Appendix G16

Report: 2014 Human Health Risk Assessment for Country Food

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

2014 Human Health Risk Assessment for Country Foods

In Accordance with NIRB Project Certificate No.004

Prepared by:

Agnico-Eagle Mines Limited – Meadowbank Division

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EXECUTIVE SUMMARY

In keeping with AEM's Nunavut Impact Review Board Project Certificate, Condition 67, a preliminary quantitative risk assessment was completed to evaluate risks to human health from contaminant exposure through consumption of country foods during operation of the Meadowbank mine. The assessment is based on soil, water and plant tissue samples collected from the minesite and reference sites in 2014. This report describes the methodology and results of the risk assessment, which follows the format of the pre-construction screening level risk assessment (2005), and initial assessment under operational conditions (2011). As per Condition 67, it incorporates recommendations from Health Canada's review of the 2011 assessment, as well as updates from the most recently published federal guidance document (Health Canada, 2012). Updated toxicity reference values and biotransfer ratios were used as available.

As recommended by Health Canada, a hazard quotient (HQ) approach was used to classify the risk associated with the low, moderate and heavy consumption of country food items from onsite, near-site, AWAR, and external reference locations. Risk was classified as negligible for each contaminant of potential concern (COPC) if the calculated HQ value was ≤ 0.2 (Health Canada, 2012). For each COPC with an HQ value > 0.2, the incremental risk associated with the mine site was assessed by identifying whether onsite, near-site or AWAR HQ values exceeded the corresponding external reference HQ value.

Key findings were as follows.

Caribou Meat

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of caribou muscle (meat) for most COPCs. For chromium, nickel, lead, thallium, and zinc, HQ values exceeded 0.2 for all study areas, including the external reference site.
    - Onsite and AWAR HQs for chromium, nickel and lead were the same as or lower than the corresponding value for the external reference site, indicating no incremental risk as a result of the project.
    - Onsite HQ values for thallium and zinc marginally exceeded external reference values in some consumption scenarios. HQs are based on the maximum measured concentration among the samples collected. For comparison, measured mean concentrations in onsite environmental media did not exceed external reference values in statistical tests, indicating that average exposure for animals spending time in the onsite caribou study area is not higher than background. As a result, incremental risk associated with these COPCs is not expected to be significant.

Caribou Kidney

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of caribou kidney from all study locations for most COPCs. The HQ value for thallium exceeded 0.2 for all study areas, including the external reference site (to a maximum of 0.6; for moderate or heavy consumption scenarios).
    - Thallium HQ values for onsite or AWAR locations were the same as or lower than external reference values, indicating no incremental risk as a result of the project.

Caribou Liver

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of caribou liver from onsite, AWAR, and external reference study areas, for all COPCs except lead, which had HQs > 0.2 for all study areas, including the external reference site (maximum HQ of 1.0).
    - Only the onsite lead HQ for low consumption by toddlers exceeded the corresponding external reference value, but the difference in HQs is marginal (0.004) and is not expected to be significant. The toxicity reference value used for lead in this assessment is equivalent to the median dietary lead exposure for the Canadian population (0.1 ug/kg bw/d), as determined in Health Canada's Final Human Health State of the Science Report on Lead (2012) and identified in Health Canada's review of the 2011 Meadowbank HHRA.

Canada Goose Meat

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of Canada goose meat from onsite, near-site, AWAR and external reference study areas, for most COPCs. For chromium and lead, HQ values exceeded 0.2 for all study areas, including the external reference site (maximum of 0.8).
    - Lead and chromium HQ values for onsite, near-site or AWAR locations were the same as or lower than external reference values, indicating no incremental risk as a result of the project.

Combined Consumption

- The combined consumption analysis produced one additional scenario under which adverse health effects may potentially occur (low combined consumption by adults due to exposure to lead).
    - HQ values marginally exceeded 0.2 for this scenario, but were the same (0.3) for onsite and external reference areas, indicating no incremental risk as a result of the project.

Overall, this analysis indicated that mining activities do not appear to be contributing significant incremental risk from COPCs to consumers of country food items sourced in and around the Meadowbank area. This is consistent with the baseline assessment (2005) which concluded that based on projected concentrations of COPCs in environmental media (soil and water), risk to persons consuming country foods would not increase appreciably following mine development. Since HQ values between the assessments are not directly comparable due to changes in various reference parameters, a comparison of projected and current concentrations of COPCs in soil was performed to assess quantitative impact predictions. Measured concentrations of COPCs in soil in 2014 did not exceed concentrations projected to occur in the Project's Final Environmental Impact Statement (Cumberland, 2006), confirming that impact predictions are not being exceeded.

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1 INTRODUCTION

1.1 BACKGROUND

In 2010 Agnico-Eagle Mines Ltd. (AEM) began operation of the Meadowbank gold mine, near Baker Lake, Nunavut, after purchasing the rights from Cumberland Resources Ltd. Prior to the purchase, Cumberland contracted Wilson Scientific Consulting Inc. (Wilson) to prepare a pre-construction human health screening level risk assessment (HHRA) to assess potential risks from the dietary uptake of mine-related contaminants in country foods.

Specifically, the pre-construction HHRA focused on identifying country foods consumed in the Meadowbank region, determining the contaminants of potential concern (COPCs) from predicted minesite activities, evaluating potential risks associated with consumption under baseline conditions, and determining recommended weekly intakes for each food item. Preliminary estimates of post-development contaminant concentrations in food items were then obtained from models used in the baseline wildlife screening level risk assessment (Azimuth, 2006), and expected potential risks to human health from consumption of country foods during mine operations were evaluated.

The baseline HHRA included 18 metals as COPCs. Under baseline conditions, the only food item which posed a marginally unacceptable risk was heavy consumption of lake trout by toddlers. However, due to the nutritional benefits of fish consumption, it was not clear that omitting lake trout from the diet would be beneficial to health.

As required under the Nunavut Impact Review Board Project Certificate -Condition 67, the HHRA was updated in 2011 to assess potential risk during mine operation. Results of this assessment indicated potentially unacceptable risk from consumption of various food items as a result of chromium and cadmium exposure. Most elevated concentrations were associated with samples from both minesite and external reference locations, indicating that potential risks existed independent of mining operations. Where differences remained after refinement of the exposure model, continued monitoring was recommended. As requested by NIRB, this assessment was reviewed by Health Canada, who indicated they had no objection to the conclusions or recommendations of the assessment, but asked for additional information from NIRB and AEM (letter to NIRB dated February 3, 2013). This information was provided, and Health Canada responded (letter to NIRB dated January 27, 2014) with no additional requests for AEM. In 2014, soil, water and plant tissue samples from the Meadowbank area were collected to update the risk assessment under operational conditions.

1.2 SITE DESCRIPTION

The Meadowbank site is located 70 km north of the hamlet of Baker Lake, Nunavut. A 115 km all-weather road was constructed between the hamlet and the mine to provide site access for personnel and deliveries arriving by commercial flight or marine barge. The hamlet itself is located 320 km inland from the west coast of Hudson Bay in the Kivalliq region of Nunavut, and an estimated population of 2164 people (GNBS, 2014).

Situated near the border of the Northern and Southern Arctic ecozones, the terrain in the Meadowbank area is typical barren-ground subarctic, with low-growing vegetation in poorly developed soil with continuous permafrost. The landscape is dominated by many interconnected

lakes and isolated ponds with indistinct drainage patterns. Topography consists of rolling hills, boulder fields and bedrock outcrops. The mine site is located at the headwaters of the Quioch River system, which flows southeast through Chesterfield Inlet into Hudson Bay. Lakes in this region are ultra-oligotrophic, with low productivity levels. This region supports few terrestrial mammals (15 species) and birds (62 species) (Azimuth, 2006). Migratory species (primarily caribou and Canada geese) are present.

1.3 BASELINE CONDITIONS

For the baseline wildlife screening level risk assessment, Azimuth (2006) screened baseline concentrations of metals in soil and water values against CCME guidelines to provide a general description of background concentrations of contaminants.

It was found that baseline concentrations of metals in the project lakes were below CCME guidelines for the protection of aquatic life, except cadmium and mercury. However cadmium was not detected in the project lake samples, but the detection limit was above the CCME guideline (adjusted for hardness). Similarly, while mercury was not detected in the project lakes, the detection limit (50 ng/L) was above the CCME guideline (26 ng/L).

Soil samples from the project area were screened against the most conservative CCME soil quality guidelines for the protection of environmental and human health (typically agricultural use criteria). Under baseline conditions, concentrations of arsenic, chromium and nickel exceeded their CCME guidelines of 12, 64, and 50 mg/kg, respectively, in 10, 17 and 9 out of 26 samples, respectively. Soil pH was below the CCME guideline of 6-8 in 37 of 50 samples (See Section 2.3.2, Azimuth, 2006).

The baseline HHRA predicted negligible risk (HQ < 1) for consumption of all foods with the exception of heavy consumption of lake trout by toddlers.

1.4 MINING ACTIVITIES

The Meadowbank project consists of several gold-bearing open-pit deposits (Portage, Goose and Vault pits). Much of the infrastructure is located in close proximity to the mill and mine facilities, with the exception for the Vault Pit which is approximately 10 km northeast of the site.

Waste rock from the Portage and Goose pits are stored in the Portage Rock Storage Facility (PRSF). During the construction period, non-potentially acid generating rock (NPAG) was used for dikes and roads with excess used as cover material in the PRSF. Potentially acid generating (PAG) waste rock is sent to the Portage waste rock area. The Portage Rock Storage Facility is constructed to minimize the disturbed area and will be capped with a layer of non-acid-generating rock. Waste rock from the Vault Pit will be stored in the Vault Rock Storage Facility. Mined ore is either processed in the mill or stockpiled for eventual processing.

Tailings are stored in the Tailings Storage Facility (TFS), defined by the series of dikes built around and across the basin of the dewatered northwest arm of Second Portage Lake. Tailings water is reclaimed for use in ore processing.

Much of the construction activity in 2013 and 2014 was related to increasing the level of Central Dike to 132.0 masl, raising the level of Stormwater Dike to 150.0 masl and constructing the Vault Dike and

associated infrastructure at the Vault pit. In 2014, pump and road infrastructure was installed in the south cell and tailings deposition was moved from the north cell to the south cell of the TSF.

