--	1.3E-03	--
F3 - Total	1.5E-01	2.6E-02	1.3E-05	1.8E-01	4.2E-03	4.6E-04	--	--	4.6E-03	--
Organics										
Total PCBs	--	--	--	--	1.7E-01	1.9E-02	3.7E-03	--	1.9E-01	--

-- = Parameter not evaluated for this pathway

Table 6 Exposure Pathway Incremental Lifetime Cancer Risks for Lower Site Exposure

Compound	ILCR Soil Ingestion	ILCR Soil Dermal	ILCR Soil Dust Inhalation	ILCR Site Soil	ILCR Caribou Ingestion	ILCR Hare Ingestion	ILCR Fish Ingestion	ILCR Water Ingestion	ILCR Food Intake	ILCR Water Dermal
Inorganics										
Beryllium	--	--	2.68E-10	--	--	--	--	--	--	-

-- = Parameter not evaluated for this pathway

Table 7 Exposure Pathway Specific Hazard Quotients for Upper Site Exposure

Compound	HQ Soil Ingestion	HQ Soil Dermal	HQ Soil Dust Inhalation	HQ Site Soil	HQ Caribou Ingestion	HQ Hare Ingestion	HQ Fish Ingestion	HQ Water Ingestion	HQ Food Intake	HQ Water Dermal
Inorganics										
Beryllium	7.25E-05	1.89E-06	2.70E-06	7.71E-05	8.35E-06	9.28E-07	--	--	9.28E-06	--
Copper	7.09E-03	6.14E-04	6.26E-07	7.70E-03	1.17E-02	7.50E-03	1.02E-02	2.79E-04	2.87E-02	3.00E-05
Lead	5.52E-02	2.87E-04	4.88E-06	5.55E-02	3.71E-04	5.62E-03	1.73E-03	--	7.73E-03	--
TPH - CCME CWS										
Aliph>C10-C12 -F2	5.89E-03	1.02E-03	5.21E-07	6.91E-03	7.54E-05	8.39E-06	--	--	8.37E-05	--
Aliph>C12-C16 -F2	7.20E-03	1.25E-03	6.36E-07	8.45E-03	9.21E-05	1.02E-05	--	--	1.02E-04	--
Arom>C10-C12 -F2	3.68E-03	6.38E-04	3.25E-07	4.32E-03	4.71E-05	5.23E-06	--	--	5.23E-05	--
Arom>C12-C16 -F2	4.50E-03	7.80E-04	3.98E-07	5.28E-03	5.76E-05	6.40E-06	--	--	6.40E-05	--
F2 - Total	2.13E-02	3.69E-03	1.88E-06	2.50E-02	2.72E-04	3.02E-05	--	--	3.02E-04	--
Aliph>C16-C21-F3	1.66E-03	2.88E-04	1.47E-07	1.95E-03	2.56E-05	2.85E-06	--	--	2.85E-05	--
Aliph>C21-C34 -F3	7.12E-04	1.23E-04	6.29E-08	8.35E-04	1.10E-05	1.22E-06	--	--	1.22E-05	--
Arom>C16-C21 -F3	2.77E-02	4.80E-03	2.45E-06	3.25E-02	4.29E-04	4.74E-05	--	--	4.74E-04	--
Arom>C21-C34 -F3	1.19E-02	2.06E-03	1.05E-06	1.39E-02	1.83E-04	2.03E-05	--	--	2.03E-04	--
F3 - Total	4.19E-02	7.27E-03	3.70E-06	4.92E-02	6.46E-04	7.18E-05	--	--	7.18E-04	--
Aliph>C34-C50 -F4	4.26E-04	7.39E-05	3.77E-08	5.00E-04	3.32E-07	3.69E-08	--	--	3.69E-07	--
Arom>C34-C50 -F4	7.10E-02	1.23E-02	6.28E-06	8.34E-02	5.53E-05	6.14E-06	--	--	6.14E-05	--
F4 - Total	7.15E-02	1.24E-02	6.31E-06	8.39E-02	5.56E-05	6.18E-06	--	--	6.18E-05	--
Organics										
Total PCBs	4.09E-04	3.55E-05	3.61E-08	4.45E-04	1.04E-03	1.15E-04	5.74E-04	--	1.73E-03	--

-- = Parameter not evaluated for this pathway

Table 8 Exposure Pathway Incremental Lifetime Cancer Risks for Upper Site Exposure

Compound	ILCR Soil Ingestion	ILCR Soil Dermal	ILCR Soil Dust Inhalation	ILCR Site Soil	ILCR Caribou Ingestion	ILCR Hare Ingestion	ILCR Fish Ingestion	ILCR Water Ingestion	ILCR Food Intake	ILCR Water Dermal
Inorganics										
Beryllium	--	--	5.60E-11	--	--	--	--	--	--	-

-- = Parameter not evaluated for this pathway

APPENDIX D

ERA MODEL INPUTS AND OUTPUTS

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Snowy Owl

Receptor Name	Snowy Owl	
Name of Area	FOX-C	
Receptor Type	1	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	2.05	kg
Food intake rate	0.290218284	kg wet-wt/day
Water intake rate	0.095439268	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.32	
Fraction of food intake rate	0.028	
Ingestion rate	0.002600356	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.001268466	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-tp)	0	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ti)	0	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	1	
Ingestion rate	0.290218284	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tm)	0.141569895	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	0.095439268	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.04655574	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0	
Fraction of food intake rate	0	
Ingestion rate	0	kg dry-wt/day
Fraction from site	0	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-fsh)	0	kg/kg-day

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Ptarmigan

Receptor Name	Ptarmigan	
Name of Area	FOX-C	
Receptor Type	1	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	0.5	kg
Food intake rate	0.124	kg wet-wt/day
Water intake rate	0.037	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.3	
Fraction of food intake rate	0.02	
Ingestion rate	0.000744	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.001488	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	1	
Ingestion rate	0.124	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tp)	0.248	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.1	
Ingestion rate	0.0124	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-ti)	0.0248	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-tm)	0	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	0.037	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.074	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0	
Fraction of food intake rate	0	
Ingestion rate	0	kg dry-wt/day
Fraction from site	0	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-fsh)	0	kg/kg-day

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Lemming

Receptor Name	Lemming	
Name of Area	FOX-C	
Receptor Type	2	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	0.04	kg
Food intake rate	0.023	kg wet-wt/day
Water intake rate	0.009	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.3	
Fraction of food intake rate	0.02	
Ingestion rate	0.000138	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.00345	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	1	
Ingestion rate	0.023	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tp)	0.575	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ti)	0	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tm)	0	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	0.009	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.225	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.1	
Fraction of food intake rate	0.01	
Ingestion rate	0.000023	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0.25	
Ingestion rate	0.00575	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0.25	
Ingestion rate	0.00575	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-fsh)	0	kg/kg-day

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Ermine

Receptor Name	Ermine	
Name of Area	FOX-C	
Receptor Type	2	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	0.128	kg
Food intake rate	0.026336787	kg wet-wt/day
Water intake rate	0.009273303	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.3	
Fraction of food intake rate	0.028	
Ingestion rate	0.000221229	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.001728352	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.05	
Ingestion rate	0.001316839	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tp)	0.010287807	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.1	
Ingestion rate	0.002633679	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-ti)	0.020575615	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.85	
Ingestion rate	0.022386269	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tm)	0.174892727	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	0.009273303	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.072447678	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0	
Fraction of food intake rate	0	
Ingestion rate	0	kg dry-wt/day
Fraction from site	0	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-fsh)	0	kg/kg-day

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Caribou

Receptor Name	Caribou	
Name of Area	FOX-C	
Receptor Type	2	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	117.5	kg
Food intake rate	18.6639	kg wet-wt/day
Water intake rate	7.222196069	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.15	
Fraction of food intake rate	0.082	
Ingestion rate	0.22956597	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.001953753	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	1	
Ingestion rate	18.6639	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tp)	0.158841702	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ti)	0	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-tm)	0	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	7.222196069	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.061465498	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0	
Fraction of food intake rate	0	
Ingestion rate	0	kg dry-wt/day
Fraction from site	0	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-fsh)	0	kg/kg-day

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Arctic Fox

Receptor Name	Arctic Fox	
Name of Area	FOX-C	
Receptor Type	2	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	5.75	kg
Food intake rate	0.933	kg wet-wt/day
Water intake rate	0.478	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.31	
Fraction of food intake rate	0.03	
Ingestion rate	0.0086769	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.001509026	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.05	
Ingestion rate	0.04665	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tp)	0.008113043	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ti)	0	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.95	
Ingestion rate	0.88635	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tm)	0.154147826	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	0.478	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.083130435	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0	
Fraction of food intake rate	0	
Ingestion rate	0	kg dry-wt/day
Fraction from site	0	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-fsh)	0	kg/kg-day

Jacques Whitford's Ecological Risk Assessment Model (Version 1.21)
Intake Parameters for the Arctic Hare

Receptor Name	Arctic Hare	
Name of Area	FOX-C	
Receptor Type	2	(1-Bird, 2-Mammal)
Small Mammal Type	1	(1-General, 2- Herbivore, 3-Insectivore) Default value should be 1
Benthic invertebrates, fish and aquatic plants based on Sediment or Surface Water Uptake	1	(1-Sediment, 2-Surface Water) Default value should be 1
General Parameters		
Body weight	4.3	kg
Food intake rate	1.149	kg wet-wt/day
Water intake rate	0.368	L/day
Ingestion of Soil		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction diet that is dry solid	0.22	
Fraction of food intake rate	0.024	
Ingestion rate	0.00606672	kg dry-wt/day
Fraction from site	1	
Intake factor (IFing-sl)	0.001410865	kg/kg-day
Ingestion of Terrestrial Plants		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.95	
Ingestion rate	1.09155	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tp)	0.253848837	kg/kg-day
Ingestion of Terrestrial Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ti)	0	kg/kg-day
Ingestion of Terrestrial Mammals/Birds		
Applicable pathway?	1	(0 = no, 1 = yes)
Fraction of food intake rate	0.05	
Ingestion rate	0.05745	kg wet-wt/day
Fraction from site	1	
Intake factor (IFing-tm)	0.013360465	kg/kg-day
Ingestion of Surface Water		
Applicable pathway?	1	(0 = no, 1 = yes)
Ingestion rate	0.368	L/day
Fraction from site	1	
Intake factor (IFing-sw)	0.085581395	L/kg-day
Ingestion of Sediment		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction diet that is dry solid	0	
Fraction of food intake rate	0	
Ingestion rate	0	kg dry-wt/day
Fraction from site	0	
Intake factor (IFing-sed)	0	kg/kg-day
Ingestion of Aquatic Plants		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ap)	0	kg/kg-day
Ingestion of Benthic Invertebrates		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-ai)	0	kg/kg-day
Ingestion of Fish		
Applicable pathway?	0	(0 = no, 1 = yes)
Fraction of food intake rate	0	
Ingestion rate	0	kg wet-wt/day
Fraction from site	0	
Intake factor (IFing-fsh)	0	kg/kg-day

Final Exposure Point Concentrations for FOX-C - Upper Site

Constituent	CAS-RN	Soil Conc. (mg/kg)	Terrestrial Plant Conc. (mg/Kg)	Terrestrial Invertebrate Conc. (mg/Kg)	Terrestrial Mammal Conc. (mg/Kg)	Surface Water Conc. (mg/L)
TPH - CCME CWS	% Composition					
Aliph>C06-C08 - F1	0.55	1.01E+00	3.63E-02	1.01E-01	9.12E-04	3.85E-02
Aliph>C08-C10 -F1	0.36	6.62E-01	6.28E-03	6.62E-02	4.51E-03	2.52E-02
Arom>C08-C10 -F1	0.09	1.66E-01	2.25E-02	1.66E-02	2.88E-05	6.30E-03
F1 - Total						
Aliph>C10-C12 -F2	0.36	7.66E+01	3.78E-01	7.66E+00	2.13E-01	1.80E-02
Aliph>C12-C16 -F2	0.44	9.36E+01	7.98E-02	9.36E+00	2.59E+00	2.20E-02
Arom>C10-C12 -F2	0.09	1.91E+01	1.41E+00	1.91E+00	3.84E-03	4.50E-03
Arom>C12-C16 -F2	0.11	2.34E+01	1.16E+00	2.34E+00	6.62E-03	5.50E-03
F2 - Total						
Aliph>C16-C21-F3	0.56	6.98E+02	3.45E-02	6.98E+01	1.06E+01	2.80E-02
Aliph>C21-C34 -F3	0.24	2.99E+02	5.03E-05	2.99E+01	1.80E+00	1.20E-02
Arom>C16-C21 -F3	0.14	1.75E+02	4.37E+00	1.75E+01	9.28E-02	7.00E-03
Arom>C21-C34 -F3	0.06	7.48E+01	5.58E-01	7.48E+00	1.57E-01	3.00E-03
F3 - Total						
Aliph>C34-C50 -F4	0.80	2.04E+02	1.21E-05	2.04E+01	6.31E-01	4.00E-02
Arom>C34-C50 -F4	0.20	5.09E+01	1.28E-01	5.09E+00	5.04E-01	1.00E-02
F4 - Total						
Organics						
Aroclor 1254 (Total PCBs)	11097691	2.00E-01	8.18E-02	7.33E-02	5.57E-01	5.00E-05
Inorganics						
Beryllium		2.91E-01	5.53E-04	2.10E-03	1.08E-04	5.00E-05
Cadmium	7440439	1.67E-01	3.25E-01	3.19E-01	8.71E-02	6.00E-05
Chromium (Total)		3.64E+01	1.48E+01	1.50E+00	1.04E+00	1.10E-03
Copper	7440508	2.60E+01	1.18E+01	2.02E+00	3.95E+00	4.00E-03
Lead	7439921	1.87E+01	7.85E+00	1.36E+00	1.26E+00	1.00E-03
Zinc	7440666	5.80E+01	8.39E+01	5.18E+01	3.78E+01	5.60E-02