1.5 GENERAL APPROACH

While the goal in the baseline HHRA was to quantify potential risks to humans from consumption of country foods under baseline and projected future site conditions, the aim of this assessment is to characterize risk under current (operational) conditions, and in particular, to determine potential effects of the project over and above background concentrations. The general approach is the same however, and includes the common risk assessment components of problem formulation, exposure assessment, toxicity assessment and risk characterization.

This report follows the format and methodology of the baseline HHRA, developed by Wilson Scientific Consulting Inc. The risk assessment framework was taken from various Canadian, American and international sources (Health Canada, USEPA, USFDA, WHO). Neither the baseline assessment nor this updated report address risks for catastrophic events such as a fuel spill. Specific management plans are in place to handle those types of incidents.

All methods as described in Wilson (2006) are summarized herein. Each component has been examined to ensure relevance to the current conditions, and methods were updated to reflect the recent Health Canada guidance documents “Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRAFoods)” (Health Canada, 2010a) and “Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) – Part 1” (Health Canada, 2012). Details of any changes are described in the sections below.

In general, the problem formulation stage developed by Wilson (2006) was assumed to be applicable to the current scenario, with the exception of estimated daily consumption values which were updated based on information collected since the initial assessment. The sources of contaminants and COPCs predicted in Azimuth (2006) prior to mine site development were evaluated in the initial HHRA under operational conditions (2011), and any changes were carried over to this assessment. The exposure assessment stage (concentrations in animal tissue) was updated with data collected in 2014. The major differences in this assessment are that maximum measured environmental concentrations were used to calculate dose rates, instead of the 95% UCLM values used in the baseline assessment, and an HQ threshold of 0.2 was used, instead of 1. These procedures follows Health Canada (2012) recommendations for PQRA, and are more conservative. The tolerable daily intake values in the effects assessment stage were updated based on currently available values from the same sources consulted by Wilson (2006). Risk estimates (hazard quotients) were re-calculated. Any specific changes to values or methods are discussed in the sections below.

2 PROBLEM FORMULATION

Problem formulation for the HHRA in 2006 involved the development of a conceptual model to determine country foods consumed in the region, consumption patterns and COPCs. Each of these components are further described in that document (Wilson, 2006), and are summarized along with any changes below.

2.1 COUNTRY FOODS

In the baseline HHRA, the consumption of terrestrial mammals, waterfowl, fish and plants was assessed for people residing in the hamlet of Baker Lake. From reviews of oral testimony collected in 2005 (Traditional Knowledge Report as part of the Meadowbank FEIS), caribou meat, kidney and liver, Canada goose meat and lake trout were found to be the food items most representative of local consumption patterns. Lake trout was included in the baseline assessment because they represent the majority of fish in the project lakes, and because of their potential to accumulate mercury. However, since a no-fishing policy was put in place for workers and fish from project lakes are non-migratory, consumption of fish impacted by the mine site is expected to be negligible. Analyses of risk from fish consumption were therefore excluded from subsequent assessments. Although Inuit may consume wild berries, it was found to be unlikely that they would be harvested from the mine site area due to distance, the fact that public access is prohibited past km 85 on the AWAR, and abundance of this food source closer to Baker Lake. Consumption of plants was therefore not evaluated in the baseline assessment or subsequent updates. Finally, although risk analyses for consumption of Canada goose are maintained in this report, it is noted that only 7% of the population of Baker Lake was found to consume this item, at a frequency of less than 1 day per month (Areva, 2011).

2.2 POTENTIAL RECEPTORS

For the baseline assessment, a young child (or toddler, aged 7 months – 4 years) and an adult were the human receptors evaluated. They are considered to be protective of the general population. Primarily Canadian sources were consulted to determine the characteristics of these receptors, described below, and site-specific values were incorporated where possible.

2.2.1 Body Weight

Body weight values from Richardson (1997) were used in this assessment, as recommended in Health Canada (2012). Considering sources such as Anderson (2005) which indicate these values are valid for Inuit populations, the body weights presented in Richardson (1997) were deemed appropriate for this assessment.

Toddler:	16.5 kg
Adult:	70.7 kg

2.2.2 Estimated Daily Consumption

Based on a review of oral testimony and professional judgement, Wilson (2006) considered three scenarios (heavy, moderate and low consumption) for each food item:

Caribou Muscle

- heavy consumption: 2 meals per day, 365 days per year
- moderate consumption: 3 meals per week, 52 weeks per year
- low consumption: 1 meal per month, 12 months per year

Caribou Organs

- heavy consumption: 1 meal per week, 52 weeks per year
- moderate consumption: 2 meals per month, 12 months per year
- low consumption: 1 meal per month, 12 months per year

Waterfowl Muscle

- heavy consumption: 3 meals per week, 52 weeks per year
- moderate consumption: 1 meal per week, 52 weeks per year
- low consumption: 1 meal per month, 12 months per year

Using a serving size of 200 g/serving for adults and 86 g/serving for toddlers (Richardson, 1997), Wilson (2006) estimated average daily consumption values as presented in Table 2-1. Since the derivation of consumption rates used in Wilson (2006) could not be traced to quantitative survey data, a review of the literature was performed to verify that values were consistent with those available from published sources. This review indicated that some consumption rates for caribou meat may have been underestimated, while consumption rates for caribou organs and Canada goose may have been overestimated compared to values identified in local or regional surveys. As a result, consumption rates were updated to reflect data from published sources, as described in Table 2-1. Scenarios of heavy, moderate and low consumption were maintained to reflect variety in preferences for country foods and the range of consumption rates identified in the literature.

Table 2-1: Food items, consumption scenarios, and estimated consumption rates considered in Wilson (2006) and this assessment. Toddler values in this assessment are 43% of adult values (Richardson, 1997) unless otherwise indicated.

Food Item	Consumption Scenario	Baseline Assessment (g/d)		Current Assessment (g/d)		Reference/Rationale
		Toddler	Adult	Toddler	Adult	
Caribou meat (muscle)	Heavy	170	400	189.2	440	Highest daily intake in Kivalliq survey (Kuhnlein, 2000), as shown in Senes (2008), Table C-1
	Moderate	37	86	89.4	208	Average daily consumption in Nunavut survey (IHS, 2012); similar to value recommended by Health Canada (2012) for wild game consumption by Canadian Aboriginal Populations (270 g/d)
	Low	2.9	6.7	15	65	Average consumption for men and maximum consumption for toddlers in Baker Lake survey using ^{137}Cs body burdens in 1989-90 (Tracy and Kramer, 2000)
Caribou organ (kidney, liver)	Heavy	12	29	1.2	2.9	Harvest survey estimate: In 2010, there were 5020 caribou harvested by Baker Lake hunters (Areva, 2011) and an adult population of 1779 (GNBS, 2014). At a kidney weight of 187 g (Crete and Nault, 1989), maximum consumption would be of 2.9 g/d if adults consume all kidneys. This value is consistent with a Yukon survey by Schuster et al. (2011) indicating 3.2 g/d consumption of kidney, and 2.5 g/d consumption of liver. Larter and Nagy (2000) indicate 2.1 g/d for kidney. Chan et al. (2012) indicate 2.7 g/d for all ungulate organs combined.
	Moderate	5.7	13	0.6	1.3	Based on proportion of "heavy" in Wilson (2006)
	Low	2.9	6.7	0.3	0.7	Based on proportion of "heavy" in Wilson (2006)
Canada goose meat (muscle)	Heavy	37	86	9.9	23	Average daily consumption in Nunavut survey (IHS, 2012); also 95th centile of consumption in Chan et al. (2012) for 2 northern Manitoba reserves
	Moderate	12	29	5.6	13	Average daily consumption in Chan et al. (2012); also value used in Senes (2008) for ptarmigan consumption in Baker Lake
	Low	2.9	6.7	0.8	1.8	Based on proportion of "heavy" in Wilson (2006)

2.3 IDENTIFICATION OF COPCS

2.3.1 Potential Sources

Major mine site operations and their potential to contribute to contaminants of potential concern (COPCs) as determined in the baseline assessment are summarized here with updates as appropriate. No new potential sources of COPCs were identified.

Open pits – Currently, mining of the Portage, Goose Island (scheduled to be complete March 2015) and Vault pits is underway. Along with ore, pits produce waste rock, which may contribute to COPCs through dust emissions.

Rock storage facilities – The North Portage and Vault rock storage facilities are currently in use. Waste rock (not containing ore) is moved to these areas. Dust may be blown from the rock piles during dumping and vehicle traffic during transport of material. Seepage from rock storage facilities is controlled in sumps and pumped back to the reclaim pond.

Borrow pits and quarries – Borrow pits and quarries were used for the construction of mine site roads and the airstrip. The COPCs for borrow pits and quarries are similar to open pits. Currently, there are no active borrow pits or quarries (material is borrowed and crushed for road maintenance from open pit operations).

Tailings Storage Facilities (TSF) – The northwest arm of Second Portage Lake was partitioned off by the East Dike and de-watered from 2009 to 2012. The northwestern portion of this area was further partitioned by the Stormwater Dike, and is used for storage of tailings. The Stormwater Dike created the North and South Cell TSF. The North Cell will be completed in 2015. Prior to 2013, much of the TSF had water cover or was covered by snow for most of the year; in 2013 and 2014, areas of the TSF had exposed tailings beaches. Although permafrost is expected to freeze the tailings, the material is fine-grained and could be a source of dust emissions during dry periods.

Roads and airstrip – Frequently used gravel haul roads run throughout the mine site to connect pits, waste rock storage and processing facilities. An airstrip, receiving approximately 4 planes per week, was built at the mine site to receive deliveries and personnel. Dust from these sources could be a potential source of contaminants. A 110 km long all weather access road (AWAR) was constructed between the mine and the Hamlet of Baker Lake, using gravel from quarries along the road. Previous SLRAs did not consider dust emissions from the AWAR in sampling programs, but following concerns from NIRB of dust deposition due to road activity a new station was added in 2014 to screen for potential risks associated with roadside habitat. The station was paired with dustfall studies and was located at km 78, 100m from the AWAR, on the downwind side.

Effluent discharge – De-watering of lakes for pit development or TSF construction is considered effluent discharge and is regulated under the current NWB Water License. Lake water is treated for suspended solids removal before discharge, and since it is an existing surface water source, it is not likely to be a source of contaminants in the receiving water. Effluent is also periodically discharged from the Portage and Vault attenuation ponds into Third Portage Lake and Wally Lake respectively, pursuant to the existing Water License and MMER requirements. The Portage Attenuation Pond is no longer in use and has become the South Cell TSF. There will be no further discharge to Third Portage Lake from the Portage Attenuation Pond. Therefore, metals regulated under MMER were considered as COPCs in this assessment.

Diesel generating plant, mine mill plant and associated facilities – Three diesel generating plants provide power for the mine. The Air Quality Impact Assessment (2005) determined emission of PAHs was “very low” and did not require modeling. The milling of rock in the processing plant takes place

under wet conditions, and is not a source of particulate emissions. All health and safety-related requirements to reduce particulate emissions during handling of the ore at the mine plant before processing are met, so these are not expected to be a significant source of contaminants.

Overall, roads, waste rock and tailings were determined to be the main sources potentially contributing to COPCs through dust emissions. Dewatering effluent discharge may potentially contribute to COPCs in water sources.

2.3.2 Contaminants of Potential Concern

In the baseline WSLRA, Azimuth (2006) identified contaminants of potential concern (COPCs) based on the chemical composition of the identified dust sources, the predicted effects of effluent on water quality in Third Portage Lake (from Golder, 2005), and a review of metals regulated under MMER (see Azimuth 2006, Section 2.5 for details).

Projected concentrations of metals in four dust sources (roads, waste rock and tailings) that exceeded the 90th centile of baseline soil concentrations or the CCME guidelines (CCME 1999) were included as COPCs. Five metals regulated under MMER (arsenic, copper, lead, nickel and zinc) were also included in the assessment. Arsenic was assessed here as inorganic arsenic, which was assumed to be 1% of total arsenic based Schoof et al. (1999) as described in Wilson (2006). Carcinogenic and non-carcinogenic effects were evaluated for this COPC. Tin was assessed as inorganic tin, which was assumed to be 100% of total tin. Although mercury was not predicted to exceed baseline soil concentrations or CCME criteria, it was included because it was found to be of concern to the general public in the Arctic. All metals assessed in Azimuth (2006) were included in this assessment. CCME guidelines for tin and uranium (non-radiological) have been published since 2006, so these metals were added during the 2011 assessment.

The COPCs for this assessment are comprised of:

Antimony	Lead	Tin (inorganic)
Arsenic (inorganic)	Manganese	Uranium (non-radiological)
Barium	Mercury (inorganic and methylmercury)	Vanadium
Beryllium	Molybdenum	Zinc
Cadmium	Nickel	
Chromium	Selenium	
Cobalt	Strontium	
Copper	Thallium	

Certain chemicals which are controlled through best management practices, and, which were not addressed in the baseline assessment, include petroleum hydrocarbons, process chemicals, dioxins,

nitrates, ammonia and PAHs. For each source of these chemicals, best management practices are in place and environmental exposures are not expected to occur.

3 EXPOSURE ASSESSMENT

Exposure assessment is used to calculate the dose of each COPC received by each ROC. The exposure assessment used here for humans follows the method from Wilson (2006), and is based on the food chain model for caribou and Canada goose developed by Azimuth (2006), and provided to AEM in Excel format for use in this assessment. The model was developed to include the influence of COPC concentrations in exposure pathways, dietary preferences, ingestion rates and dose-adjustment factors.

3.1 COPC CONCENTRATIONS IN SOURCE MEDIA

To estimate risk from consumption of country foods, concentrations in each food item (caribou meat, caribou organs, Canada goose meat) were modelled from collected samples of environmental media (soil, water, sedge, lichen, berries) collected in onsite, near-site, AWAR, and external reference study areas. Methods are summarized here, and further details are provided in the 2014 wildlife screening level risk assessment.

Concentrations of COPCs were measured in and around the Meadowbank site in water, soil and plant tissue (sedges, lichens, berries) in August, 2014. Methods of collection were as in Azimuth (2006). A total of 55 samples each of soil and plant tissue (lichen, sedge, berries) were collected. This included five samples of each media type from four onsite locations, three near-site locations, one AWAR location (km 78; 100 m downwind of the road) and three external reference locations (see Figure 3-1). The AWAR location is new in 2014, and was added to conduct preliminary screening in recognition of concerns raised by the Hamlet of Baker Lake regarding generation of dust along this road.

Water samples were collected as part of the 2014 Core Receiving Environment Monitoring Program (CREMP). Onsite concentrations are from samples collected in Second Portage Lake (SPL) and the east and north basins of Third Portage Lake (TPE, TPN). Near-site concentrations are from samples collected in Tehek Lake (TE), and external reference samples are from Inuggugayualik Lake (INUG) and Pipedream Lake (PDL; see Figure 3-1). Onsite water concentrations were used for the AWAR study area analysis.

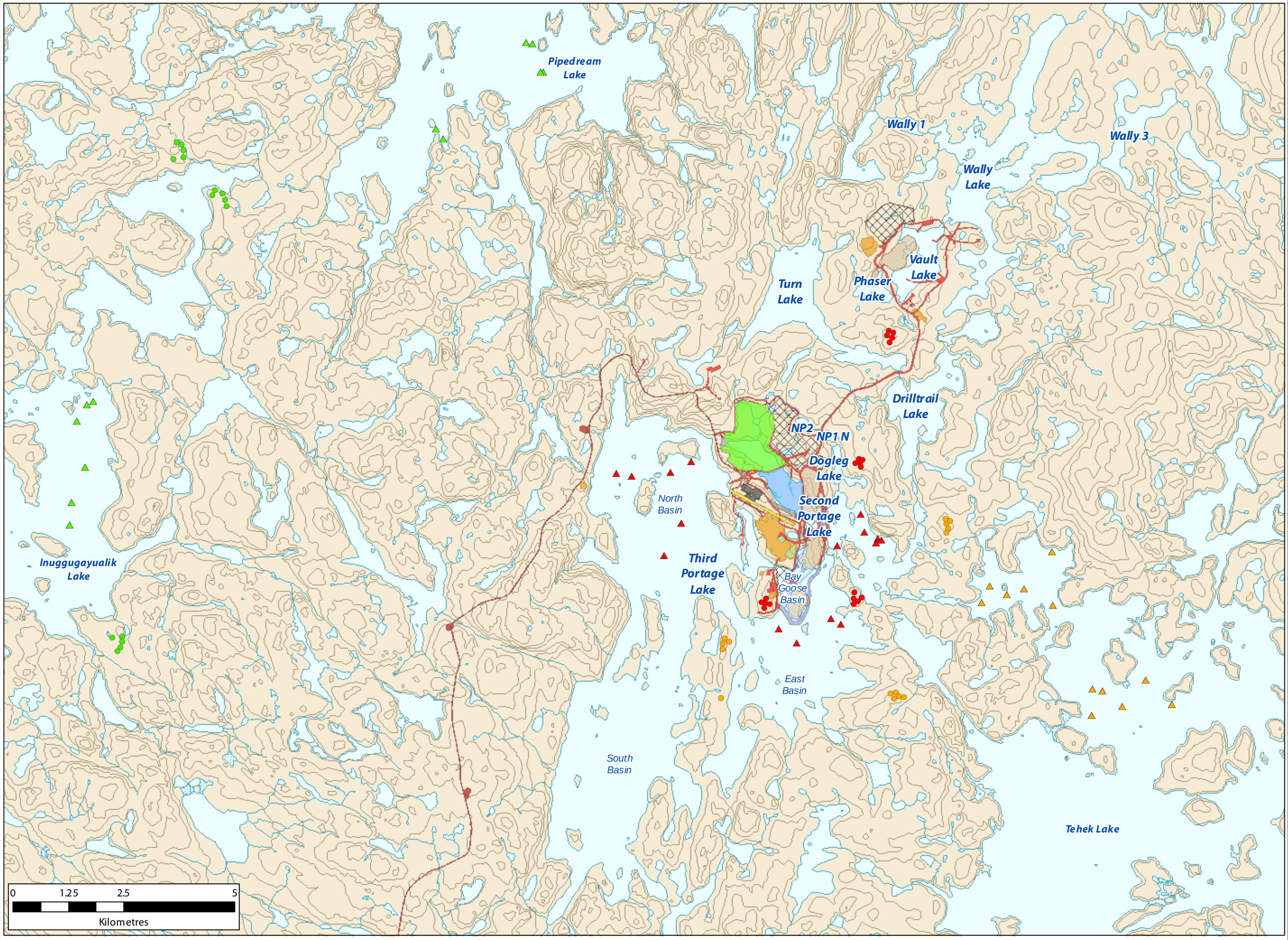
Concentrations in soil and plant tissue used for food chain modeling were maximum measured values for each location (onsite, near-site, AWAR, external reference), as recommended by Health Canada (2012) as opposed to the 95% UCLM values used in the baseline assessment. If values were below the laboratory detection limit, a value of ½ the detection limit was used.

Complete (100%) absorption of COPCs in ingested media across the gastrointestinal tract was assumed. Based on published literature, methyl mercury was assumed to comprise 1% of total mercury in soil, 0% in water, 17% in insects, and 34% of total mercury in plant tissue (Azimuth, 2006, Section 3.1.3.2). Concentrations of COPCs in insects were modeled in several cases (arsenic, cadmium, copper, lead, zinc) from soil concentrations using published bioaccumulation models (see Azimuth (2006), Appendix D). For the rest of the COPCs, an insect BAF of 1 was assumed (i.e. 100% of soil concentration).

For both caribou and Canada goose, exposure values were calculated based on an assumed 33% of time in the study area (onsite, near-site, or AWAR) with the remainder of exposure (67%) based on external reference values, according to Senes (2008). Because it was assumed reasonable for a caribou to easily travel between onsite and near-site sample stations within a day (Martin Gebauer,

Nunavut Environmental, 2012, personal communication), onsite and near-site samples were combined for the “onsite” assessment for caribou.

Further description of the assumptions used to calculate daily intake rates of COPCs for caribou and Canada goose can be found in the 2014 wildlife screening level risk assessment (WSLRA), including dietary preferences and intake factors for soil, water and food. Laboratory certificates of analysis are also provided in that document.