Final Exposure Point Concentrations for FOX-C - Lower Site

Constituent	CAS-RN	Soil Conc. (mg/kg)	Terrestrial Plant Conc. (mg/Kg)	Terrestrial Invertebrate Conc. (mg/Kg)	Terrestrial Mammal Conc. (mg/Kg)	Surface Water Conc. (mg/L)
TPH - CCME CWS	% Composition					
Aliph>C06-C08 - F1	0.55	3.90E+00	1.40E-01	3.90E-01	2.00E-03	3.85E-02
Aliph>C08-C10 -F1	0.36	2.55E+00	2.42E-02	2.55E-01	7.43E-03	2.52E-02
Arom>C08-C10 -F1	0.09	6.38E-01	8.66E-02	6.38E-02	8.60E-05	6.30E-03
F1 - Total						
Aliph>C10-C12 -F2	0.36	5.46E+01	2.69E-01	5.46E+00	1.53E-01	1.80E-02
Aliph>C12-C16 -F2	0.44	6.67E+01	5.68E-02	6.67E+00	1.87E+00	2.20E-02
Arom>C10-C12 -F2	0.09	1.36E+01	1.00E+00	1.36E+00	2.74E-03	4.50E-03
Arom>C12-C16 -F2	0.11	1.67E+01	8.23E-01	1.67E+00	4.73E-03	5.50E-03
F2 - Total						
Aliph>C16-C21-F3	0.56	1.71E+02	8.46E-03	1.71E+01	2.66E+00	2.80E-02
Aliph>C21-C34 -F3	0.24	7.34E+01	1.23E-05	7.34E+00	4.53E-01	1.20E-02
Arom>C16-C21 -F3	0.14	4.28E+01	1.07E+00	4.28E+00	2.29E-02	7.00E-03
Arom>C21-C34 -F3	0.06	1.84E+01	1.37E-01	1.84E+00	3.89E-02	3.00E-03
F3 - Total						
Aliph>C34-C50 -F4	0.80	8.87E+01	5.28E-06	8.87E+00	2.88E-01	4.00E-02
Arom>C34-C50 -F4	0.20	2.22E+01	5.56E-02	2.22E+00	2.27E-01	1.00E-02
F4 - Total						
Organics						
Aroclor 1254 (Total PCBs)	11097691	5.00E-02	8.18E-02	1.11E-02	5.48E-01	5.00E-05
Inorganics						
Beryllium		5.43E-01	1.03E-03	3.91E-03	2.00E-04	5.00E-05
Cadmium	7440439	8.22E-02	3.25E-01	1.82E-01	6.17E-02	6.00E-05
Chromium (Total)		7.94E+01	1.48E+01	1.43E+00	1.84E+00	1.10E-03
Copper	7440508	3.02E+01	1.18E+01	2.10E+00	4.03E+00	4.00E-03
Lead	7439921	1.08E+01	7.85E+00	8.78E-01	9.89E-01	1.00E-03
Zinc	7440666	8.02E+01	8.39E+01	5.77E+01	3.87E+01	5.60E-02

Reference Toxicity Doses for Bird Species Exposed to Constituents fo Concern from FOX-C

Constituent	Test Species	Test Species Body Weight (kg wet)	Body Weight Reference	Effect	Reference	Endpoint	Daily Dose (mg/kg-day)	Total Uncertainty Factor (a)	Chronic LOAEL-Test Species (b) (mg/kg-day)	Receptor Species	Body Weight Scaling Factor	Reference Toxicity Dose (mg/kg-day)
TPH - CCME CWS												
Aliph>C06-C08 - F1	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+02	1	5.00E+02	Ptarmigan	8.71E-01	4.35E+02
Aliph>C08-C10 -F1	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+02	1	5.00E+02	Ptarmigan	8.71E-01	4.35E+02
Arom>C08-C10 -F1	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+01	1	5.00E+01	Ptarmigan	8.71E-01	4.35E+01
F1 - Total							--		--			--
Aliph>C10-C12 -F2	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+02	1	5.00E+02	Ptarmigan	8.71E-01	4.35E+02
Aliph>C12-C16 -F2	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+02	1	5.00E+02	Ptarmigan	8.71E-01	4.35E+02
Arom>C10-C12 -F2	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+01	1	5.00E+01	Ptarmigan	8.71E-01	4.35E+01
Arom>C12-C16 -F2	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	5.00E+01	1	5.00E+01	Ptarmigan	8.71E-01	4.35E+01
F2 - Total							--		--			--
Aliph>C16-C21-F3	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	1.00E+03	1	1.00E+03	Ptarmigan	8.71E-01	8.71E+02
Aliph>C21-C34 -F3	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	1.50E+02	1	1.50E+02	Ptarmigan	8.71E-01	1.31E+02
Arom>C16-C21 -F3	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	1.00E+02	1	1.00E+02	Ptarmigan	8.71E-01	8.71E+01
Arom>C21-C34 -F3	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	1.50E+02	1	1.50E+02	Ptarmigan	8.71E-01	1.31E+02
F3 - Total							--		--			--
Aliph>C34-C50 -F4	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	3.00E+03	1	3.00E+03	Ptarmigan	8.71E-01	2.61E+03
Arom>C34-C50 -F4	Mallard Duck	1	Heinz et al. 1989	Liver hypertrophy and splenic atrophy	Adapted from Szaro et al. (1978)	chronic LOAEL	1.50E+02	1	1.50E+02	Ptarmigan	8.71E-01	1.31E+02
F4 - Total							--		--			--
Organics												
Aroclor 1254 (Total PCBs)	Ring-necked Pheasant	1	EPA 1993e	reproductive	Dahlgren et al 1972, Sample et al., 1996	chronic LOAEL	1.80E+00	1	1.80E+00	Ptarmigan	8.71E-01	1.57E+00
Inorganics												
Beryllium	Rat	0.35	USEPA (1988a)	longevity, weight loss (sub lethal)	Sample et al. (1996), ORNL ES/ER/TM-86/R3	chronic NOAEL	6.60E-01	1	6.60E-01	Ptarmigan	1.07E+00	7.09E-01
Cadmium	Mallard duck	1	Heinz et al. 1989	reproduction	White & Finley (1978), Sample et al. (1996)	chronic LOAEL	2.00E+01	1	2.00E+01	Ptarmigan	8.71E-01	1.74E+01
Chromium (Total)	Black duck	1.25	Dunning 1984	reproduction	Sample et al. (1996)	chronic LOAEL	5.00E+00	1	5.00E+00	Ptarmigan	8.33E-01	4.16E+00
Copper	Chicken (chicks)	0.121	EPA 1988a	growth, mortality	Mehring et al. (1960), Sample et al. (1996)	chronic LOAEL	6.17E+01	1	6.17E+01	Ptarmigan	1.33E+00	8.19E+01
Lead	Japanese quail	0.15	Vos et al. 1971	reproduction	Edens et al. (1976), Sample et al. (1996)	chronic LOAEL	1.13E+01	1	1.13E+01	Ptarmigan	1.27E+00	1.44E+01
Zinc	White Leghorn hen	1.851	Sample et al. 1996	reproduction	Stahl et al. (1990), Sample et al. (1996)	chronic LOAEL	1.31E+02	1	1.31E+02	Ptarmigan	7.70E-01	1.01E+02

Notes:

(a) The following uncertainty factors are used: 5 for subchronic to chronic; 0.2 for NOAEL to LOAEL (5 for LOAEL to NOAEL); 6 for LD_{50} or LD_{LO} to LOAEL; 5 for mammal to bird.

(b) The chronic LOAEL is calculated as the Daily Dose divided by the Total Uncertainty Factor.

NA - Not Available

Reference Toxicity Doses for Test Organisms - Mammals - Exposed to Constituents fo Concern from FOX-C

Constituent	Test Species	Test Species Body Weight (kg wet)	Body Weight Reference	Effect	Reference	Endpoint	Daily Dose (mg/kg-day)	Total Uncertainty Factor (a)	Chronic LOAEL - Test Species (b) (mg/kg-day)	Receptor Species	Body Weight Scaling Factor
TPH - CCME CWS											
Aliph>C06-C08 - F1	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	2.00E+02	1	2.00E+02	Arctic Fox	7.30E-01
Aliph>C08-C10 -F1	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	2.00E+02	1	2.00E+02	Arctic Fox	7.30E-01
Arom>C08-C10 -F1	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	5.00E+01	1	5.00E+01	Arctic Fox	7.30E-01
F1 - Total							--		--		0.00E+00
Aliph>C10-C12 -F2	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	2.00E+02	1	2.00E+02	Arctic Fox	7.30E-01
Aliph>C12-C16 -F2	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	2.00E+02	1	2.00E+02	Arctic Fox	7.30E-01
Arom>C10-C12 -F2	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	1.00E+02	1	1.00E+02	Arctic Fox	7.30E-01
Arom>C12-C16 -F2	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	1.00E+02	1	1.00E+02	Arctic Fox	7.30E-01
F2 - Total							--		--		0.00E+00
Aliph>C16-C21-F3	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	4.00E+02	1	4.00E+02	Arctic Fox	7.30E-01
Aliph>C21-C34 -F3	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	4.00E+02	1	4.00E+02	Arctic Fox	7.30E-01
Arom>C16-C21 -F3	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	1.00E+02	1	1.00E+02	Arctic Fox	7.30E-01
Arom>C21-C34 -F3	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	1.00E+02	1	1.00E+02	Arctic Fox	7.30E-01
F3 - Total							--		--		0.00E+00
Aliph>C34-C50 -F4	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	1.00E+03	1	1.00E+03	Arctic Fox	7.30E-01
Arom>C34-C50 -F4	Mouse	0.03	USEPA (1988a)	Various	Weight of Evidence from ATSDR (200X), TPHCWG (1997), Hutcheson et al. (1996) and CWS (2001)	chronic LOAEL	1.00E+02	1	1.00E+02	Arctic Fox	7.30E-01
F4 - Total							--		--		0.00E+00

Reference Toxicity Doses for Test Organisms - Mammals - Exposed to Constituents fo Concern from FOX-C

Constituent	Test Species	Test Species Body Weight (kg wet)	Body Weight Reference	Effect	Reference	Endpoint	Daily Dose (mg/kg-day)	Total Uncertainty Factor (a)	Chronic LOAEL - Test Species (b) (mg/kg-day)	Receptor Species	Body Weight Scaling Factor
Organics											
Aroclor 1254 (Total PCBs)	Mink	1	USEPA (1988a)	reproduction	Sample et al. (1996)	chronic LOAEL	6.85E-01	1	6.85E-01	Arctic Fox	9.00E-01
Inorganics											
Beryllium	Rat	0.35	USEPA (1988a)	longevity, weight loss	Schroeder & Mitchner (1971), Sample et al. (1996)	chronic NOAEL	6.60E-01	0.2	3.30E+00	Arctic Fox	8.45E-01
Cadmium	Rat	0.35	USEPA (1988a)	reproduction	Sutou et al. (1980), Sample et al. (1996)	chronic LOAEL	1.00E+01	1	1.00E+01	Arctic Fox	8.45E-01
Chromium (Total)	Rat	0.35	USEPA (1988a)	reproduction	Ivankovic & Preussmann (1975), Sample et al. (1996)	chronic NOAEL	2.74E+03	0.2	1.37E+04	Arctic Fox	8.45E-01
Cobalt	Rat	0.35	USEPA (1988a)	reproduction	ATSDR (2001)	chronic LOAEL	1.00E+01	1	1.00E+01	Arctic Fox	8.45E-01
Copper	Mink	1	USEPA (1988a)	reproduction	Aulerich et al. (1982), Sample et al. (1996)	chronic LOAEL	1.51E+01	1	1.51E+01	Arctic Fox	9.00E-01
Cyanide	Rat	0.35	USEPA (1988a)	reproduction	Tewe & Maner (1981), Sample et al. (1996)	chronic NOAEL	6.87E+01	0.2	3.44E+02	Arctic Fox	8.45E-01
Iron	Mouse	0.03	USEPA (1988a)	not specified	British Journal of Pharmacology (1965), Ramamoorthy et al. (1995)	chronic LD_{50}	6.80E+02	6	1.13E+02	Arctic Fox	7.30E-01
Lead	Rat	0.35	USEPA (1988a)	reproduction	Azar et al. (1973), Sample et al. (1996)	chronic LOAEL	8.00E+01	1	8.00E+01	Arctic Fox	8.45E-01
Lithium	Rat	0.35	USEPA (1988a)	reproduction	Marathe & Thomas (1986), Sample et al. (1996)	chronic LOAEL	1.88E+01	1	1.88E+01	Arctic Fox	8.45E-01
Manganese	Rat	0.35	USEPA (1988a)	reproduction	Laskey et al. (1982), Sample et al. (1996)	chronic LOAEL	2.84E+02	1	2.84E+02	Arctic Fox	8.45E-01
Mercury - Inorganic	Rat	0.35	USEPA (1988a)	reproduction	Verschuuren et al. (1976), Sample (1996)	chronic LOAEL	1.60E-01	1	1.60E-01	Arctic Fox	8.45E-01
Molybdenum	Mouse	0.03	USEPA (1988a)	reproduction	Schroeder & Mitchner (1971), Sample et al. (1996)	chronic LOAEL	2.60E+00	1	2.60E+00	Arctic Fox	7.30E-01
Nickel	Rat	0.35	USEPA (1988a)	reproduction	Ambrose et al. (1976), Sample et al. (1996)	chronic LOAEL	8.00E+01	1	8.00E+01	Arctic Fox	8.45E-01
Selenium	Rat	0.35	USEPA (1988a)	reproduction	Rosenfeld & Beath (1954), Sample et al. (1996)	chronic LOAEL	3.30E-01	1	3.30E-01	Arctic Fox	8.45E-01
Silver	Mouse	0.03	USEPA (1988a)	mortality	Silver nitrate solutions and concentrations MSDS	chronic LD_{50}	9.20E+00	6	1.53E+00	Arctic Fox	7.30E-01
Strontium	Rat	0.35	USEPA (1988a)	body weight & bone change	Skoryna (1981), Sample et al. (1996)	chronic NOAEL	2.63E+02	0.2	1.32E+03	Arctic Fox	8.45E-01
Thallium	Rat	0.35	USEPA (1988a)	reproduction	Formigli et al. (1986), Sample et al. (1996)	subchronic LOAEL	7.40E-01	5	1.48E-01	Arctic Fox	8.45E-01
Uranium	Mouse	0.03	USEPA (1988a)	reproduction	Paternain et al. (1989), Sample et al. (1996)	chronic LOAEL	6.13E+00	1	6.13E+00	Arctic Fox	7.30E-01
Vanadium	Rat	0.35	USEPA (1988a)	reproduction	Domingo et al. (1986), Sample et al. (1996)	chronic LOAEL	2.10E+00	1	2.10E+00	Arctic Fox	8.45E-01
Zinc	Rat	0.35	USEPA (1988a)	reproduction	Schlicker & Cox (1968), Sample et al. (1996)	chronic LOAEL	3.20E+02	1	3.20E+02	Arctic Fox	8.45E-01