Legend

Soil/Veg Sampling Location

- Onsite
- Near Site
- External Reference

Water Sampling Locations

- Onsite
- Near Site
- External Reference

2014 Mine Plan

- Quarry
- AWPAR Quarry
- Dewatered Lake
- Portage Attenuation Facility
- Tailings Storage Facility
- Roads
- AWPAR
- Dikes
- Diversion Ditch
- Stockpiles
- Pits
- Facility
- Airstrip
- Waste Dump

Wildlife Screening Level Risk Assessment

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N W E S
UTM Zone 14 NAD83

DATE: MARCH 2015

SCALE: 1:80,000

DRAWN BY: LW

CHECKED BY:MAY

FIGURE:

3-1

3.2 COPC CONCENTRATIONS IN COUNTRY FOOD ITEMS

3.2.1 Caribou Muscle

To estimate concentrations of COPCs in caribou muscle, estimated daily intake values for caribou were multiplied by caribou weight (75 kg; Dauphine (1976) in Wilson (2006)) and feed-to-muscle biotransfer factors from the literature. Feed-to-muscle biotransfer factors were updated for the 2011 assessment, and all values are maintained here. All biotransfer factors are provided in Appendix B.

Muscle concentrations (C_M) were calculated as:

$$C_M = EDI_C \times W_C \times BTF$$

Where:

C_M = Concentration in muscle tissue (meat); mg/kg ww

EDI_C = estimated daily intake of COPC by caribou; mg/kg ww/d

W_C = caribou weight; kg

BTF = biotransfer factor (feed to muscle; beef); d/kg ww

Estimated concentrations in caribou muscle are shown in Appendix D.

3.2.2 Caribou Kidney and Liver

Concentrations of COPCs in caribou kidney and liver were estimated from muscle concentrations using muscle-to-kidney and muscle-to-liver transfer factors for caribou provided by Gamberg (2012) (Appendix B). While these factors are unpublished, they are from a large scale and long-term study that is currently part of the Northern Contaminants Program. Transfer factors for inorganic mercury and methylmercury were not available and were assumed to be the same as for total mercury. The values used here differ from the 2006 assessment, in which only kidney transfer factors calculated from mean concentrations were available (mainly for moose), and these were assumed to be representative of both organs in caribou.

Kidney concentrations (C_K) and liver concentrations (C_L) were calculated as:

$$C_K \text{ or } C_L = C_M \times BTF$$

Where:

C_K = concentration of COPC in caribou kidney; mg/kg ww

C_L = concentration of COPC in caribou liver; mg/kg ww

C_M = concentration of COPC in caribou muscle; mg/kg ww (see Section 3.2.1)

BTF = transfer factor (muscle to organ; caribou)

Estimated concentrations in caribou kidney and liver are shown in Appendix D.

3.2.3 Canada Goose Muscle

To estimate concentrations in Canada goose muscle, estimated daily intake rates were multiplied by goose weight (2 kg; Mowbray et al. (2002) in Wilson (2006)) and feed-to-muscle biotransfer factors from the literature. Feed-to-muscle biotransfer factors were maintained from the baseline assessment (see Wilson, 2006), which used the source US DOE (2003) – see Appendix B.

Goose muscle concentrations (C_{GM}) were calculated as:

$$C_{GM} = EDI_G \times W_G \times BTF$$

Where:

C_G = concentration of COPC in goose muscle; mg/kg ww

EDI_G = estimated daily intake of COPC by goose; mg/kg ww/d

W_G = weight of goose; kg

BTF = biotransfer factor (feed to muscle; chicken); d/kg ww

Estimated concentrations in Canada goose muscle are shown in Appendix C.

3.3 EXPOSURE FROM CONSUMPTION OF COUNTRY FOOD

As in Wilson (2006), daily exposure from consumption of country foods was calculated based on Health Canada (2012) as:

$$Dose = C_F \times IR_F \times RAF_{ORAL} / BW$$

Where:

Dose = estimated daily intake of COPC from consumption of food item; ug/kg bw/day

C_F = concentration of COPC in food item (caribou meat, kidney, liver, goose meat); mg/kg ww

IR_F = consumption rate of food item; g/day

RAF_{ORAL} = relative absorption factor (assumed to be 1)

BW = body weight of person; kg

4 TOXICITY ASSESSMENT

The toxicity reference values (TRVs) used in the baseline assessment were collated from regulatory agencies such as Health Canada, USEPA and the WHO. Values were updated in this assessment to follow the order of preferences for sources described in Health Canada (2012). As per Condition 67, Health Canada reviewed the 2011 assessment and AEM has incorporated relevant feedback into this report. As a result, values from Health Canada (2010b), USEPA (2015) (IRIS database), RIVM (2001) and ATSDR (2015) are used with two exceptions (lead and thallium – see Sections 4.1.3 and 4.1.9). All values and sources are presented in Table 4-1, and a discussion for values that differ from previous assessments is provided below. Details for all other values can be found in the baseline and 2011 assessments.

As in the baseline assessment, TRVs for metals are expressed as Tolerable Daily Intakes (TDIs) for non-cancer endpoints, and cancer slope factors for cancer endpoints. Inorganic arsenic was the only COPC identified as a potential carcinogen through the oral ingestion route, and the cancer slope factor was 1.80 $(mg/kg \cdot day)^{-1}$ (Health Canada, 2010b).

Table 4-1: Tolerable daily intake (TDI) values used in the baseline (2005) assessment and subsequent updates (2011, 2014). USEPA (2006, 2012a, 2015) sources represent the IRIS database.

COPC	TDI (µg/kg·day)			Source		
	2005	2011	2014	2005	2011	2014
Antimony	0.4	0.4	0.4	USEPA 2006	USEPA 2012a	USEPA 2015
Arsenic	2	0.3	0.3	HC 2002	USEPA 2012a	USEPA 2015
Barium	200	200	200	USEPA 2006	USEPA 2012a	HC 2010b
Beryllium	2	2	2	USEPA 2006	USEPA 2012a	USEPA 2015
Cadmium	1	0.8	1*	HC 2004a	HC 2004a	HC 2010b
Chromium	5.4	1	1	HC 1996	HC 2004a	HC 2010b
Cobalt	1.4	1.4	1.4	RIVM 2001	RIVM 2001	RIVM 2001
Copper	250	30	91#	HC 2002	HC 2004a	HC 2010b
Lead	3.6	3.6	0.1+	HC 2004a	HC 2004a	HC 2014
Manganese	140	-	136#	USEPA 2006	-	HC 2010b
Mercury (inorganic)	0.71	0.3	0.3	HC 2002	HC 2004a	HC 2010b
Mercury (methyl)	0.2	0.1	0.2^	HC 2002	USEPA 2012a	HC 2010b
Molybdenum	5	5	23000#	USEPA 2006	USEPA 2012a	HC 2010b
Nickel	17	17	20	IM 2001	IM 2001	USEPA 2015
Selenium	5	5	6200#	USEPA 2006	USEPA 2012a	HC 2010b
Strontium	600	-	600	USEPA 2006	-	USEPA 2015
Thallium	0.07	0.07	0.01*	USEPA 2006	USEPA 2012a	USEPA 2012b
Tin	-	200	300	-	ITER 2012	ATSDR 2005
Uranium	-	0.6	0.6	-	HC 2004a	HC 2010b
Vanadium	5	5	5	USEPA 2006	USEPA 2012a	USEPA 2015
Zinc	700	300	480#	HC 2002	USEPA 2012a	HC 2010b

*provisional or screening value
#essential trace element toxicity value (toddlers)
^value for women of child-bearing age and children <12 yrs
+median dietary lead exposure for the Canadian population (see Section 4.1.3)

4.1.1 Cadmium

Health Canada (2010b) reports a provisional TDI for cadmium of 1 ug/kg bw/d. Use of a provisional value for cadmium of 1 ug/kg bw/d was also described in the baseline assessment.

4.1.2 Copper

Guidance documents from Health Canada (Health Canada, 2010b) have amended TRVs for essential trace elements, including copper, to better reflect benefits and risks by using the tolerable upper intake level as the reference exposure level. Values are provided for various age groups, and the value for toddlers has been used for this assessment. As a result, the TDI for copper has increased to 91 ug/kg bw/d from 30 ug/kg bw/d in the 2011 assessment.

4.1.3 Lead

Health Canada (2010b) lists the TDI for lead as “in review”. During their review of the 2011 Meadowbank HHRA, Health Canada indicated that dietary exposure to lead should be As Low As Reasonably Achievable (ALARA principle). Health Canada compared exposure from consumption of country foods in the Meadowbank area to the median dietary lead exposure for the Canadian population (0.1 ug/kg bw/d), as determined in Health Canada’s Final Human Health State of the Science Report on Lead (2012). As a result, this value was adopted as the TRV for this assessment. However, it is noted that average daily intake values are commonly higher among First Nations, as measured in BC and Manitoba (0.23 ug/kg bw/d and 1.35 ug/kg bw/d, respectively; Chan et al. (2011, 2012)).

4.1.4 Manganese

Guidance documents from Health Canada (Health Canada, 2010b) have now amended TRVs for essential trace elements, including manganese, to better reflect benefits and risks by using the tolerable upper intake level as the reference exposure level. Values are provided for various age groups, and the value for toddlers has been used for this assessment. As a result, the TDI for manganese has decreased to 136 ug/kg bw/d from 140 ug/kg bw/d in the 2005 assessment. Manganese was not analyzed in the 2011 assessment.

4.1.5 Methylmercury

Guidance documents from Health Canada (Health Canada, 2010b) present two values for methylmercury, and this assessment has used the lower value presented (for women of child-bearing age and children <12 yrs) of 0.2 ug/kg bw/d. This corresponds to the value from Health Canada used in the baseline assessment.

4.1.6 Molybdenum

Guidance documents from Health Canada (Health Canada, 2010b) have now amended TRVs for essential trace elements, including molybdenum, to better reflect benefits and risks by using the tolerable upper intake level as the reference exposure level. Values are provided for various age

groups, and the value for toddlers has been used for this assessment. As a result, the TDI for molybdenum has increased to 23,000 ug/kg bw/d from 5 ug/kg bw/d in the previous assessments.

4.1.7 Nickel

The source for the TRV for nickel used in the previous assessments (Institute of Medicine, 2001) is not a Health Canada-recommended source, and as a result the TRV for nickel was amended to the USEPA IRIS database RfD of 20 ug/kg bw/d, which is a slight increase from the previously-used value of 17 ug/kg bw/d.