Notes:

(a) The following uncertainty factors are used: 5 for subchronic to chronic; 0.2 for NOAEL to LOAEL (5 for LOAEL to NOAEL); 6 for LD_{50} or LD_{LO} to LOAEL.

(b) The chronic LOAEL is calculated as the Daily Dose divided by the Total Uncertainty Factor.

NA - Not Available

Reference Toxicity Dose (mg/kg-day)
1.46E+02
1.46E+02
3.65E+01
--
1.46E+02
1.46E+02
7.30E+01
7.30E+01
--
2.92E+02
2.92E+02
7.30E+01
7.30E+01
--
7.30E+02
7.30E+01
--

Reference Toxicity Dose (mg/kg-day)
6.17E-01
2.79E+00
8.45E+00
1.16E+04
8.45E+00
1.36E+01
2.90E+02
8.27E+01
6.76E+01
1.59E+01
2.40E+02
1.35E-01
1.90E+00
6.76E+01
2.79E-01
1.12E+00
1.11E+03
1.25E-01
4.47E+00
1.78E+00
2.71E+02

Ecological Hazard Quotients for the Ptarmigan Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**5.87E-02**
Aliph>C06-C08 - F1	4.35E+02	1.51E-03	3.46E-06	9.00E-03	2.07E-05	2.51E-03	5.77E-06	--	--	2.85E-03	6.55E-06	3.65E-05
Aliph>C08-C10 -F1	4.35E+02	9.86E-04	2.26E-06	1.56E-03	3.58E-06	1.64E-03	3.77E-06	--	--	1.86E-03	4.28E-06	1.39E-05
Arom>C08-C10 -F1	4.35E+01	2.46E-04	5.66E-06	5.58E-03	1.28E-04	4.11E-04	9.44E-06	--	--	4.66E-04	1.07E-05	1.54E-04
F1 - Total												**2.04E-04**
Aliph>C10-C12 -F2	4.35E+02	1.14E-01	2.62E-04	9.38E-02	2.15E-04	1.90E-01	4.36E-04	--	--	1.33E-03	3.06E-06	9.17E-04
Aliph>C12-C16 -F2	4.35E+02	1.39E-01	3.20E-04	1.98E-02	4.54E-05	2.32E-01	5.33E-04	--	--	1.63E-03	3.74E-06	9.02E-04
Arom>C10-C12 -F2	4.35E+01	2.85E-02	6.54E-04	3.49E-01	8.03E-03	4.75E-02	1.09E-03	--	--	3.33E-04	7.65E-06	9.78E-03
Arom>C12-C16 -F2	4.35E+01	3.48E-02	8.00E-04	2.86E-01	6.58E-03	5.80E-02	1.33E-03	--	--	4.07E-04	9.35E-06	8.72E-03
F2 - Total												**2.03E-02**
Aliph>C16-C21-F3	8.71E+02	1.04E+00	1.19E-03	8.55E-03	9.82E-06	1.73E+00	1.99E-03	--	--	2.07E-03	2.38E-06	3.19E-03
Aliph>C21-C34 -F3	1.31E+02	4.45E-01	3.41E-03	1.25E-05	9.55E-08	7.42E-01	5.68E-03	--	--	8.88E-04	6.80E-06	9.10E-03
Arom>C16-C21 -F3	8.71E+01	2.60E-01	2.98E-03	1.08E+00	1.25E-02	4.33E-01	4.97E-03	--	--	5.18E-04	5.95E-06	2.04E-02
Arom>C21-C34 -F3	1.31E+02	1.11E-01	8.52E-04	1.38E-01	1.06E-03	1.85E-01	1.42E-03	--	--	2.22E-04	1.70E-06	3.33E-03
F3 - Total												**3.60E-02**
Aliph>C34-C50 -F4	2.61E+03	3.03E-01	1.16E-04	3.01E-06	1.15E-09	5.05E-01	1.93E-04	--	--	2.96E-03	1.13E-06	3.11E-04
Arom>C34-C50 -F4	1.31E+02	7.58E-02	5.80E-04	3.16E-02	2.42E-04	1.26E-01	9.67E-04	--	--	7.40E-04	5.67E-06	1.79E-03
F4 - Total												**2.11E-03**
Organics												
Aroclor 1254 (Total PCBs)	1.57E+00	2.98E-04	1.90E-04	2.03E-02	1.29E-02	1.82E-03	1.16E-03	--	--	3.70E-06	2.36E-06	1.43E-02
Inorganics												
Beryllium	7.09E-01	4.33E-04	6.11E-04	1.37E-04	1.93E-04	5.20E-05	7.33E-05	--	--	3.70E-06	5.22E-06	8.83E-04
Cadmium	1.74E+01	2.48E-04	1.43E-05	8.06E-02	4.63E-03	7.92E-03	4.55E-04	--	--	4.44E-06	2.55E-07	5.10E-03
Chromium (Total)	4.16E+00	5.41E-02	1.30E-02	3.67E+00	8.82E-01	3.73E-02	8.96E-03	--	--	8.14E-05	1.96E-05	**9.04E-01**
Copper	8.19E+01	3.87E-02	4.72E-04	2.93E+00	3.57E-02	5.01E-02	6.11E-04	--	--	2.96E-04	3.61E-06	3.68E-02
Lead	1.44E+01	2.78E-02	1.93E-03	1.95E+00	1.35E-01	3.38E-02	2.35E-03	--	--	7.40E-05	5.15E-06	**1.40E-01**
Zinc	1.01E+02	8.62E-02	8.55E-04	2.08E+01	2.06E-01	1.29E+00	1.27E-02	--	--	4.14E-03	4.11E-05	**2.20E-01**

Ecological Hazard Quotients for the Ermine Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**4.00E-02**
Aliph>C06-C08 - F1	1.83E+02	1.75E-03	9.54E-06	3.73E-04	2.04E-06	2.08E-03	1.14E-05	1.60E-04	8.70E-07	2.79E-03	1.52E-05	3.90E-05
Aliph>C08-C10 -F1	1.83E+02	1.14E-03	6.24E-06	6.46E-05	3.52E-07	1.36E-03	7.43E-06	7.88E-04	4.30E-06	1.83E-03	9.96E-06	2.83E-05
Arom>C08-C10 -F1	4.58E+01	2.86E-04	6.24E-06	2.31E-04	5.05E-06	3.41E-04	7.43E-06	5.03E-06	1.10E-07	4.56E-04	9.96E-06	2.88E-05
F1 - Total												**9.61E-05**
Aliph>C10-C12 -F2	1.83E+02	1.32E-01	7.22E-04	3.89E-03	2.12E-05	1.58E-01	8.59E-04	3.72E-02	2.03E-04	1.30E-03	7.11E-06	1.81E-03
Aliph>C12-C16 -F2	1.83E+02	1.62E-01	8.82E-04	8.21E-04	4.48E-06	1.93E-01	1.05E-03	4.53E-01	2.47E-03	1.59E-03	8.69E-06	4.42E-03
Arom>C10-C12 -F2	9.17E+01	3.31E-02	3.61E-04	1.45E-02	1.58E-04	3.94E-02	4.30E-04	6.71E-04	7.32E-06	3.26E-04	3.56E-06	9.60E-04
Arom>C12-C16 -F2	9.17E+01	4.04E-02	4.41E-04	1.19E-02	1.30E-04	4.81E-02	5.25E-04	1.16E-03	1.26E-05	3.98E-04	4.35E-06	1.11E-03
F2 - Total												**8.30E-03**
Aliph>C16-C21-F3	3.67E+02	1.21E+00	3.29E-03	3.55E-04	9.67E-07	1.44E+00	3.92E-03	1.85E+00	5.05E-03	2.03E-03	5.53E-06	1.23E-02
Aliph>C21-C34 -F3	3.67E+02	5.17E-01	1.41E-03	5.17E-07	1.41E-09	6.16E-01	1.68E-03	3.15E-01	8.60E-04	8.69E-04	2.37E-06	3.95E-03
Arom>C16-C21 -F3	9.17E+01	3.02E-01	3.29E-03	4.50E-02	4.91E-04	3.59E-01	3.92E-03	1.62E-02	1.77E-04	5.07E-04	5.53E-06	7.88E-03
Arom>C21-C34 -F3	9.17E+01	1.29E-01	1.41E-03	5.74E-03	6.26E-05	1.54E-01	1.68E-03	2.74E-02	2.99E-04	2.17E-04	2.37E-06	3.45E-03
F3 - Total												**2.75E-02**
Aliph>C34-C50 -F4	9.17E+02	3.52E-01	3.84E-04	1.25E-07	1.36E-10	4.19E-01	4.57E-04	1.10E-01	1.20E-04	2.90E-03	3.16E-06	9.65E-04
Arom>C34-C50 -F4	9.17E+01	8.80E-02	9.60E-04	1.31E-03	1.43E-05	1.05E-01	1.14E-03	8.82E-02	9.62E-04	7.24E-04	7.90E-06	3.09E-03
F4 - Total												**4.05E-03**
Organics												
Aroclor 1254 (Total PCBs)	7.75E-01	3.46E-04	4.46E-04	8.42E-04	1.09E-03	1.51E-03	1.95E-03	9.73E-02	1.26E-01	3.62E-06	4.67E-06	**1.29E-01**
Inorganics												
Beryllium	3.51E+00	5.03E-04	1.43E-04	5.69E-06	1.62E-06	4.31E-05	1.23E-05	1.90E-05	5.41E-06	3.62E-06	1.03E-06	1.64E-04
Cadmium	1.06E+01	2.89E-04	2.72E-05	3.34E-03	3.15E-04	6.57E-03	6.19E-04	1.52E-02	1.43E-03	4.35E-06	4.09E-07	2.39E-03
Chromium (Total)	1.45E+04	6.29E-02	4.33E-06	1.52E-01	1.05E-05	3.09E-02	2.13E-06	1.82E-01	1.25E-05	7.97E-05	5.48E-09	2.94E-05
Copper	1.71E+01	4.49E-02	2.62E-03	1.21E-01	7.09E-03	4.15E-02	2.43E-03	6.90E-01	4.03E-02	2.90E-04	1.69E-05	5.25E-02
Lead	8.50E+01	3.22E-02	3.79E-04	8.08E-02	9.50E-04	2.81E-02	3.30E-04	2.20E-01	2.59E-03	7.24E-05	8.53E-07	4.25E-03
Zinc	3.40E+02	1.00E-01	2.95E-04	8.63E-01	2.54E-03	1.07E+00	3.14E-03	6.61E+00	1.94E-02	4.06E-03	1.19E-05	2.54E-02

Ecological Hazard Quotients for the Arctic Fox Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**2.67E-02**
Aliph>C06-C08 - F1	1.46E+02	1.53E-03	1.05E-05	2.95E-04	2.02E-06	--	--	1.41E-04	9.64E-07	3.20E-03	2.19E-05	3.54E-05
Aliph>C08-C10 -F1	1.46E+02	1.00E-03	6.85E-06	5.09E-05	3.49E-07	--	--	6.95E-04	4.76E-06	2.09E-03	1.44E-05	2.63E-05
Arom>C08-C10 -F1	3.65E+01	2.50E-04	6.85E-06	1.82E-04	5.00E-06	--	--	4.44E-06	1.22E-07	5.24E-04	1.44E-05	2.63E-05
F1 - Total												**8.80E-05**
Aliph>C10-C12 -F2	1.46E+02	1.16E-01	7.92E-04	3.07E-03	2.10E-05	--	--	3.28E-02	2.25E-04	1.50E-03	1.03E-05	1.05E-03
Aliph>C12-C16 -F2	1.46E+02	1.41E-01	9.68E-04	6.47E-04	4.44E-06	--	--	3.99E-01	2.74E-03	1.83E-03	1.25E-05	3.72E-03
Arom>C10-C12 -F2	7.30E+01	2.89E-02	3.96E-04	1.14E-02	1.57E-04	--	--	5.91E-04	8.11E-06	3.74E-04	5.13E-06	5.66E-04
Arom>C12-C16 -F2	7.30E+01	3.53E-02	4.84E-04	9.37E-03	1.28E-04	--	--	1.02E-03	1.40E-05	4.57E-04	6.27E-06	6.33E-04
F2 - Total												**5.97E-03**
Aliph>C16-C21-F3	2.92E+02	1.05E+00	3.61E-03	2.80E-04	9.59E-07	--	--	1.63E+00	5.59E-03	2.33E-03	7.98E-06	9.21E-03
Aliph>C21-C34 -F3	2.92E+02	4.51E-01	1.55E-03	4.08E-07	1.40E-09	--	--	2.78E-01	9.53E-04	9.98E-04	3.42E-06	2.50E-03
Arom>C16-C21 -F3	7.30E+01	2.63E-01	3.61E-03	3.55E-02	4.86E-04	--	--	1.43E-02	1.96E-04	5.82E-04	7.98E-06	4.30E-03
Arom>C21-C34 -F3	7.30E+01	1.13E-01	1.55E-03	4.53E-03	6.20E-05	--	--	2.41E-02	3.31E-04	2.49E-04	3.42E-06	1.94E-03
F3 - Total												**1.80E-02**
Aliph>C34-C50 -F4	7.30E+02	3.07E-01	4.21E-04	9.84E-08	1.35E-10	--	--	9.73E-02	1.33E-04	3.33E-03	4.56E-06	5.59E-04
Arom>C34-C50 -F4	7.30E+01	7.68E-02	1.05E-03	1.03E-03	1.42E-05	--	--	7.77E-02	1.07E-03	8.31E-04	1.14E-05	2.14E-03
F4 - Total												**2.70E-03**
Organics												
Aroclor 1254 (Total PCBs)	6.17E-01	3.02E-04	4.89E-04	6.64E-04	1.08E-03	--	--	8.58E-02	1.39E-01	4.16E-06	6.74E-06	**1.41E-01**
Inorganics												
Beryllium	2.79E+00	4.39E-04	1.57E-04	4.49E-06	1.61E-06	--	--	1.67E-05	5.99E-06	4.16E-06	1.49E-06	1.66E-04
Cadmium	8.45E+00	2.52E-04	2.98E-05	2.64E-03	3.12E-04	--	--	1.34E-02	1.59E-03	4.99E-06	5.90E-07	1.93E-03
Chromium (Total)	1.16E+04	5.49E-02	4.75E-06	1.20E-01	1.04E-05	--	--	1.60E-01	1.38E-05	9.14E-05	7.90E-09	2.90E-05
Copper	1.36E+01	3.92E-02	2.88E-03	9.57E-02	7.02E-03	--	--	6.08E-01	4.46E-02	3.33E-04	2.44E-05	5.46E-02
Lead	6.76E+01	2.81E-02	4.16E-04	6.37E-02	9.42E-04	--	--	1.94E-01	2.87E-03	8.31E-05	1.23E-06	4.23E-03
Zinc	2.71E+02	8.74E-02	3.23E-04	6.81E-01	2.52E-03	--	--	5.82E+00	2.15E-02	4.66E-03	1.72E-05	2.44E-02

Ecological Hazard Quotients for the Caribou Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**4.32E-02**
Aliph>C06-C08 - F1	1.22E+02	1.98E-03	1.62E-05	5.77E-03	4.74E-05	--	--	--	--	2.37E-03	1.94E-05	8.30E-05
Aliph>C08-C10 -F1	1.22E+02	1.29E-03	1.06E-05	9.97E-04	8.19E-06	--	--	--	--	1.55E-03	1.27E-05	3.15E-05
Arom>C08-C10 -F1	3.04E+01	3.24E-04	1.06E-05	3.57E-03	1.17E-04	--	--	--	--	3.87E-04	1.27E-05	1.41E-04
F1 - Total												**2.55E-04**
Aliph>C10-C12 -F2	1.22E+02	1.50E-01	1.23E-03	6.01E-02	4.93E-04	--	--	--	--	1.11E-03	9.09E-06	1.73E-03
Aliph>C12-C16 -F2	1.22E+02	1.83E-01	1.50E-03	1.27E-02	1.04E-04	--	--	--	--	1.35E-03	1.11E-05	1.62E-03
Arom>C10-C12 -F2	6.09E+01	3.74E-02	6.14E-04	2.24E-01	3.68E-03	--	--	--	--	2.77E-04	4.54E-06	4.30E-03
Arom>C12-C16 -F2	6.09E+01	4.57E-02	7.51E-04	1.83E-01	3.01E-03	--	--	--	--	3.38E-04	5.55E-06	3.77E-03
F2 - Total												**1.14E-02**
Aliph>C16-C21-F3	2.43E+02	1.36E+00	5.60E-03	5.48E-03	2.25E-05	--	--	--	--	1.72E-03	7.07E-06	5.63E-03
Aliph>C21-C34 -F3	2.43E+02	5.85E-01	2.40E-03	7.99E-06	3.28E-08	--	--	--	--	7.38E-04	3.03E-06	2.40E-03
Arom>C16-C21 -F3	6.09E+01	3.41E-01	5.60E-03	6.94E-01	1.14E-02	--	--	--	--	4.30E-04	7.07E-06	1.70E-02
Arom>C21-C34 -F3	6.09E+01	1.46E-01	2.40E-03	8.86E-02	1.46E-03	--	--	--	--	1.84E-04	3.03E-06	3.86E-03
F3 - Total												**2.89E-02**
Aliph>C34-C50 -F4	6.09E+02	3.98E-01	6.54E-04	1.93E-06	3.16E-09	--	--	--	--	2.46E-03	4.04E-06	6.58E-04
Arom>C34-C50 -F4	6.09E+01	9.95E-02	1.63E-03	2.03E-02	3.33E-04	--	--	--	--	6.15E-04	1.01E-05	1.98E-03
F4 - Total												**2.63E-03**
Organics												
Aroclor 1254 (Total PCBs)	5.15E-01	3.91E-04	7.59E-04	1.30E-02	2.52E-02	--	--	--	--	3.07E-06	5.97E-06	2.60E-02
Inorganics												
Beryllium	2.33E+00	5.69E-04	2.44E-04	8.78E-05	3.77E-05	--	--	--	--	3.07E-06	1.32E-06	2.83E-04
Cadmium	7.05E+00	3.26E-04	4.63E-05	5.16E-02	7.32E-03	--	--	--	--	3.69E-06	5.23E-07	7.37E-03
Chromium (Total)	9.65E+03	7.11E-02	7.36E-06	2.35E+00	2.44E-04	--	--	--	--	6.76E-05	7.00E-09	2.51E-04
Copper	1.14E+01	5.08E-02	4.47E-03	1.87E+00	1.65E-01	--	--	--	--	2.46E-04	2.16E-05	**1.69E-01**
Lead	5.64E+01	3.64E-02	6.46E-04	1.25E+00	2.21E-02	--	--	--	--	6.15E-05	1.09E-06	2.27E-02
Zinc	2.26E+02	1.13E-01	5.02E-04	1.33E+01	5.90E-02	--	--	--	--	3.44E-03	1.52E-05	5.96E-02

Ecological Hazard Quotients for the Arctic Hare Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**4.15E-02**
Aliph>C06-C08 - F1	1.48E+02	1.43E-03	9.62E-06	9.22E-03	6.21E-05	--	--	1.22E-05	8.21E-08	3.29E-03	2.22E-05	9.40E-05
Aliph>C08-C10 -F1	1.48E+02	9.35E-04	6.29E-06	1.59E-03	1.07E-05	--	--	6.02E-05	4.05E-07	2.16E-03	1.45E-05	3.20E-05
Arom>C08-C10 -F1	3.71E+01	2.34E-04	6.29E-06	5.71E-03	1.54E-04	--	--	3.84E-07	1.04E-08	5.39E-04	1.45E-05	1.75E-04
F1 - Total												**3.00E-04**
Aliph>C10-C12 -F2	1.48E+02	1.08E-01	7.28E-04	9.60E-02	6.46E-04	--	--	2.84E-03	1.92E-05	1.54E-03	1.04E-05	1.40E-03
Aliph>C12-C16 -F2	1.48E+02	1.32E-01	8.89E-04	2.02E-02	1.36E-04	--	--	3.46E-02	2.33E-04	1.88E-03	1.27E-05	1.27E-03
Arom>C10-C12 -F2	7.42E+01	2.70E-02	3.64E-04	3.58E-01	4.82E-03	--	--	5.13E-05	6.90E-07	3.85E-04	5.19E-06	5.19E-03
Arom>C12-C16 -F2	7.42E+01	3.30E-02	4.45E-04	2.93E-01	3.95E-03	--	--	8.85E-05	1.19E-06	4.71E-04	6.34E-06	4.40E-03
F2 - Total												**1.23E-02**
Aliph>C16-C21-F3	2.97E+02	9.85E-01	3.32E-03	8.75E-03	2.95E-05	--	--	1.41E-01	4.76E-04	2.40E-03	8.07E-06	3.83E-03
Aliph>C21-C34 -F3	2.97E+02	4.22E-01	1.42E-03	1.28E-05	4.30E-08	--	--	2.41E-02	8.12E-05	1.03E-03	3.46E-06	1.51E-03
Arom>C16-C21 -F3	7.42E+01	2.46E-01	3.32E-03	1.11E+00	1.49E-02	--	--	1.24E-03	1.67E-05	5.99E-04	8.07E-06	1.83E-02
Arom>C21-C34 -F3	7.42E+01	1.06E-01	1.42E-03	1.42E-01	1.91E-03	--	--	2.09E-03	2.82E-05	2.57E-04	3.46E-06	3.36E-03
F3 - Total												**2.70E-02**
Aliph>C34-C50 -F4	7.42E+02	2.87E-01	3.87E-04	3.08E-06	4.15E-09	--	--	8.43E-03	1.14E-05	3.42E-03	4.61E-06	4.03E-04
Arom>C34-C50 -F4	7.42E+01	7.18E-02	9.68E-04	3.24E-02	4.36E-04	--	--	6.74E-03	9.07E-05	8.56E-04	1.15E-05	1.51E-03
F4 - Total												**1.91E-03**
Organics												
Aroclor 1254 (Total PCBs)	6.28E-01	2.82E-04	4.50E-04	2.08E-02	3.31E-02	--	--	7.44E-03	1.18E-02	4.28E-06	6.82E-06	4.54E-02
Inorganics												
Beryllium	2.84E+00	4.11E-04	1.45E-04	1.40E-04	4.94E-05	--	--	1.45E-06	5.10E-07	4.28E-06	1.51E-06	1.96E-04
Cadmium	8.60E+00	2.36E-04	2.74E-05	8.25E-02	9.59E-03	--	--	1.16E-03	1.35E-04	5.13E-06	5.97E-07	9.75E-03
Chromium (Total)	1.18E+04	5.13E-02	4.36E-06	3.76E+00	3.19E-04	--	--	1.39E-02	1.18E-06	9.41E-05	8.00E-09	3.25E-04
Copper	1.39E+01	3.67E-02	2.64E-03	3.00E+00	2.16E-01	--	--	5.27E-02	3.80E-03	3.42E-04	2.47E-05	**2.22E-01**
Lead	6.88E+01	2.63E-02	3.82E-04	1.99E+00	2.90E-02	--	--	1.68E-02	2.44E-04	8.56E-05	1.24E-06	2.96E-02
Zinc	2.75E+02	8.18E-02	2.97E-04	2.13E+01	7.74E-02	--	--	5.05E-01	1.83E-03	4.79E-03	1.74E-05	7.95E-02