4.1.8 Selenium

Guidance documents from Health Canada (Health Canada, 2010b) have now amended TRVs for essential trace elements, including selenium, to better reflect benefits and risks by using the tolerable upper intake level as the reference exposure level. Values are provided for various age groups, and the value for toddlers has been used for this assessment. As a result, the TDI for selenium has increased to 6200 ug/kg bw/d from 5 ug/kg bw/d in the previous assessments.

4.1.9 Thallium

As noted in the De Beers Canada Inc. Snap Lake Mine - Thallium and Cesium in Fish Tissue Response Plan for the Mackenzie Valley Land and Water Board (December 2014), no federal or international agencies publish a TRV for thallium. As a result, the screening provisional value developed by USEPA (Provisional Peer-Reviewed Toxicity Values for Thallium and Compounds, October 2012) for chronic exposure to soluble thallium of 0.01 ug/kg bw/d was adopted for this assessment. This represents a decrease from the previously-used screening value of 0.07 ug/kg bw/d formerly published on the USEPA IRIS database.

4.1.10 Tin

In keeping with the Health Canada (2010b) preferred sources, the TRV for inorganic tin in this assessment was amended to the ATSDR value of 300 ug/kg bw/d, which is for intermediate-duration exposure to inorganic tin as stannous chloride.

4.1.11 Zinc

Guidance documents from Health Canada (Health Canada, 2010b) have now amended TRVs for essential trace elements, including zinc, to better reflect benefits and risks by using the tolerable upper intake level as the reference exposure level. Values are provided for various age groups, and the value for toddlers has been adopted for this assessment. As a result, the TDI for zinc has increased to 480 ug/kg bw/d from 300 ug/kg bw/d in the 2011 assessment.

5 RISK CHARACTERIZATION

5.1 HAZARD QUOTIENTS

The risk characterization stage compares predicted exposure concentrations with published tolerable daily intake (TDI) values from the literature. Non-cancer risks were classified using hazard quotients (HQs), which are calculated as:

$$HQ = Dose / TDI$$

Where:

Dose = estimated daily intake from country foods; ug/kg bw/day

TDI = toxicity reference value; ug/kg bw/day

Based on recommendations in Health Canada (2012) for single-substance exposure in PQRA, a hazard quotient ≤ 0.2 indicates negligible risk when exposure from one pathway (i.e. country foods) is considered. This is different from the baseline assessment in which negligible risk was associated with an HQ ≤ 1.

Because of the conservative assumptions included at this level of assessment, there is generally considered to be a high degree of certainty associated with results indicating negligible risk. For HQs greater than 0.2, adverse health effects will not necessarily occur. Rather, the assumptions and uncertainties associated with the risk analysis should be studied, and the possibility for more detailed or probabilistic assessment may be considered.

The main goal of this assessment is to determine potential effects of the project over and above background concentrations. Therefore, when HQs exceeded the threshold of 0.2, HQ values for onsite, near-field and AWAR locations were compared with external reference values or historical data in order to comment on the incremental effects of the project on exposure to COPCs in country foods. Values are not directly compared to baseline HQs, because TDIs and some exposure parameters differ in certain cases, as described in the preceding sections. It is noted that the magnitude of HQs is not necessarily proportional to risk, due to differences in underlying dose-response curves. While very large HQ values may indicate higher potential for risk, HQs with small differences cannot be compared in a meaningful way (Ritter et al. 2002). Expected significance of the incremental risk (difference in HQs) is therefore identified in each instance through additional analysis of the underlying data.

HQ values exceeding the threshold value of 0.2 are presented and discussed below for each food item and combined consumption of all items. All calculated HQs are provided in Appendix D.

5.1.1 Caribou Muscle

For the consumption of caribou muscle (meat) HQ values exceeding 0.2 are shown in Table 5-1.The only COPCs for which onsite or AWAR HQ values exceeded the external reference value were thallium and zinc (shaded grey). Each COPC is discussed in more detail below.

Table 5-1. HQ values exceeding 0.2 for consumption of caribou meat from onsite, AWAR and external reference study areas

COPC	Receptor	Consumption Scenario	Onsite	AWAR	External Reference
Chromium	Adult	Heavy	7.2	5.9	7.2
		Moderate	3.4	2.8	3.4
		Low	1.1	0.9	1.1
	Toddler	Heavy	13.2	11.0	13.3
		Moderate	6.3	5.2	6.3
		Low	1.0	0.9	1.1
Lead	Adult	Heavy	0.6	0.5	0.6
		Moderate	0.3	0.2	0.3
	Toddler	Heavy	1.1	0.9	1.1
		Moderate	0.5	0.4	0.5
Nickel	Toddler	Heavy	0.3	0.3	0.4
Thallium	Adult	Heavy	3.5	3.1	3.3
		Moderate	1.6	1.5	1.6
		Low	0.5	0.5	0.5
	Toddler	Heavy	6.4	5.7	6.1
		Moderate	3.0	2.7	2.9
		Low	0.5	0.5	0.5
Zinc	Adult	Heavy	0.3	0.2	0.2
	Toddler	Heavy	0.5	0.4	0.4

5.1.1.1 *Discussion for Chromium*

While HQ values for chromium exceeded the threshold of 0.2 in this assessment, onsite and AWAR HQ values did not exceed external reference values, indicating no incremental effect of the project on risk from consumption of caribou meat. Elevated HQ values were also observed in the 2011 assessment for all sites. This may be explained by the fact that ultramafic rock, which is commonly found in the region, is generally known to contain elevated concentrations of chromium (e.g., on the order of 2000 mg/kg) relative to other rock types (Motzer and Engineers, 2004). While potentially elevated chromium in the region may be of interest to regulators, as discussed in previous assessments, several assumptions that make this a very conservative assessment should be taken into consideration. These include: modeling of tissue concentrations from soil, plant and water measurements; use of maximum measured concentrations in environmental media; and the assumption that 100% of the total chromium measured in soil, water and plant tissue occurs in caribou muscle as hexavalent chromium, which is the significantly more toxic form. To this last point, it has been estimated that only about 11-63% of total chromium in food items occurs in the hexavalent form (Schroeder et al. 1961).

Although no significant incremental effects of the project on exposure to chromium in caribou meat were found here, the previous assessment (2011) found significantly elevated chromium in lichen onsite compared to the external reference, and continued monitoring was recommended. Concentrations of chromium in lichen are therefore compared for all assessment years in Table 5-2, below. No significant differences between onsite, near-site and external reference values of chromium in lichen were found in 2014 (one-way ANOVA, $\alpha = 0.05$, $F_{(2,47)} = 1.91$, $p = 0.16$), and mean values onsite and near-site have decreased since 2011.

Table 5-2. Concentrations of chromium in lichen (mg/kg ww) for onsite, near-site and external reference locations in baseline, 2011 and 2014.*baseline value = mean of all sites (n=50), calculated from dry weight mean using average moisture content.

Site	Onsite (mg/kg ww)		Near-site (mg/kg ww)		External Reference (mg/kg ww)	
	Mean	SD	Mean	SD	Mean	SD
Baseline (2005)	3.4*					
2011	27.5	17.82	19.5	17.74	10.1	8.86
2014	14.1	6.63	15.8	4.86	11.9	4.34

5.1.1.2 *Discussion for Lead*

While some HQ values for lead exceeded the threshold of 0.2 in this assessment, onsite and AWAR HQ values did not exceed external reference values, indicating no incremental effect of the project on risk from consumption of caribou meat. It is noted that Health Canada has adopted the "ALARA" principle for lead, and the TDI used in this assessment is the median dietary lead exposure for the Canadian population (0.1 ug/kg bw/d), as described in Health Canada's review of Meadowbank's 2011 HHRA. However, average daily intake values are commonly higher among First Nations, as measured in BC and Manitoba (0.23 ug/kg bw/d and 1.35 ug/kg bw/d, respectively; Chan et al. (2011, 2012)), and use of the BC value would result in HQ > 0.2 for heavy consumption scenarios only.

5.1.1.3 *Discussion for Nickel*

Since HQs for nickel were marginally unacceptable (HQ = 0.3 or 0.4) under the heaviest consumption scenario for toddlers only, risk from these COPCs is improbable considering the conservative assumptions of this assessment. No incremental risk is associated with consumption of caribou spending time on the mine site.

5.1.1.4 *Discussion for Thallium and Zinc*

The TDI for thallium used in this assessment is a screening provisional value for chronic exposure to soluble thallium presented in USEPA (2012b). The screening provisional value is provided in the absence of sufficient data to develop a provisional reference dose. While the incremental effect of the project on HQ values was generally not substantial (maximum difference = 0.3), concentrations of thallium in environmental media were assessed to determine whether statistically significant differences exist between average onsite and external reference locations. Baseline values are not compared because detection limits for thallium were significantly higher in that assessment (1.0 vs 0.050 mg/kg for soil and 0.030 vs 0.00040 mg/kg for plant tissue).

Mean concentrations (± standard deviation) of thallium in sedge, lichen and soil in 2014 are shown in Figure 5-1. Measured concentrations in berries were non-detectable in all but one sample each for onsite and external reference locations, and in all water samples. No significant differences in lichen and soil concentrations of thallium were found between onsite and external reference locations, and concentrations in sedge were found to be significantly higher at the external reference site (Student's t-test, $\alpha = 0.05$; for sedge, lichen and soil: $t_{(48)} = -4.01, 0.46, 1.72$, respectively).