Ecological Hazard Quotients for the Snowy Owl Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**1.11E-02**
Aliph>C06-C08 - F1	5.77E+02	1.28E-03	2.22E-06	--	--	--	--	8.61E-05	1.49E-07	1.79E-03	3.11E-06	5.48E-06
Aliph>C08-C10 -F1	5.77E+02	8.40E-04	1.46E-06	--	--	--	--	5.64E-04	9.76E-07	1.17E-03	2.03E-06	4.46E-06
Arom>C08-C10 -F1	5.77E+01	2.10E-04	3.64E-06	--	--	--	--	1.41E-06	2.44E-08	2.93E-04	5.08E-06	8.75E-06
F1 - Total												**1.87E-05**
Aliph>C10-C12 -F2	5.77E+02	9.71E-02	1.68E-04	--	--	--	--	1.97E-02	3.42E-05	8.38E-04	1.45E-06	2.04E-04
Aliph>C12-C16 -F2	5.77E+02	1.19E-01	2.06E-04	--	--	--	--	3.36E-01	5.82E-04	1.02E-03	1.77E-06	7.90E-04
Arom>C10-C12 -F2	5.77E+01	2.43E-02	4.21E-04	--	--	--	--	6.14E-05	1.06E-06	2.10E-04	3.63E-06	4.25E-04
Arom>C12-C16 -F2	5.77E+01	2.97E-02	5.14E-04	--	--	--	--	1.50E-04	2.60E-06	2.56E-04	4.44E-06	5.21E-04
F2 - Total												**1.94E-03**
Aliph>C16-C21-F3	1.15E+03	8.85E-01	7.67E-04	--	--	--	--	1.49E+00	1.29E-03	1.30E-03	1.13E-06	2.06E-03
Aliph>C21-C34 -F3	1.73E+02	3.79E-01	2.19E-03	--	--	--	--	2.55E-01	1.47E-03	5.59E-04	3.23E-06	3.67E-03
Arom>C16-C21 -F3	1.15E+02	2.21E-01	1.92E-03	--	--	--	--	3.49E-03	3.02E-05	3.26E-04	2.82E-06	1.95E-03
Arom>C21-C34 -F3	1.73E+02	9.49E-02	5.48E-04	--	--	--	--	1.22E-02	7.03E-05	1.40E-04	8.07E-07	6.19E-04
F3 - Total												**8.30E-03**
Aliph>C34-C50 -F4	3.46E+03	2.58E-01	7.46E-05	--	--	--	--	8.94E-02	2.58E-05	1.86E-03	5.38E-07	1.01E-04
Arom>C34-C50 -F4	1.73E+02	6.46E-02	3.73E-04	--	--	--	--	5.63E-02	3.25E-04	4.66E-04	2.69E-06	7.01E-04
F4 - Total												**8.01E-04**
Organics												
Aroclor 1254 (Total PCBs)	2.08E+00	2.54E-04	1.22E-04	--	--	--	--	1.77E-03	8.53E-04	2.33E-06	1.12E-06	9.76E-04
Inorganics												
Beryllium	9.40E-01	3.69E-04	3.93E-04	--	--	--	--	1.27E-05	1.36E-05	2.33E-06	2.48E-06	4.09E-04
Cadmium	2.31E+01	2.12E-04	9.18E-06	--	--	--	--	1.23E-02	5.34E-04	2.79E-06	1.21E-07	5.43E-04
Chromium (Total)	5.52E+00	4.61E-02	8.36E-03	--	--	--	--	1.47E-01	2.66E-02	5.12E-05	9.28E-06	3.50E-02
Copper	1.09E+02	3.30E-02	3.04E-04	--	--	--	--	5.59E-01	5.14E-03	1.86E-04	1.71E-06	5.45E-03
Lead	1.91E+01	2.37E-02	1.24E-03	--	--	--	--	1.78E-01	9.35E-03	4.66E-05	2.44E-06	1.06E-02
Zinc	1.34E+02	7.35E-02	5.50E-04	--	--	--	--	5.35E+00	4.00E-02	2.61E-03	1.95E-05	4.06E-02

Ecological Hazard Quotients for the Lemming Exposed to Constituents of Interest in the FOX-C Upper Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**7.11E-02**
Aliph>C06-C08 - F1	1.97E+02	3.49E-03	1.78E-05	2.09E-02	1.06E-04	--	--	--	--	8.66E-03	4.41E-05	1.68E-04
Aliph>C08-C10 -F1	1.97E+02	2.29E-03	1.16E-05	3.61E-03	1.84E-05	--	--	--	--	5.67E-03	2.88E-05	5.88E-05
Arom>C08-C10 -F1	4.91E+01	5.71E-04	1.16E-05	1.29E-02	2.63E-04	--	--	--	--	1.42E-03	2.88E-05	3.04E-04
F1 - Total												**5.30E-04**
Aliph>C10-C12 -F2	1.97E+02	2.64E-01	1.34E-03	2.17E-01	1.11E-03	--	--	--	--	4.05E-03	2.06E-05	2.47E-03
Aliph>C12-C16 -F2	1.97E+02	3.23E-01	1.64E-03	4.59E-02	2.33E-04	--	--	--	--	4.95E-03	2.52E-05	1.90E-03
Arom>C10-C12 -F2	9.83E+01	6.60E-02	6.72E-04	8.10E-01	8.24E-03	--	--	--	--	1.01E-03	1.03E-05	8.92E-03
Arom>C12-C16 -F2	9.83E+01	8.07E-02	8.21E-04	6.64E-01	6.76E-03	--	--	--	--	1.24E-03	1.26E-05	7.59E-03
F2 - Total												**2.09E-02**
Aliph>C16-C21-F3	3.93E+02	2.41E+00	6.13E-03	1.98E-02	5.04E-05	--	--	--	--	6.30E-03	1.60E-05	6.19E-03
Aliph>C21-C34 -F3	3.93E+02	1.03E+00	2.63E-03	2.89E-05	7.36E-08	--	--	--	--	2.70E-03	6.87E-06	2.63E-03
Arom>C16-C21 -F3	9.83E+01	6.02E-01	6.13E-03	2.51E+00	2.56E-02	--	--	--	--	1.58E-03	1.60E-05	3.17E-02
Arom>C21-C34 -F3	9.83E+01	2.58E-01	2.63E-03	3.21E-01	3.26E-03	--	--	--	--	6.75E-04	6.87E-06	5.90E-03
F3 - Total												**4.64E-02**
Aliph>C34-C50 -F4	9.83E+02	7.03E-01	7.15E-04	6.97E-06	7.09E-09	--	--	--	--	9.00E-03	9.16E-06	7.24E-04
Arom>C34-C50 -F4	9.83E+01	1.76E-01	1.79E-03	7.33E-02	7.46E-04	--	--	--	--	2.25E-03	2.29E-05	2.56E-03
F4 - Total												**3.28E-03**
Organics												
Aroclor 1254 (Total PCBs)	8.31E-01	6.90E-04	8.30E-04	4.70E-02	5.66E-02	--	--	--	--	1.13E-05	1.35E-05	5.74E-02
Inorganics												
Beryllium	3.76E+00	1.00E-03	2.67E-04	3.18E-04	8.46E-05	--	--	--	--	1.13E-05	2.99E-06	3.55E-04
Cadmium	1.14E+01	5.76E-04	5.06E-05	1.87E-01	1.64E-02	--	--	--	--	1.35E-05	1.19E-06	1.65E-02
Chromium (Total)	1.56E+04	1.26E-01	8.05E-06	8.51E+00	5.46E-04	--	--	--	--	2.48E-04	1.59E-08	5.54E-04
Copper	1.84E+01	8.97E-02	4.88E-03	6.79E+00	3.69E-01	--	--	--	--	9.00E-04	4.90E-05	**3.74E-01**
Lead	9.11E+01	6.43E-02	7.06E-04	4.51E+00	4.95E-02	--	--	--	--	2.25E-04	2.47E-06	5.02E-02
Zinc	3.64E+02	2.00E-01	5.49E-04	4.82E+01	1.32E-01	--	--	--	--	1.26E-02	3.46E-05	**1.33E-01**

Ecological Hazard Quotients for the Caribou Exposed to Constituents of Interest in the Background

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**0.00E+00**
Aliph>C06-C08 - F1	1.22E+02	--	--	--	--	--	--	--	--	--	--	--
Aliph>C08-C10 -F1	1.22E+02	--	--	--	--	--	--	--	--	--	--	--
Arom>C08-C10 -F1	3.04E+01	--	--	--	--	--	--	--	--	--	--	--
F1 - Total												**0.00E+00**
Aliph>C10-C12 -F2	1.22E+02	--	--	--	--	--	--	--	--	--	--	--
Aliph>C12-C16 -F2	1.22E+02	--	--	--	--	--	--	--	--	--	--	--
Arom>C10-C12 -F2	6.09E+01	--	--	--	--	--	--	--	--	--	--	--
Arom>C12-C16 -F2	6.09E+01	--	--	--	--	--	--	--	--	--	--	--
F2 - Total												**0.00E+00**
Aliph>C16-C21-F3	2.43E+02	--	--	--	--	--	--	--	--	--	--	--
Aliph>C21-C34 -F3	2.43E+02	--	--	--	--	--	--	--	--	--	--	--
Arom>C16-C21 -F3	6.09E+01	--	--	--	--	--	--	--	--	--	--	--
Arom>C21-C34 -F3	6.09E+01	--	--	--	--	--	--	--	--	--	--	--
F3 - Total												**0.00E+00**
Aliph>C34-C50 -F4	6.09E+02	--	--	--	--	--	--	--	--	--	--	--
Arom>C34-C50 -F4	6.09E+01	--	--	--	--	--	--	--	--	--	--	--
F4 - Total												**0.00E+00**
Organics												
Aroclor 1254 (Total PCBs)	5.15E-01	--	--	--	--	--	--	--	--	--	--	--
Inorganics												
Beryllium	2.33E+00	5.47E-04	2.35E-04	8.45E-05	3.63E-05	--	--	--	--	3.07E-06	1.32E-06	2.73E-04
Cadmium	7.05E+00	1.95E-04	2.76E-05	6.59E-03	9.34E-04	--	--	--	--	3.69E-06	5.23E-07	9.62E-04
Chromium (Total)	9.65E+03	6.92E-02	7.17E-06	6.98E-02	7.23E-06	--	--	--	--	6.76E-05	7.00E-09	1.44E-05
Copper	1.14E+01	4.00E-02	3.51E-03	2.20E-01	1.94E-02	--	--	--	--	2.46E-04	2.16E-05	2.29E-02
Lead	5.64E+01	2.09E-02	3.71E-04	4.97E-02	8.81E-04	--	--	--	--	6.15E-05	1.09E-06	1.25E-03
Zinc	2.26E+02	9.06E-02	4.01E-04	1.36E+00	6.03E-03	--	--	--	--	3.44E-03	1.52E-05	6.44E-03

Ecological Hazard Quotients for the Ptarmigan Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**2.50E-02**
Aliph>C06-C08 - F1	4.35E+02	5.80E-03	1.33E-05	3.47E-02	7.97E-05	9.67E-03	2.22E-05	--	--	2.85E-03	6.55E-06	1.22E-04
Aliph>C08-C10 -F1	4.35E+02	3.80E-03	8.73E-06	6.00E-03	1.38E-05	6.33E-03	1.45E-05	--	--	1.86E-03	4.28E-06	4.13E-05
Arom>C08-C10 -F1	4.35E+01	9.49E-04	2.18E-05	2.15E-02	4.94E-04	1.58E-03	3.64E-05	--	--	4.66E-04	1.07E-05	5.62E-04
F1 - Total												**7.26E-04**
Aliph>C10-C12 -F2	4.35E+02	8.12E-02	1.87E-04	6.68E-02	1.54E-04	1.35E-01	3.11E-04	--	--	1.33E-03	3.06E-06	6.54E-04
Aliph>C12-C16 -F2	4.35E+02	9.92E-02	2.28E-04	1.41E-02	3.24E-05	1.65E-01	3.80E-04	--	--	1.63E-03	3.74E-06	6.44E-04
Arom>C10-C12 -F2	4.35E+01	2.03E-02	4.66E-04	2.49E-01	5.72E-03	3.38E-02	7.77E-04	--	--	3.33E-04	7.65E-06	6.97E-03
Arom>C12-C16 -F2	4.35E+01	2.48E-02	5.70E-04	2.04E-01	4.69E-03	4.14E-02	9.50E-04	--	--	4.07E-04	9.35E-06	6.22E-03
F2 - Total												**1.45E-02**
Aliph>C16-C21-F3	8.71E+02	2.55E-01	2.93E-04	2.10E-03	2.41E-06	4.25E-01	4.88E-04	--	--	2.07E-03	2.38E-06	7.86E-04
Aliph>C21-C34 -F3	1.31E+02	1.09E-01	8.37E-04	3.06E-06	2.35E-08	1.82E-01	1.39E-03	--	--	8.88E-04	6.80E-06	2.24E-03
Arom>C16-C21 -F3	8.71E+01	6.38E-02	7.32E-04	2.66E-01	3.06E-03	1.06E-01	1.22E-03	--	--	5.18E-04	5.95E-06	5.02E-03
Arom>C21-C34 -F3	1.31E+02	2.73E-02	2.09E-04	3.40E-02	2.60E-04	4.55E-02	3.49E-04	--	--	2.22E-04	1.70E-06	8.20E-04
F3 - Total												**8.86E-03**
Aliph>C34-C50 -F4	2.61E+03	1.32E-01	5.06E-05	1.31E-06	5.02E-10	2.20E-01	8.43E-05	--	--	2.96E-03	1.13E-06	1.36E-04
Arom>C34-C50 -F4	1.31E+02	3.30E-02	2.53E-04	1.38E-02	1.06E-04	5.50E-02	4.21E-04	--	--	7.40E-04	5.67E-06	7.85E-04
F4 - Total												**9.21E-04**
Organics												
Aroclor 1254 (Total PCBs)	1.57E+00	7.44E-05	4.75E-05	2.03E-02	1.29E-02	2.76E-04	1.76E-04	--	--	3.70E-06	2.36E-06	1.32E-02
Inorganics												
Beryllium	7.09E-01	8.08E-04	1.14E-03	2.56E-04	3.61E-04	9.70E-05	1.37E-04	--	--	3.70E-06	5.22E-06	1.64E-03
Cadmium	1.74E+01	1.22E-04	7.03E-06	8.06E-02	4.63E-03	4.51E-03	2.59E-04	--	--	4.44E-06	2.55E-07	4.90E-03
Chromium (Total)	4.16E+00	1.18E-01	2.84E-02	3.67E+00	8.82E-01	3.54E-02	8.50E-03	--	--	8.14E-05	1.96E-05	**9.19E-01**
Copper	8.19E+01	4.49E-02	5.48E-04	2.93E+00	3.57E-02	5.21E-02	6.36E-04	--	--	2.96E-04	3.61E-06	3.69E-02
Lead	1.44E+01	1.61E-02	1.12E-03	1.95E+00	1.35E-01	2.18E-02	1.51E-03	--	--	7.40E-05	5.15E-06	**1.38E-01**
Zinc	1.01E+02	1.19E-01	1.18E-03	2.08E+01	2.06E-01	1.43E+00	1.42E-02	--	--	4.14E-03	4.11E-05	**2.22E-01**

Ecological Hazard Quotients for the Ermine Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**1.48E-02**
Aliph>C06-C08 - F1	1.83E+02	6.74E-03	3.68E-05	1.44E-03	7.85E-06	8.02E-03	4.38E-05	3.49E-04	1.90E-06	2.79E-03	1.52E-05	1.05E-04
Aliph>C08-C10 -F1	1.83E+02	4.41E-03	2.41E-05	2.49E-04	1.36E-06	5.25E-03	2.86E-05	1.30E-03	7.09E-06	1.83E-03	9.96E-06	7.11E-05
Arom>C08-C10 -F1	4.58E+01	1.10E-03	2.41E-05	8.91E-04	1.94E-05	1.31E-03	2.86E-05	1.50E-05	3.28E-07	4.56E-04	9.96E-06	8.24E-05
F1 - Total												**2.59E-04**
Aliph>C10-C12 -F2	1.83E+02	9.43E-02	5.14E-04	2.77E-03	1.51E-05	1.12E-01	6.12E-04	2.68E-02	1.46E-04	1.30E-03	7.11E-06	1.30E-03
Aliph>C12-C16 -F2	1.83E+02	1.15E-01	6.29E-04	5.85E-04	3.19E-06	1.37E-01	7.49E-04	3.28E-01	1.79E-03	1.59E-03	8.69E-06	3.18E-03
Arom>C10-C12 -F2	9.17E+01	2.36E-02	2.57E-04	1.03E-02	1.13E-04	2.81E-02	3.06E-04	4.79E-04	5.23E-06	3.26E-04	3.56E-06	6.85E-04
Arom>C12-C16 -F2	9.17E+01	2.88E-02	3.14E-04	8.47E-03	9.24E-05	3.43E-02	3.74E-04	8.28E-04	9.03E-06	3.98E-04	4.35E-06	7.94E-04
F2 - Total												**5.95E-03**
Aliph>C16-C21-F3	3.67E+02	2.96E-01	8.08E-04	8.71E-05	2.38E-07	3.53E-01	9.62E-04	4.64E-01	1.27E-03	2.03E-03	5.53E-06	3.04E-03
Aliph>C21-C34 -F3	3.67E+02	1.27E-01	3.46E-04	1.27E-07	3.46E-10	1.51E-01	4.12E-04	7.92E-02	2.16E-04	8.69E-04	2.37E-06	9.77E-04
Arom>C16-C21 -F3	9.17E+01	7.41E-02	8.08E-04	1.10E-02	1.20E-04	8.82E-02	9.62E-04	4.01E-03	4.37E-05	5.07E-04	5.53E-06	1.94E-03
Arom>C21-C34 -F3	9.17E+01	3.17E-02	3.46E-04	1.41E-03	1.54E-05	3.78E-02	4.12E-04	6.81E-03	7.43E-05	2.17E-04	2.37E-06	8.50E-04
F3 - Total												**6.81E-03**
Aliph>C34-C50 -F4	9.17E+02	1.53E-01	1.67E-04	5.43E-08	5.93E-11	1.83E-01	1.99E-04	5.03E-02	5.49E-05	2.90E-03	3.16E-06	4.25E-04
Arom>C34-C50 -F4	9.17E+01	3.83E-02	4.18E-04	5.72E-04	6.24E-06	4.56E-02	4.98E-04	3.98E-02	4.34E-04	7.24E-04	7.90E-06	1.36E-03
F4 - Total												**1.79E-03**
Organics												
Aroclor 1254 (Total PCBs)	7.75E-01	8.64E-05	1.12E-04	8.42E-04	1.09E-03	2.29E-04	2.95E-04	9.58E-02	1.24E-01	3.62E-06	4.67E-06	**1.25E-01**
Inorganics												
Beryllium	3.51E+00	9.38E-04	2.68E-04	1.06E-05	3.03E-06	8.04E-05	2.29E-05	3.50E-05	9.98E-06	3.62E-06	1.03E-06	3.05E-04
Cadmium	1.06E+01	1.42E-04	1.34E-05	3.34E-03	3.15E-04	3.74E-03	3.52E-04	1.08E-02	1.02E-03	4.35E-06	4.09E-07	1.70E-03
Chromium (Total)	1.45E+04	1.37E-01	9.44E-06	1.52E-01	1.05E-05	2.94E-02	2.02E-06	3.22E-01	2.22E-05	7.97E-05	5.48E-09	4.41E-05
Copper	1.71E+01	5.22E-02	3.05E-03	1.21E-01	7.09E-03	4.32E-02	2.52E-03	7.05E-01	4.12E-02	2.90E-04	1.69E-05	5.39E-02
Lead	8.50E+01	1.87E-02	2.20E-04	8.08E-02	9.50E-04	1.81E-02	2.13E-04	1.73E-01	2.04E-03	7.24E-05	8.53E-07	3.42E-03
Zinc	3.40E+02	1.39E-01	4.08E-04	8.63E-01	2.54E-03	1.19E+00	3.49E-03	6.77E+00	1.99E-02	4.06E-03	1.19E-05	2.64E-02

Ecological Hazard Quotients for the Arctic Fox Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**1.01E-02**
Aliph>C06-C08 - F1	1.46E+02	5.88E-03	4.03E-05	1.13E-03	7.78E-06	--	--	3.08E-04	2.11E-06	3.20E-03	2.19E-05	7.22E-05
Aliph>C08-C10 -F1	1.46E+02	3.85E-03	2.64E-05	1.96E-04	1.35E-06	--	--	1.15E-03	7.85E-06	2.09E-03	1.44E-05	5.00E-05
Arom>C08-C10 -F1	3.65E+01	9.63E-04	2.64E-05	7.03E-04	1.93E-05	--	--	1.33E-05	3.64E-07	5.24E-04	1.44E-05	6.04E-05
F1 - Total												**1.82E-04**
Aliph>C10-C12 -F2	1.46E+02	8.23E-02	5.64E-04	2.19E-03	1.50E-05	--	--	2.36E-02	1.62E-04	1.50E-03	1.03E-05	7.52E-04
Aliph>C12-C16 -F2	1.46E+02	1.01E-01	6.90E-04	4.61E-04	3.16E-06	--	--	2.89E-01	1.98E-03	1.83E-03	1.25E-05	2.69E-03
Arom>C10-C12 -F2	7.30E+01	2.06E-02	2.82E-04	8.15E-03	1.12E-04	--	--	4.22E-04	5.79E-06	3.74E-04	5.13E-06	4.05E-04
Arom>C12-C16 -F2	7.30E+01	2.52E-02	3.45E-04	6.68E-03	9.15E-05	--	--	7.30E-04	1.00E-05	4.57E-04	6.27E-06	4.53E-04
F2 - Total												**4.29E-03**
Aliph>C16-C21-F3	2.92E+02	2.59E-01	8.86E-04	6.87E-05	2.35E-07	--	--	4.09E-01	1.40E-03	2.33E-03	7.98E-06	2.30E-03
Aliph>C21-C34 -F3	2.92E+02	1.11E-01	3.80E-04	1.00E-07	3.43E-10	--	--	6.98E-02	2.39E-04	9.98E-04	3.42E-06	6.22E-04
Arom>C16-C21 -F3	7.30E+01	6.47E-02	8.86E-04	8.71E-03	1.19E-04	--	--	3.53E-03	4.84E-05	5.82E-04	7.98E-06	1.06E-03
Arom>C21-C34 -F3	7.30E+01	2.77E-02	3.80E-04	1.11E-03	1.52E-05	--	--	6.00E-03	8.22E-05	2.49E-04	3.42E-06	4.81E-04
F3 - Total												**4.46E-03**
Aliph>C34-C50 -F4	7.30E+02	1.34E-01	1.84E-04	4.29E-08	5.87E-11	--	--	4.43E-02	6.07E-05	3.33E-03	4.56E-06	2.49E-04
Arom>C34-C50 -F4	7.30E+01	3.35E-02	4.59E-04	4.51E-04	6.18E-06	--	--	3.51E-02	4.81E-04	8.31E-04	1.14E-05	9.57E-04
F4 - Total												**1.21E-03**
Organics												
Aroclor 1254 (Total PCBs)	6.17E-01	7.55E-05	1.22E-04	6.64E-04	1.08E-03	--	--	8.44E-02	1.37E-01	4.16E-06	6.74E-06	**1.38E-01**
Inorganics												
Beryllium	2.79E+00	8.19E-04	2.94E-04	8.37E-06	3.00E-06	--	--	3.08E-05	1.11E-05	4.16E-06	1.49E-06	3.09E-04
Cadmium	8.45E+00	1.24E-04	1.47E-05	2.64E-03	3.12E-04	--	--	9.51E-03	1.12E-03	4.99E-06	5.90E-07	1.45E-03
Chromium (Total)	1.16E+04	1.20E-01	1.04E-05	1.20E-01	1.04E-05	--	--	2.84E-01	2.45E-05	9.14E-05	7.90E-09	4.53E-05
Copper	1.36E+01	4.56E-02	3.34E-03	9.57E-02	7.02E-03	--	--	6.22E-01	4.56E-02	3.33E-04	2.44E-05	5.60E-02
Lead	6.76E+01	1.63E-02	2.41E-04	6.37E-02	9.42E-04	--	--	1.52E-01	2.25E-03	8.31E-05	1.23E-06	3.44E-03
Zinc	2.71E+02	1.21E-01	4.47E-04	6.81E-01	2.52E-03	--	--	5.96E+00	2.20E-02	4.66E-03	1.72E-05	2.50E-02

Ecological Hazard Quotients for the Caribou Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**1.73E-02**
Aliph>C06-C08 - F1	1.22E+02	7.62E-03	6.26E-05	2.22E-02	1.83E-04	--	--	--	--	2.37E-03	1.94E-05	2.65E-04
Aliph>C08-C10 -F1	1.22E+02	4.99E-03	4.10E-05	3.84E-03	3.16E-05	--	--	--	--	1.55E-03	1.27E-05	8.52E-05
Arom>C08-C10 -F1	3.04E+01	1.25E-03	4.10E-05	1.38E-02	4.52E-04	--	--	--	--	3.87E-04	1.27E-05	5.06E-04
F1 - Total												**8.56E-04**
Aliph>C10-C12 -F2	1.22E+02	1.07E-01	8.76E-04	4.28E-02	3.52E-04	--	--	--	--	1.11E-03	9.09E-06	1.24E-03
Aliph>C12-C16 -F2	1.22E+02	1.30E-01	1.07E-03	9.03E-03	7.42E-05	--	--	--	--	1.35E-03	1.11E-05	1.16E-03
Arom>C10-C12 -F2	6.09E+01	2.67E-02	4.38E-04	1.59E-01	2.62E-03	--	--	--	--	2.77E-04	4.54E-06	3.06E-03
Arom>C12-C16 -F2	6.09E+01	3.26E-02	5.35E-04	1.31E-01	2.15E-03	--	--	--	--	3.38E-04	5.55E-06	2.69E-03
F2 - Total												**8.14E-03**
Aliph>C16-C21-F3	2.43E+02	3.35E-01	1.38E-03	1.34E-03	5.52E-06	--	--	--	--	1.72E-03	7.07E-06	1.39E-03
Aliph>C21-C34 -F3	2.43E+02	1.44E-01	5.89E-04	1.96E-06	8.05E-09	--	--	--	--	7.38E-04	3.03E-06	5.92E-04
Arom>C16-C21 -F3	6.09E+01	8.37E-02	1.38E-03	1.70E-01	2.80E-03	--	--	--	--	4.30E-04	7.07E-06	4.18E-03
Arom>C21-C34 -F3	6.09E+01	3.59E-02	5.89E-04	2.18E-02	3.57E-04	--	--	--	--	1.84E-04	3.03E-06	9.50E-04
F3 - Total												**7.11E-03**
Aliph>C34-C50 -F4	6.09E+02	1.73E-01	2.85E-04	8.39E-07	1.38E-09	--	--	--	--	2.46E-03	4.04E-06	2.89E-04
Arom>C34-C50 -F4	6.09E+01	4.33E-02	7.12E-04	8.83E-03	1.45E-04	--	--	--	--	6.15E-04	1.01E-05	8.67E-04
F4 - Total												**1.16E-03**
Organics												
Aroclor 1254 (Total PCBs)	5.15E-01	9.77E-05	1.90E-04	1.30E-02	2.52E-02	--	--	--	--	3.07E-06	5.97E-06	2.54E-02
Inorganics												
Beryllium	2.33E+00	1.06E-03	4.56E-04	1.64E-04	7.04E-05	--	--	--	--	3.07E-06	1.32E-06	5.27E-04
Cadmium	7.05E+00	1.61E-04	2.28E-05	5.16E-02	7.32E-03	--	--	--	--	3.69E-06	5.23E-07	7.34E-03
Chromium (Total)	9.65E+03	1.55E-01	1.61E-05	2.35E+00	2.44E-04	--	--	--	--	6.76E-05	7.00E-09	2.60E-04
Copper	1.14E+01	5.90E-02	5.19E-03	1.87E+00	1.65E-01	--	--	--	--	2.46E-04	2.16E-05	**1.70E-01**
Lead	5.64E+01	2.11E-02	3.74E-04	1.25E+00	2.21E-02	--	--	--	--	6.15E-05	1.09E-06	2.25E-02
Zinc	2.26E+02	1.57E-01	6.94E-04	1.33E+01	5.90E-02	--	--	--	--	3.44E-03	1.52E-05	5.97E-02