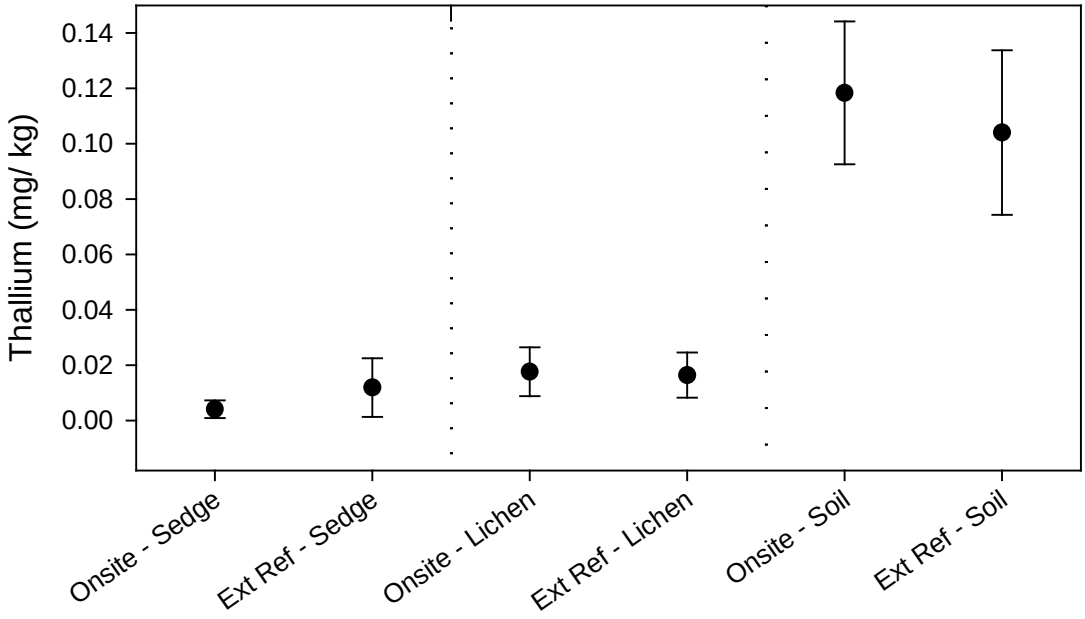

Figure 5-1. Mean concentrations (± standard deviation) of thallium in sedge, lichen and soil for onsite (n=35) and external reference (n=15) study areas in 2014.

Similarly for zinc, the range of concentrations measured for onsite and external reference locations were compared and are presented in Figure 5-2. No significant differences between onsite and external reference values were found for any media (Student's t-test, $\alpha = 0.05$; for sedge, lichen, soil and berries: $t_{(48)} = 0.49$, 1.75, -1.35 and 1.37, respectively).

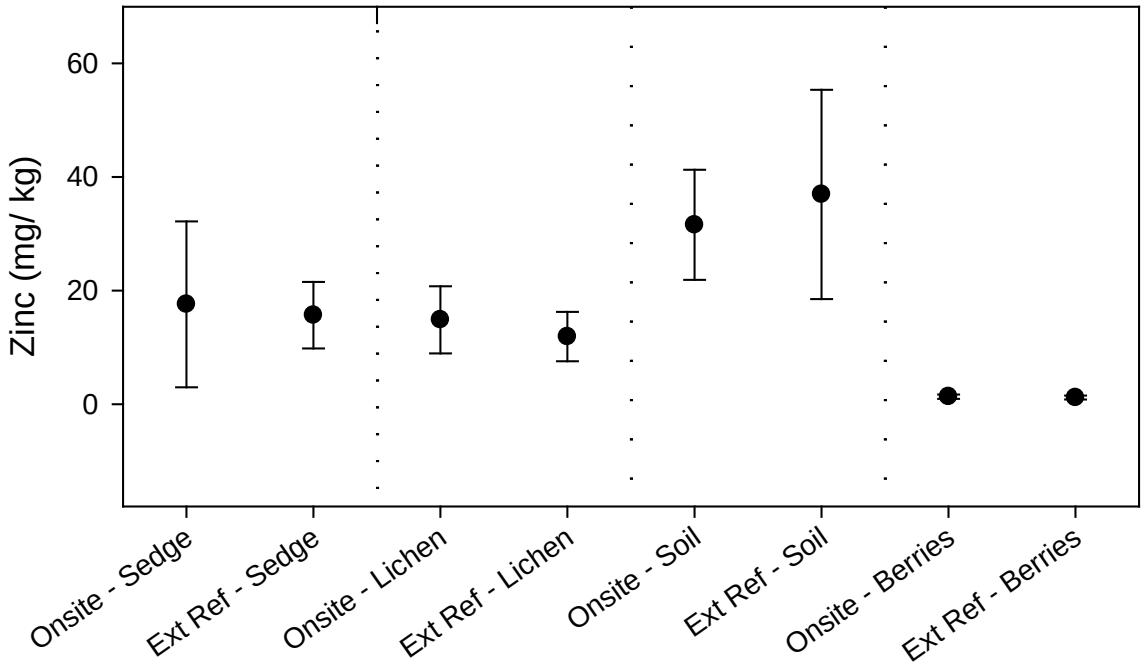

Figure 5-2. Mean concentrations (± standard deviation) of zinc in sedge, lichen, berries and soil for onsite (n=35) and external reference (n=15) study areas in 2014.

These data for thallium and zinc indicate that average exposure for animals spending time in the onsite caribou study area is not higher than background, and as a result, incremental risk from these COPCs is not expected.

5.1.2 Caribou Kidney

HQ values exceeding 0.2 are shown in Table 5-3. The only COPC presenting potentially unacceptable risk under any consumption scenario is thallium (see discussion in Section 5.1.1.4). All HQ values for onsite or AWAR locations are the same as or lower than external reference values, indicating no incremental effect of the project on risk related to consumption of caribou kidney.

Table 5-3. HQ values exceeding 0.2 for consumption of caribou kidney from onsite, AWAR and external reference study areas

COPC	Receptor	Consumption Scenario	Onsite	AWAR	External Reference
Thallium	Adult	Heavy	0.3	0.3	0.3
	Toddler	Heavy	0.6	0.5	0.6
		Moderate	0.3	0.3	0.3

5.1.3 Caribou Liver

HQ values exceeding 0.2 are shown in Table 5-4. The only COPC presenting potentially unacceptable risk is lead. Only the onsite HQ for low consumption by toddlers exceeds the corresponding external reference value, but the difference is marginal. If taken to 3 decimal places, these HQ values are 0.252 and 0.248, for onsite and external reference sites, respectively. Considering guidance to round HQ values to 1-2 decimal places, that tolerable daily intakes are typically considered to be within an order of magnitude of true values, and the conservative TDI used in this assessment (see Section 5.1.1.2) this difference is not considered to be significant. As a result, incremental risk as a result of the project from low consumption of caribou liver by toddlers is not expected to be significant.

Table 5-4. HQ values exceeding 0.2 for consumption of caribou liver from onsite, AWAR and external reference study areas

COPC	Receptor	Consumption Scenario	Onsite	AWAR	External Reference
Lead	Adult	Heavy	0.6	0.5	0.6
		Moderate	0.3	0.2	0.3
	Toddler	Heavy	1.0	0.8	1.0
		Moderate	0.5	0.4	0.5
		Low	0.3	0.2	0.2

5.1.4 Canada Goose Muscle

HQ values exceeding 0.2 are shown in Table 5-5. The only COPCs presenting potentially unacceptable risk are chromium and lead. All HQ values for onsite, near-site or AWAR locations are the same as or lower than external reference values for these COPC's, indicating no incremental effect of the project on risk from consumption of Canada goose meat. See Section 5.1.1.1 for a discussion of the conservative assumptions particularly associated with chromium, and Section 5.1.1.2 for a discussion of the TDI used for lead in this assessment.

Table 5-5. HQ values exceeding 0.2 for consumption of Canada goose meat from onsite, AWAR and external reference study areas

COPC	Receptor	Consumption Scenario	Onsite	Near-site	AWAR	External Reference
Chromium	Adult	Heavy	0.4	0.4	0.3	0.4
		Moderate	0.2	0.3	0.2	0.3
	Toddler	Heavy	0.7	0.8	0.6	0.8
		Moderate	0.4	0.5	0.4	0.5
Lead	Toddler	Heavy	0.4	0.4	0.3	0.4

5.1.5 Combined Consumption

HQs were calculated for individuals who consume all food items at low, moderate and heavy consumption rates. Risk from combined consumption was determined by summing HQs for the individual food items (caribou meat, caribou kidney, caribou liver, Canada goose meat). Values were calculated for the onsite and external reference study areas. Table 5-6 summarizes values that were > 0.2 (see Appendix D for all values).

In general, only HQ values for lead changed significantly in this assessment, because HQ values > 0.2 were associated with three out of four food items. The combined consumption analyses produced one additional scenario under which potential risk of adverse health effects may increase due to exposure to lead (low combined consumption by adults). However, HQ values marginally exceeded 0.2, and were equivalent for onsite and external reference locations. In addition, under the combined consumption scenario, the onsite lead HQ for heavy consumption by adults (1.5) marginally exceeded the corresponding external reference value (1.4). However, if taken to 3 decimal places these values were 1.458 and 1.447, respectively, and this difference is not expected to be significant. Other than this and the scenarios for thallium and zinc already discussed in Section 5.1.1.4, HQ values were the same for onsite and external reference study areas, indicating no additional incremental risk is associated with the project as a result of combined consumption.

Table 5-6. HQs for combined consumption of caribou meat, caribou kidney, caribou liver and Canada goose meat at low, moderate and heavy consumption rates. Only values > 0.2 are shown.

COPC	Receptor	Consumption Scenario	Onsite	External Reference
Chromium	Adult	Heavy	7.6	7.7
		Moderate	3.6	3.7
		Low	1.1	1.1
	Toddler	Heavy	14.0	14.3
		Moderate	6.7	6.8
		Low	1.1	1.2
Lead	Adult	Heavy	1.5	1.4
		Moderate	0.7	0.7
		Light	0.3	0.3
	Toddler	Heavy	2.6	2.6
		Moderate	1.1	1.1
		Low	0.4	0.4
Nickel	Toddler	Heavy	0.4	0.4
Thallium	Adult	Heavy	3.9	3.7
		Moderate	1.8	1.8
		Low	0.6	0.6
	Toddler	Heavy	7.1	6.9
		Moderate	3.4	3.2
		Low	0.7	0.7
Zinc	Adult	Heavy	0.3	0.2
	Toddler	Heavy	0.5	0.4

5.2 INCREMENTAL LIFETIME CANCER RISK

For carcinogenic substances (inorganic arsenic), risk was determined assuming lifetime exposure (no amortization) at adult consumption rates. Incremental lifetime cancer risk (ILCR), calculated as:

$$ILCR = LADD \times SL$$

Where:

ILCR = incremental lifetime cancer risk

LADD = estimated lifetime average daily dose from country foods; ug/kg bw/day

SL = slope factor; $(ug/kg/day)^{-1}$

Based on recommendations in Health Canada (2010a) for single-substance exposure, cancer risk is found to be "essentially negligible" (*de minimis*) when ILCR ≤ 1×10^{-5}.