Ecological Hazard Quotients for the Arctic Hare Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**1.73E-02**
Aliph>C06-C08 - F1	1.48E+02	5.50E-03	3.71E-05	3.55E-02	2.39E-04	--	--	2.67E-05	1.80E-07	3.29E-03	2.22E-05	2.99E-04
Aliph>C08-C10 -F1	1.48E+02	3.60E-03	2.43E-05	6.14E-03	4.14E-05	--	--	9.93E-05	6.69E-07	2.16E-03	1.45E-05	8.08E-05
Arom>C08-C10 -F1	3.71E+01	9.00E-04	2.43E-05	2.20E-02	5.92E-04	--	--	1.15E-06	3.10E-08	5.39E-04	1.45E-05	6.31E-04
F1 - Total												**1.01E-03**
Aliph>C10-C12 -F2	1.48E+02	7.70E-02	5.19E-04	6.84E-02	4.61E-04	--	--	2.05E-03	1.38E-05	1.54E-03	1.04E-05	1.00E-03
Aliph>C12-C16 -F2	1.48E+02	9.41E-02	6.34E-04	1.44E-02	9.72E-05	--	--	2.50E-02	1.69E-04	1.88E-03	1.27E-05	9.12E-04
Arom>C10-C12 -F2	7.42E+01	1.92E-02	2.59E-04	2.55E-01	3.43E-03	--	--	3.66E-05	4.93E-07	3.85E-04	5.19E-06	3.70E-03
Arom>C12-C16 -F2	7.42E+01	2.35E-02	3.17E-04	2.09E-01	2.81E-03	--	--	6.32E-05	8.52E-07	4.71E-04	6.34E-06	3.14E-03
F2 - Total												**8.75E-03**
Aliph>C16-C21-F3	2.97E+02	2.42E-01	8.14E-04	2.15E-03	7.24E-06	--	--	3.55E-02	1.19E-04	2.40E-03	8.07E-06	9.49E-04
Aliph>C21-C34 -F3	2.97E+02	1.04E-01	3.49E-04	3.13E-06	1.06E-08	--	--	6.05E-03	2.04E-05	1.03E-03	3.46E-06	3.73E-04
Arom>C16-C21 -F3	7.42E+01	6.04E-02	8.14E-04	2.72E-01	3.67E-03	--	--	3.06E-04	4.12E-06	5.99E-04	8.07E-06	4.50E-03
Arom>C21-C34 -F3	7.42E+01	2.59E-02	3.49E-04	3.48E-02	4.68E-04	--	--	5.20E-04	7.01E-06	2.57E-04	3.46E-06	8.28E-04
F3 - Total												**6.65E-03**
Aliph>C34-C50 -F4	7.42E+02	1.25E-01	1.69E-04	1.34E-06	1.81E-09	--	--	3.84E-03	5.17E-06	3.42E-03	4.61E-06	1.78E-04
Arom>C34-C50 -F4	7.42E+01	3.13E-02	4.22E-04	1.41E-02	1.90E-04	--	--	3.04E-03	4.09E-05	8.56E-04	1.15E-05	6.64E-04
F4 - Total												**8.43E-04**
Organics												
Aroclor 1254 (Total PCBs)	6.28E-01	7.05E-05	1.12E-04	2.08E-02	3.31E-02	--	--	7.32E-03	1.17E-02	4.28E-06	6.82E-06	4.49E-02
Inorganics												
Beryllium	2.84E+00	7.66E-04	2.70E-04	2.62E-04	9.23E-05	--	--	2.67E-06	9.41E-07	4.28E-06	1.51E-06	3.65E-04
Cadmium	8.60E+00	1.16E-04	1.35E-05	8.25E-02	9.59E-03	--	--	8.24E-04	9.58E-05	5.13E-06	5.97E-07	9.70E-03
Chromium (Total)	1.18E+04	1.12E-01	9.52E-06	3.76E+00	3.19E-04	--	--	2.46E-02	2.09E-06	9.41E-05	8.00E-09	3.31E-04
Copper	1.39E+01	4.26E-02	3.07E-03	3.00E+00	2.16E-01	--	--	5.39E-02	3.89E-03	3.42E-04	2.47E-05	**2.23E-01**
Lead	6.88E+01	1.52E-02	2.21E-04	1.99E+00	2.90E-02	--	--	1.32E-02	1.92E-04	8.56E-05	1.24E-06	2.94E-02
Zinc	2.75E+02	1.13E-01	4.11E-04	2.13E+01	7.74E-02	--	--	5.17E-01	1.88E-03	4.79E-03	1.74E-05	7.97E-02

Ecological Hazard Quotients for the Snowy Owl Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**3.85E-03**
Aliph>C06-C08 - F1	5.77E+02	4.95E-03	8.57E-06	--	--	--	--	1.17E-04	2.03E-07	1.79E-03	3.11E-06	1.19E-05
Aliph>C08-C10 -F1	5.77E+02	3.24E-03	5.61E-06	--	--	--	--	7.65E-04	1.33E-06	1.17E-03	2.03E-06	8.97E-06
Arom>C08-C10 -F1	5.77E+01	8.09E-04	1.40E-05	--	--	--	--	1.91E-06	3.31E-08	2.93E-04	5.08E-06	1.91E-05
F1 - Total												**4.00E-05**
Aliph>C10-C12 -F2	5.77E+02	6.92E-02	1.20E-04	--	--	--	--	1.43E-02	2.48E-05	8.38E-04	1.45E-06	1.46E-04
Aliph>C12-C16 -F2	5.77E+02	8.46E-02	1.47E-04	--	--	--	--	2.44E-01	4.22E-04	1.02E-03	1.77E-06	5.70E-04
Arom>C10-C12 -F2	5.77E+01	1.73E-02	3.00E-04	--	--	--	--	4.45E-05	7.71E-07	2.10E-04	3.63E-06	3.04E-04
Arom>C12-C16 -F2	5.77E+01	2.12E-02	3.66E-04	--	--	--	--	1.09E-04	1.88E-06	2.56E-04	4.44E-06	3.73E-04
F2 - Total												**1.39E-03**
Aliph>C16-C21-F3	1.15E+03	2.17E-01	1.88E-04	--	--	--	--	3.74E-01	3.24E-04	1.30E-03	1.13E-06	5.13E-04
Aliph>C21-C34 -F3	1.73E+02	9.32E-02	5.38E-04	--	--	--	--	6.41E-02	3.70E-04	5.59E-04	3.23E-06	9.11E-04
Arom>C16-C21 -F3	1.15E+02	5.43E-02	4.71E-04	--	--	--	--	8.77E-04	7.59E-06	3.26E-04	2.82E-06	4.81E-04
Arom>C21-C34 -F3	1.73E+02	2.33E-02	1.35E-04	--	--	--	--	3.05E-03	1.76E-05	1.40E-04	8.07E-07	1.53E-04
F3 - Total												**2.06E-03**
Aliph>C34-C50 -F4	3.46E+03	1.13E-01	3.25E-05	--	--	--	--	4.07E-02	1.18E-05	1.86E-03	5.38E-07	4.48E-05
Arom>C34-C50 -F4	1.73E+02	2.81E-02	1.63E-04	--	--	--	--	2.56E-02	1.48E-04	4.66E-04	2.69E-06	3.13E-04
F4 - Total												**3.58E-04**
Organics												
Aroclor 1254 (Total PCBs)	2.08E+00	6.34E-05	3.05E-05	--	--	--	--	5.01E-04	2.41E-04	2.33E-06	1.12E-06	2.73E-04
Inorganics												
Beryllium	9.40E-01	6.89E-04	7.33E-04	--	--	--	--	2.34E-05	2.49E-05	2.33E-06	2.48E-06	7.60E-04
Cadmium	2.31E+01	1.04E-04	4.52E-06	--	--	--	--	8.73E-03	3.78E-04	2.79E-06	1.21E-07	3.83E-04
Chromium (Total)	5.52E+00	1.01E-01	1.82E-02	--	--	--	--	2.61E-01	4.72E-02	5.12E-05	9.28E-06	6.55E-02
Copper	1.09E+02	3.83E-02	3.53E-04	--	--	--	--	5.71E-01	5.26E-03	1.86E-04	1.71E-06	5.61E-03
Lead	1.91E+01	1.37E-02	7.19E-04	--	--	--	--	1.40E-01	7.34E-03	4.66E-05	2.44E-06	8.07E-03
Zinc	1.34E+02	1.02E-01	7.61E-04	--	--	--	--	5.48E+00	4.10E-02	2.61E-03	1.95E-05	4.17E-02

Ecological Hazard Quotients for the Lemming Exposed to Constituents of Interest in the FOX-C Lower Site

Constituent	Reference Toxicity Dose (mg/kg-day)	Average Daily Dose (mg/kg-day)	Surface Soil Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Plant Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Invert. Hazard Quotient	Average Daily Dose (mg/kg-day)	Terr. Mammal Hazard Quotient	Average Daily Dose (mg/kg-day)	Surface Water Hazard Quotient	Hazard Quotients and Index
TPH - CCME CWS												**2.95E-02**
Aliph>C06-C08 - F1	1.97E+02	1.35E-02	6.84E-05	8.04E-02	4.09E-04	--	--	--	--	8.66E-03	4.41E-05	5.22E-04
Aliph>C08-C10 -F1	1.97E+02	8.81E-03	4.48E-05	1.39E-02	7.08E-05	--	--	--	--	5.67E-03	2.88E-05	1.44E-04
Arom>C08-C10 -F1	4.91E+01	2.20E-03	4.48E-05	4.98E-02	1.01E-03	--	--	--	--	1.42E-03	2.88E-05	1.09E-03
F1 - Total												**1.75E-03**
Aliph>C10-C12 -F2	1.97E+02	1.88E-01	9.58E-04	1.55E-01	7.88E-04	--	--	--	--	4.05E-03	2.06E-05	1.77E-03
Aliph>C12-C16 -F2	1.97E+02	2.30E-01	1.17E-03	3.27E-02	1.66E-04	--	--	--	--	4.95E-03	2.52E-05	1.36E-03
Arom>C10-C12 -F2	9.83E+01	4.71E-02	4.79E-04	5.77E-01	5.87E-03	--	--	--	--	1.01E-03	1.03E-05	6.36E-03
Arom>C12-C16 -F2	9.83E+01	5.75E-02	5.85E-04	4.73E-01	4.82E-03	--	--	--	--	1.24E-03	1.26E-05	5.41E-03
F2 - Total												**1.49E-02**
Aliph>C16-C21-F3	3.93E+02	5.91E-01	1.50E-03	4.87E-03	1.24E-05	--	--	--	--	6.30E-03	1.60E-05	1.53E-03
Aliph>C21-C34 -F3	3.93E+02	2.53E-01	6.45E-04	7.10E-06	1.81E-08	--	--	--	--	2.70E-03	6.87E-06	6.51E-04
Arom>C16-C21 -F3	9.83E+01	1.48E-01	1.50E-03	6.17E-01	6.28E-03	--	--	--	--	1.58E-03	1.60E-05	7.80E-03
Arom>C21-C34 -F3	9.83E+01	6.34E-02	6.45E-04	7.88E-02	8.01E-04	--	--	--	--	6.75E-04	6.87E-06	1.45E-03
F3 - Total												**1.14E-02**
Aliph>C34-C50 -F4	9.83E+02	3.06E-01	3.11E-04	3.04E-06	3.09E-09	--	--	--	--	9.00E-03	9.16E-06	3.21E-04
Arom>C34-C50 -F4	9.83E+01	7.65E-02	7.79E-04	3.19E-02	3.25E-04	--	--	--	--	2.25E-03	2.29E-05	1.13E-03
F4 - Total												**1.45E-03**
Organics												
Aroclor 1254 (Total PCBs)	8.31E-01	1.73E-04	2.08E-04	4.70E-02	5.66E-02	--	--	--	--	1.13E-05	1.35E-05	5.68E-02
Inorganics												
Beryllium	3.76E+00	1.87E-03	4.98E-04	5.93E-04	1.58E-04	--	--	--	--	1.13E-05	2.99E-06	6.59E-04
Cadmium	1.14E+01	2.84E-04	2.49E-05	1.87E-01	1.64E-02	--	--	--	--	1.35E-05	1.19E-06	1.64E-02
Chromium (Total)	1.56E+04	2.74E-01	1.76E-05	8.51E+00	5.46E-04	--	--	--	--	2.48E-04	1.59E-08	5.64E-04
Copper	1.84E+01	1.04E-01	5.67E-03	6.79E+00	3.69E-01	--	--	--	--	9.00E-04	4.90E-05	**3.75E-01**
Lead	9.11E+01	3.73E-02	4.09E-04	4.51E+00	4.95E-02	--	--	--	--	2.25E-04	2.47E-06	4.99E-02
Zinc	3.64E+02	2.77E-01	7.59E-04	4.82E+01	1.32E-01	--	--	--	--	1.26E-02	3.46E-05	**1.33E-01**

Animal Tissue Concentration Based Upon Plant, Soil and Water Ingestion at FOX-C Upper Site