ILCR values for all food items and all locations were < 1×10^{-5} (see Appendix D for values), indicating essentially negligible risk as a result of exposure to arsenic from consumption of country foods.

5.3 UNCERTAINTY ASSESSMENT

Assumptions included in each section of the assessment are discussed here, along with implications for over- or under-estimating risk. Because of the conservative assumptions included at this level of assessment, there is generally considered to be a high degree of certainty associated with results indicating negligible risk.

5.3.1 COPC Identification

Projected concentrations of metals in four dust sources (roads, waste rock and tailings) that exceeded the 90th centile of baseline soil concentrations or the CCME guidelines (CCME 1999, 2001) were included as COPCs, as well as five metals regulated under MMER (arsenic, copper, lead, nickel and zinc; regardless of projected concentrations) and mercury due to general public concerns. No new sources of COPCs were identified in this assessment. These methods resulted in a comprehensive list of COPCs and are consistent with Health Canada (2012) guidance.

5.3.2 Receptor Characteristics

Receptor characteristics such as body weight were obtained from Canadian sources that indicated they were representative of the target population.

Consumption rates were adjusted in this assessment based on a review of the literature, and the updated values incorporate local and regional surveys in several cases. As a result, consumption rates are considered to more closely reflect the target population than federal guidance values. For example, assessed consumption rates for caribou meat are up to nearly 2x the value presented for consumption of wild game in Health Canada (2012), which more closely resembles average consumption in Nunavut. In addition, low, moderate and heavy consumption scenarios were assessed to represent a range of preferences, reducing uncertainty in the assessment.

5.3.3 Contaminant Concentrations

The number of samples collected for onsite, near-site and external reference study areas (15-20 each) is considered adequate for characterizing metals concentrations in environmental media for PQRA. The number of samples collected for the AWAR study location (5) is recognized to be low, and thus associated with higher uncertainty, but this site was included to conduct supplementary screening, and is not a component of the regular monitoring plan outlined in Meadowbank's Terrestrial Ecosystem Management Plan and Wilson (2006).

Maximum measured concentrations for each study area were used in the assessment, which is considered appropriate for PQRA (Health Canada, 2012) and provides conservative estimates of exposure since in reality animals are more likely exposed to a range of concentrations.

Concentrations of COPCs in country food items were modeled from environmental media, and assumptions of the model are discussed in the associated WSLRA. Overall, when assumptions were used they were estimated to be conservative, in order to avoid underestimating risk. As described in Health Canada (2010a), factors affecting contaminant uptake by biota are highly variable, and as a result, components of food chain models (such as biotransfer factors) are generally biased towards maximizing tissue concentrations. Where species-specific values were not available in the food chain model, they were typically taken from beef or poultry studies (e.g. feed-to-muscle transfer factors).

Although lower tiers of assessment such as this may not commonly consider accumulation in certain tissues such as organs, this assessment incorporated muscle-to-organ transfer factors specifically for caribou, resulting in greater confidence in tissue concentrations for these food items.

This assessment does not consider any effects of food handling or preparation, which may affect COPC speciation in food items.

5.3.4 Toxicity

As described in Wilson (2006), estimates of “safe” levels of exposure published by regulatory agencies are generally very conservative and incorporate safety factors. Since TDIs and cancer slope factors are not commonly derived from human-based studies, these safety factors are meant to be protective. In addition, TRVs are typically derived from laboratory studies, where bioavailability of the contaminant is typically higher than may occur in the environment, resulting in another level of conservatism. However it should be recognized that TDIs and cancer slope factors are not definitive values, but should generally be considered to be within one order of magnitude of the true value.

6 CONCLUSIONS

This preliminary quantitative HHRA evaluated the risks to humans from contaminant exposure through consumption of country foods sourced in and around the Meadowbank site during year 5 of operation.

Important findings are as follows:

Caribou Meat

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of caribou muscle (meat) for most COPCs. For chromium, nickel, lead, thallium, and zinc, HQ values exceeded 0.2 for all study areas, including the external reference site.
    - Onsite and AWAR HQs for chromium, nickel and lead were the same as or lower than the corresponding value for the external reference site, indicating no incremental risk as a result of the project.
    - Onsite HQ values for thallium and zinc marginally exceeded external reference values in some consumption scenarios. HQs are based on the maximum measured concentration among the samples collected. For comparison, measured mean concentrations in onsite environmental media did not exceed external reference values in statistical tests, indicating that average exposure for animals spending time in the onsite caribou study area is not higher than background. As a result, incremental risk associated with these COPCs is not expected to be significant.

Caribou Kidney

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of caribou kidney from all study locations for most COPCs. The HQ value for thallium exceeded 0.2 for all study areas, including the external reference site (to a maximum of 0.6; for moderate or heavy consumption scenarios).
    - Thallium HQ values for onsite or AWAR locations were the same as or lower than external reference values, indicating no incremental risk as a result of the project.

Caribou Liver

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of caribou liver from onsite, AWAR, and external reference study areas, for all COPCs except lead, which had HQs > 0.2 for all study areas, including the external reference site (maximum HQ of 1.0).
    - Only the onsite lead HQ for low consumption by toddlers exceeded the corresponding external reference value, but the difference in HQs is marginal (0.004) and is not expected to be significant. The toxicity reference value used for lead in this assessment is equivalent to the median dietary lead exposure for the Canadian population (0.1 ug/kg bw/d), as determined in Health Canada's Final Human Health State of the Science Report on Lead (2012) and identified in Health Canada's review of the 2011 Meadowbank HHRA.

Canada Goose Meat

- Negligible risk (HQ ≤ 0.2) is associated with the consumption of Canada goose meat from onsite, near-site, AWAR and external reference study areas, for most COPCs. For chromium and lead, HQ values exceeded 0.2 for all study areas, including the external reference site (maximum of 0.8).
    - Lead and chromium HQ values for onsite, near-site or AWAR locations were the same as or lower than external reference values, indicating no incremental risk as a result of the project.

Combined Consumption

- The combined consumption analysis produced one additional scenario under which adverse health effects may potentially occur (low combined consumption by adults due to exposure to lead).
    - HQ values marginally exceeded 0.2 for this scenario, but were the same (0.3) for onsite and external reference areas, indicating no incremental risk as a result of the project.

Overall, this analysis indicated that mining activities do not appear to be contributing significant incremental risk from COPCs to consumers of country food items sourced in and around the Meadowbank area. This is consistent with the baseline assessment (2005) which concluded that based on projected concentrations of COPCs in environmental media (soil and water), risk to persons consuming country foods would not increase appreciably following mine development. Since HQ values between the assessments are not directly comparable due to changes in various reference parameters, a comparison of projected and current concentrations of COPCs in soil was performed to assess quantitative impact predictions. Measured concentrations of COPCs in soil in 2014 did not exceed concentrations projected to occur in the Project's Final Environmental Impact Statement (Cumberland, 2006), confirming that impact predictions are not being exceeded.

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Appendix A

Example Calculation

Exposure to Pb in Caribou Kidney (onsite; heavy consumption)

Following the submission of the 2011 PQRA, Health Canada requested examples of calculations. The following examples are provided and describe the calculation of the hazard quotient for exposure of adults to lead, based on the heavy consumption of caribou kidney from animals spending 33% of their time in the onsite study area, and 67% of their time at the external reference study area. Note that final values may differ slightly due to rounding.

Exposure Assessment

Muscle concentrations (C_M) were calculated as:

$$C_M = EDI_C \times W_C \times BTF$$

Where:

C_M = Concentration in muscle tissue (meat); mg/kg ww

EDI_C = estimated daily intake of COPC by caribou; mg/kg ww/d (see accompanying wildlife SLRA for calculations)

W_C = caribou weight; kg

BTF = biotransfer factor (feed to muscle; beef); d/kg ww

Example:

C_M (mg/kg ww) = 0.184 mg/kg ww/d x 75 kg x 0.0004 d/kg ww

= 0.00552

Kidney concentrations (C_K) and liver concentrations (C_L) were calculated as:

$$C_K \text{ or } C_L = C_M \times BTF$$

Where:

C_K = concentration of COPC in caribou kidney; mg/kg ww

C_L = concentration of COPC in caribou liver; mg/kg ww

C_M = concentration of COPC in caribou muscle; mg/kg ww

BTF = transfer factor (muscle to organ; caribou)

Example:

C_K (mg/kg ww) = 0.00516 mg/kg ww x 33.19

= 0.184

Human exposure concentrations through consumption were calculated as:

$$Dose = C_F \times IR_F \times RAF_{ORAL} / BW$$

Where:

Dose = estimated daily intake of COPC from consumption of food item; ug/kg bw/day

C_F = concentration of COPC in food item; mg/kg ww

IR_F = consumption rate of food item; g/day

RAF_{ORAL} = relative absorption factor (assumed to be 1)

BW = body weight of person; kg

Example:

Dose (ug/kg bw/d) = 0.184 mg/kg ww x 2.9 g/d x 1 / 70.7 kg

= 0.0075

Risk Characterization

HQ = Dose (ug/kg ww/d) / TDI (ug/kg bw/d)**

= 0.0075 / 0.1

= 0.07 (rounded to 0.1 in assessment)

**see values in Appendix D

Appendix B

Transfer Factors

Transfer Factors

Feed-to-muscle transfer factors were obtained from the following sources. For caribou, all values are for beef, with the exception of selenium, which is for pig. All muscle-to-organ factors were obtained from Gamberg, 2012. All values for Canada goose are for chicken.