Constituent	Concentration in Plant (mg/kg-wet plant)	Ingestion Rate - Plant (kg wet-wt/day)	Concentration in Soil (mg/kg-dry soil)	Ingestion Rate - Soil (kg dry-wt/day)	Concentration in Water (mg/L)	Ingestion Rate - Water (L/day)	$Ba_{p,s,w}$ (day/kg tissue, fresh wt)	BS (unitless)	Concentration in Caribou (mg/kg - fresh wt)
TPH - CCME CWS									
Aliph>C06-C08 - F1	3.63E-02	3.33E+01	1.01E+00	3.00E-01	3.85E-02	5.50E+01	2.51E-04	1.00E+00	9.12E-04
Aliph>C08-C10 -F1	6.28E-03	3.33E+01	6.62E-01	3.00E-01	2.52E-02	5.50E+01	2.51E-03	1.00E+00	4.51E-03
Arom>C08-C10 -F1	2.25E-02	3.33E+01	1.66E-01	3.00E-01	6.30E-03	5.50E+01	2.51E-05	1.00E+00	2.88E-05
F1 - Total									**5.45E-03**
Aliph>C10-C12 -F2	3.78E-01	3.33E+01	7.66E+01	3.00E-01	1.80E-02	5.50E+01	7.76E-03	7.50E-01	2.13E-01
Aliph>C12-C16 -F2	7.98E-02	3.33E+01	9.36E+01	3.00E-01	2.20E-02	5.50E+01	1.62E-01	5.00E-01	2.59E+00
Arom>C10-C12 -F2	1.41E+00	3.33E+01	1.91E+01	3.00E-01	4.50E-03	5.50E+01	7.24E-05	1.00E+00	3.84E-03
Arom>C12-C16 -F2	1.16E+00	3.33E+01	2.34E+01	3.00E-01	5.50E-03	5.50E+01	1.45E-04	1.00E+00	6.62E-03
F2 - Total									**2.81E+00**
Aliph>C16-C21-F3	3.45E-02	3.33E+01	6.98E+02	3.00E-01	2.80E-02	5.50E+01	2.00E-01	2.50E-01	1.06E+01
Aliph>C21-C34 -F3	5.03E-05	3.33E+01	2.99E+02	3.00E-01	1.20E-02	5.50E+01	2.00E-01	1.00E-01	1.81E+00
Arom>C16-C21 -F3	4.37E+00	3.33E+01	1.75E+02	3.00E-01	7.00E-03	5.50E+01	4.68E-04	1.00E+00	9.28E-02
Arom>C21-C34 -F3	5.58E-01	3.33E+01	7.48E+01	3.00E-01	3.00E-03	5.50E+01	3.80E-03	1.00E+00	1.57E-01
F3 - Total									**1.27E+01**
Aliph>C34-C50 -F4	1.21E-05	3.33E+01	2.04E+02	3.00E-01	4.00E-02	5.50E+01	2.00E-01	5.00E-02	6.33E-01
Arom>C34-C50 -F4	1.28E-01	3.33E+01	5.09E+01	3.00E-01	1.00E-02	5.50E+01	2.51E-02	1.00E+00	5.04E-01
F4 - Total									**1.14E+00**
Organics									
Aroclor 1254 (Total PCBs)	8.18E-02	3.33E+01	2.00E-01	3.00E-01	5.00E-05	5.50E+01	2.04E-01	1.00E+00	5.69E-01
Inorganics									
Beryllium	5.53E-04	3.33E+01	2.91E-01	3.00E-01	5.00E-05	5.50E+01	1.00E-03	1.00E+00	1.08E-04
Cadmium	3.25E-01	3.33E+01	1.67E-01	3.00E-01	6.00E-05	5.50E+01	5.50E-04	1.00E+00	5.99E-03
Chromium (Total)	1.48E+01	3.33E+01	3.64E+01	3.00E-01	1.10E-03	5.50E+01	5.50E-03	1.00E+00	2.77E+00
Copper	1.18E+01	3.33E+01	2.60E+01	3.00E-01	4.00E-03	5.50E+01	1.00E-02	1.00E+00	4.01E+00
Lead	7.85E+00	3.33E+01	1.87E+01	3.00E-01	1.00E-03	5.50E+01	3.00E-04	1.00E+00	8.02E-02
Zinc	8.39E+01	3.33E+01	5.80E+01	3.00E-01	5.60E-02	5.50E+01	1.00E-01	1.00E+00	2.82E+02

tion Based Upon Plant, Soil and Water Ingestion

Constituent	Concentration in Plant (mg/kg-wet plant)	Ingestion Rate - Plant (kg wet-wt/day)	Concentration in Soil (mg/kg-dry soil)	Ingestion Rate - Soil (kg dry-wt/day)	Concentration in Water (mg/L)	Ingestion Rate - Water (L/day)	$Ba_{p,s,w}$ (day/kg tissue, fresh wt)	BS (unitless)	Concentration in Caribou (mg/kg - fresh wt)
TPH - CCME CWS									
Aliph>C06-C08 - F1	1.40E-01	3.33E+01	3.90E+00	3.00E-01	3.85E-02	5.50E+01	2.51E-04	1.00E+00	2.00E-03
Aliph>C08-C10 -F1	2.42E-02	3.33E+01	2.55E+00	3.00E-01	2.52E-02	5.50E+01	2.51E-03	1.00E+00	7.43E-03
Arom>C08-C10 -F1	8.66E-02	3.33E+01	6.38E-01	3.00E-01	6.30E-03	5.50E+01	2.51E-05	1.00E+00	8.60E-05
F1 - Total									**9.51E-03**
Aliph>C10-C12 -F2	2.69E-01	3.33E+01	5.46E+01	3.00E-01	1.80E-02	5.50E+01	7.76E-03	7.50E-01	1.53E-01
Aliph>C12-C16 -F2	5.68E-02	3.33E+01	6.67E+01	3.00E-01	2.20E-02	5.50E+01	1.62E-01	5.00E-01	1.87E+00
Arom>C10-C12 -F2	1.00E+00	3.33E+01	1.36E+01	3.00E-01	4.50E-03	5.50E+01	7.24E-05	1.00E+00	2.74E-03
Arom>C12-C16 -F2	8.23E-01	3.33E+01	1.67E+01	3.00E-01	5.50E-03	5.50E+01	1.45E-04	1.00E+00	4.73E-03
F2 - Total									**2.03E+00**
Aliph>C16-C21-F3	8.46E-03	3.33E+01	1.71E+02	3.00E-01	2.80E-02	5.50E+01	2.00E-01	2.50E-01	2.66E+00
Aliph>C21-C34 -F3	1.23E-05	3.33E+01	7.34E+01	3.00E-01	1.20E-02	5.50E+01	2.00E-01	1.00E-01	4.54E-01
Arom>C16-C21 -F3	1.07E+00	3.33E+01	4.28E+01	3.00E-01	7.00E-03	5.50E+01	4.68E-04	1.00E+00	2.29E-02
Arom>C21-C34 -F3	1.37E-01	3.33E+01	1.84E+01	3.00E-01	3.00E-03	5.50E+01	3.80E-03	1.00E+00	3.89E-02
F3 - Total									**3.18E+00**
Aliph>C34-C50 -F4	5.28E-06	3.33E+01	8.87E+01	3.00E-01	4.00E-02	5.50E+01	2.00E-01	5.00E-02	2.88E-01
Arom>C34-C50 -F4	5.56E-02	3.33E+01	2.22E+01	3.00E-01	1.00E-02	5.50E+01	2.51E-02	1.00E+00	2.27E-01
F4 - Total									**5.16E-01**
Organics									
Aroclor 1254 (Total PCBs)	8.18E-02	3.33E+01	5.00E-02	3.00E-01	5.00E-05	5.50E+01	2.04E-01	1.00E+00	5.60E-01
Inorganics									
Beryllium	1.03E-03	3.33E+01	5.43E-01	3.00E-01	5.00E-05	5.50E+01	1.00E-03	1.00E+00	2.00E-04
Cadmium	3.25E-01	3.33E+01	8.22E-02	3.00E-01	6.00E-05	5.50E+01	5.50E-04	1.00E+00	5.97E-03
Chromium (Total)	1.48E+01	3.33E+01	7.94E+01	3.00E-01	1.10E-03	5.50E+01	5.50E-03	1.00E+00	2.84E+00
Copper	1.18E+01	3.33E+01	3.02E+01	3.00E-01	4.00E-03	5.50E+01	1.00E-02	1.00E+00	4.03E+00
Lead	7.85E+00	3.33E+01	1.08E+01	3.00E-01	1.00E-03	5.50E+01	3.00E-04	1.00E+00	7.95E-02
Zinc	8.39E+01	3.33E+01	8.02E+01	3.00E-01	5.60E-02	5.50E+01	1.00E-01	1.00E+00	2.82E+02

Animal Tissue Concentration Based Upon Plant, Soil and Water Ingestion in the Background

Constituent	Concentration in Plant (mg/kg-wet plant)	Ingestion Rate - Plant (kg wet-wt/day)	Concentration in Soil (mg/kg-dry soil)	Ingestion Rate - Soil (kg dry-wt/day)	Concentration in Water (mg/L)	Ingestion Rate - Water (L/day)	$Ba_{p,s,w}$ (day/kg tissue, fresh wt)	BS (unitless)	Concentration in Caribou (mg/kg - fresh wt)
TPH - CCME CWS									
Aliph>C06-C08 - F1	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.51E-04	1.00E+00	-
Aliph>C08-C10 -F1	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.51E-03	1.00E+00	-
Arom>C08-C10 -F1	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.51E-05	1.00E+00	-
F1 - Total									**-**
Aliph>C10-C12 -F2	0	3.33E+01	0	3.00E-01	0	5.50E+01	7.76E-03	7.50E-01	-
Aliph>C12-C16 -F2	0	3.33E+01	0	3.00E-01	0	5.50E+01	1.62E-01	5.00E-01	-
Arom>C10-C12 -F2	0	3.33E+01	0	3.00E-01	0	5.50E+01	7.24E-05	1.00E+00	-
Arom>C12-C16 -F2	0	3.33E+01	0	3.00E-01	0	5.50E+01	1.45E-04	1.00E+00	-
F2 - Total									**-**
Aliph>C16-C21-F3	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.00E-01	2.50E-01	-
Aliph>C21-C34 -F3	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.00E-01	1.00E-01	-
Arom>C16-C21 -F3	0	3.33E+01	0	3.00E-01	0	5.50E+01	4.68E-04	1.00E+00	-
Arom>C21-C34 -F3	0	3.33E+01	0	3.00E-01	0	5.50E+01	3.80E-03	1.00E+00	-
F3 - Total									**-**
Aliph>C34-C50 -F4	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.00E-01	5.00E-02	-
Arom>C34-C50 -F4	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.51E-02	1.00E+00	-
F4 - Total									**-**
Organics									
Aroclor 1254 (Total PCBs)	0	3.33E+01	0	3.00E-01	0	5.50E+01	2.04E-01	1.00E+00	-
Inorganics									
Beryllium	5.32E-04	3.33E+01	2.80E-01	3.00E-01	5.00E-05	5.50E+01	1.00E-03	1.00E+00	1.04E-04
Cadmium	4.15E-02	3.33E+01	9.97E-02	3.00E-01	6.00E-05	5.50E+01	5.50E-04	1.00E+00	7.78E-04
Chromium (Total)	4.40E-01	3.33E+01	3.54E+01	3.00E-01	1.10E-03	5.50E+01	5.50E-03	1.00E+00	1.39E-01
Copper	1.39E+00	3.33E+01	2.05E+01	3.00E-01	4.00E-03	5.50E+01	1.00E-02	1.00E+00	5.26E-01
Lead	3.13E-01	3.33E+01	1.07E+01	3.00E-01	1.00E-03	5.50E+01	3.00E-04	1.00E+00	4.11E-03
Zinc	8.57E+00	3.33E+01	4.64E+01	3.00E-01	5.60E-02	5.50E+01	1.00E-01	1.00E+00	3.02E+01

Final Exposure Point Concentrations for the Background

Constituent	CAS-RN	Soil Conc. (mg/kg)	Terrestrial Plant Conc. (mg/Kg)	Terrestrial Invertebrate Conc. (mg/Kg)	Terrestrial Mammal Conc. (mg/Kg)	Surface Water Conc. (mg/L)
TPH - CCME CWS	% Composition					
Aliph>C06-C08 - F1	0.55	--	--	--	--	--
Aliph>C08-C10 -F1	0.36	--	--	--	--	--
Arom>C08-C10 -F1	0.09	--	--	--	--	--
F1 - Total						
Aliph>C10-C12 -F2	0.36	--	--	--	--	--
Aliph>C12-C16 -F2	0.44	--	--	--	--	--
Arom>C10-C12 -F2	0.09	--	--	--	--	--
Arom>C12-C16 -F2	0.11	--	--	--	--	--
F2 - Total						
Aliph>C16-C21-F3	0.56	--	--	--	--	--
Aliph>C21-C34 -F3	0.24	--	--	--	--	--
Arom>C16-C21 -F3	0.14	--	--	--	--	--
Arom>C21-C34 -F3	0.06	--	--	--	--	--
F3 - Total						
Aliph>C34-C50 -F4	0.80	--	--	--	--	--
Arom>C34-C50 -F4	0.20	--	--	--	--	--
F4 - Total						
Organics						
Aroclor 1254 (Total PCBs)	11097691	--	--	--	--	--
Inorganics						
Beryllium		2.80E-01	5.32E-04	2.02E-03	1.04E-04	5.00E-05
Cadmium	7440439	9.97E-02	4.15E-02	2.12E-01	6.78E-02	6.00E-05
Chromium (Total)		3.54E+01	4.40E-01	1.51E+00	1.02E+00	1.10E-03
Copper	7440508	2.05E+01	1.39E+00	1.90E+00	3.81E+00	4.00E-03
Lead	7439921	1.07E+01	3.13E-01	8.72E-01	9.85E-01	1.00E-03
Zinc	7440666	4.64E+01	8.57E+00	4.82E+01	3.72E+01	5.60E-02