COPC	Caribou				Canada Goose	
	Feed-to-Muscle (d/kg)	Source	Muscle-to-Kidney	Muscle-to-Liver	Feed-to-Muscle (d/kg)	Source
Antimony	0.0012	IAEA 2010	1.17	0.82	0.006	Staven et al. 2003
Arsenic	0.002	USEPA 2005	6.45	0.64	0.83	Staven et al. 2003
Barium	0.00014	IAEA 2010	40.9	2.66	0.019	IAEA 2010
Beryllium	0.001	USEPA 2005	2.33	0.87	0.4	Staven et al. 2003
Cadmium	0.0058	IAEA 2010	2049	287	1.75	IAEA 2010
Chromium	0.0055	USEPA 2005	0.52	0.78	0.8	Staven et al. 2003
Cobalt	0.00043	IAEA 2010	10.5	18.6	0.97	IAEA 2010
Copper	0.01	RAIS 2012	2.06	13.7	0.5	Staven et al. 2003
Lead	0.0007	IAEA 2010	33.2	250	0.8	IAEA 2010
Manganese	0.0005	IAEA 2010	0.85	0.68	0.05	IAEA 2010
Mercury (inorganic)	0.00609	NCRP 1989	105	15.0	0.03	IAEA 2010
Mercury (methyl)	0.00078	USEPA 2005	105	15.0	0.03	Staven et al. 2003
Molybdenum	0.001	IAEA 2010	44.2	153	0.18	IAEA 2010
Nickel	0.006	USEPA 2005	1.68	1.21	0.001	Staven et al. 2003
Selenium	0.32	IAEA 2010	19.3	2.28	9.7	IAEA 2010
Strontium	0.008	IAEA 2010	5.27	1.28	0.08	Staven et al. 2003
Thallium	0.04	USEPA 2005	14.9	2.51	0.8	Staven et al. 2003
Tin	0.001	RAIS 2012	3.88	9.44	0.8	IAEA 2010
Uranium	0.00039	IAEA 2010	3.23	2.61	0.75	IAEA 2010
Vanadium	0.0025	RAIS 2012	4.33	5.85	2	Staven et al. 2003
Zinc	0.16	IAEA 2010	0.95	1.11	0.47	IAEA 2010

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Appendix C

Measured and Estimated COPC Concentrations in Soil, Plants, Insects and Water

Measured and Estimated COPC Concentrations
Onsite Location - 2014
(table based on Azimuth, 2006)

	Units	Moisture Content[1] (%)	COPC Concentrations										
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Total Mercury
Soil (measured)													
Maximum	mg/kg dw	-	0.240	55.700	53.900	0.620	0.279	58.700	13.500	19.500	23.400	366.000	0.022
Lake Water (measured)													
Maximum	mg/L	-	0.000	0.001	0.004	0.000	0.000	0.000	0.000	0.001	0.001	0.004	0.000
Sedges (measured)													
Maximum	mg/kg ww	51.63%	0.008	1.450	51.600	0.049	0.040	23.700	0.975	2.910	0.889	405.000	0.040
Lichen (measured)													
Maximum	mg/kg ww	39.95%	0.014	3.560	31.700	0.180	0.301	59.400	3.010	5.400	3.980	240.000	0.146
Berries (measured)													
Maximum	mg/kg ww	83.34%	0.001	0.193	2.300	0.011	0.023	0.869	0.100	0.991	0.103	26.000	0.003
Insects (predicted)[3]													
Maximum	mg/kg dw		0.240	3.628	53.900	0.620	0.665	58.700	13.500	17.130	1.781	366.000	0.022
	mg/kg ww	65.00%	0.084	1.270	18.865	0.217	0.233	20.545	4.725	5.995	0.623	128.100	0.008

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
Onsite Location - 2014
(table based on Azimuth, 2006)

		COPC Concentrations										
	Units	Inorg-Hg[2]	MeHg[2]	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium	Zinc
Soil (measured)												
Maximum	mg/kg dw	0.022	0.000	1.250	35.900	0.100	17.600	0.167	1.000	4.990	25.800	66.700
Lake Water (measured)												
Maximum	mg/L	0.000	0.000	0.000	0.001	0.000	0.017	0.000	0.000	0.000	0.001	0.003
Sedges (measured)												
Maximum	mg/kg ww	0.026	0.014	4.750	8.720	0.030	11.100	0.013	0.029	0.135	2.610	32.200
Lichen (measured)												
Maximum	mg/kg ww	0.096	0.050	0.754	19.500	0.088	17.800	0.048	0.103	0.898	9.550	38.400
Berries (measured)												
Maximum	mg/kg ww	0.002	0.001	0.054	0.432	0.005	0.700	0.002	0.096	0.016	0.219	2.760
Insects (predicted)[3]												
Maximum	mg/kg dw	0.022	0.000	1.250	35.900	0.100	17.600	0.167	1.000	4.990	25.800	201.149
	mg/kg ww	0.008	0.000	0.438	12.565	0.035	6.160	0.058	0.350	1.747	9.030	70.402

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
Near-site Location - 2014
(table based on Azimuth, 2006)

	Units	Moisture Content[1] (%)	COPC Concentrations										
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Total Mercury
Soil (measured)													
Maximum	mg/kg dw	-	0.050	23.000	41.200	0.760	0.189	92.800	8.500	11.600	12.500	607.000	0.025
Lake Water (measured)													
Maximum	mg/L	-	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.000
Sedges (measured)													
Maximum	mg/kg ww	46.03%	0.017	5.330	45.600	0.050	0.072	44.100	1.720	5.360	1.790	851.000	0.031
Lichen (measured)													
Maximum	mg/kg ww	23.39%	0.016	2.350	36.000	0.046	0.172	31.900	1.730	3.550	2.350	254.000	0.210
Berries (measured)													
Maximum	mg/kg ww	83.97%	0.001	0.020	3.870	0.001	0.013	0.239	0.017	0.846	0.014	52.600	0.002
Insects (predicted)[3]													
Maximum	mg/kg dw		0.050	1.594	41.200	0.760	0.524	92.800	8.500	14.582	1.148	607.000	0.025
	mg/kg ww	65.00%	0.018	0.558	14.420	0.266	0.183	32.480	2.975	5.104	0.402	212.450	0.009

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
Near-site Location - 2014
(table based on Azimuth, 2006)

		COPC Concentrations										
	Units	Inorg-Hg[2]	MeHg[2]	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium	Zinc
Soil (measured)												
Maximum	mg/kg dw	0.024	0.000	0.970	35.200	0.100	15.100	0.156	1.000	3.850	19.000	43.300
Lake Water (measured)												
Maximum	mg/L	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.001	0.002
Sedges (measured)												
Maximum	mg/kg ww	0.020	0.010	3.220	15.800	0.036	12.400	0.012	0.020	0.157	3.720	88.700
Lichen (measured)												
Maximum	mg/kg ww	0.139	0.071	0.293	12.100	0.083	9.740	0.035	0.038	0.244	3.470	27.100
Berries (measured)												
Maximum	mg/kg ww	0.001	0.001	0.031	0.315	0.005	0.872	0.001	0.133	0.002	0.028	1.870
Insects (predicted)[3]												
Maximum	mg/kg dw	0.024	0.000	0.970	35.200	0.100	15.100	0.156	1.000	3.850	19.000	182.910
	mg/kg ww	0.009	0.000	0.340	12.320	0.035	5.285	0.055	0.350	1.348	6.650	64.018

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
Onsite+Near-site Location - 2014
(table based on Azimuth, 2006)

	Units	Moisture Content[1] (%)	COPC Concentrations										
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Total Mercury
Soil (measured)													
Maximum	mg/kg dw	-	0.240	55.700	53.900	0.760	0.279	92.800	13.500	19.500	23.400	607.000	0.025
Lake Water (measured)													
Maximum	mg/L	-	0.000	0.001	0.004	0.000	0.000	0.000	0.000	0.001	0.001	0.004	0.000
Sedges (measured)													
Maximum	mg/kg ww	49.23%	0.017	5.330	51.600	0.050	0.072	44.100	1.720	5.360	1.790	851.000	0.040
Lichen (measured)													
Maximum	mg/kg ww	32.85%	0.016	3.560	36.000	0.180	0.301	59.400	3.010	5.400	3.980	254.000	0.210
Berries (measured)													
Maximum	mg/kg ww	83.61%	0.001	0.193	3.870	0.011	0.023	0.869	0.100	0.991	0.103	52.600	0.003
Insects (predicted)[3]													
Maximum	mg/kg dw		0.240	3.628	53.900	0.760	0.665	92.800	13.500	17.130	1.781	607.000	0.025
	mg/kg ww	65.00%	0.084	1.270	18.865	0.266	0.233	32.480	4.725	5.995	0.623	212.450	0.009

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
Onsite+Near-site Location - 2014
(table based on Azimuth, 2006)

		COPC Concentrations										
	Units	Inorg-Hg[2]	MeHg[2]	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium	Zinc
Soil (measured)												
Maximum	mg/kg dw	0.024	0.000	1.250	35.900	0.100	17.600	0.167	1.000	4.990	25.800	66.700
Lake Water (measured)												
Maximum	mg/L	0.000	0.000	0.000	0.001	0.000	0.017	0.000	0.000	0.000	0.001	0.003
Sedges (measured)												
Maximum	mg/kg ww	0.026	0.014	4.750	15.800	0.036	12.400	0.013	0.029	0.157	3.720	88.700
Lichen (measured)												
Maximum	mg/kg ww	0.139	0.071	0.754	19.500	0.088	17.800	0.048	0.103	0.898	9.550	38.400
Berries (measured)												
Maximum	mg/kg ww	0.002	0.001	0.054	0.432	0.005	0.872	0.002	0.133	0.016	0.219	2.760
Insects (predicted)[3]												
Maximum	mg/kg dw	0.024	0.000	1.250	35.900	0.100	17.600	0.167	1.000	4.990	25.800	201.149
	mg/kg ww	0.009	0.000	0.438	12.565	0.035	6.160	0.058	0.350	1.747	9.030	70.402

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
AWAR Location - 2014
(table based on Azimuth, 2006)

	Units	Moisture Content[1] (%)	COPC Concentrations										
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Total Mercury
Soil (measured)													
Maximum	mg/kg dw	-	0.050	2.800	38.400	0.310	0.025	43.300	6.230	11.100	5.440	257.000	0.003
Lake Water (measured)													
Maximum	mg/L	-	0.000	0.001	0.004	0.000	0.000	0.000	0.000	0.001	0.001	0.004	0.000
Sedges (measured)													
Maximum	mg/kg ww	49.20%	0.005	0.352	26.100	0.020	0.038	10.300	0.781	3.710	0.195	228.000	0.013
Lichen (measured)													
Maximum	mg/kg ww	24.36%	0.018	1.830	43.600	0.098	0.171	32.900	3.180	4.230	2.190	225.000	0.062
Berries (measured)													
Maximum	mg/kg ww	83.60%	0.001	0.019	1.880	0.001	0.028	0.506	0.043	0.937	0.019	31.100	0.001
Insects (predicted)[3]													
Maximum	mg/kg dw		0.050	0.225	38.400	0.310	0.153	43.300	6.230	14.385	0.641	257.000	0.003
	mg/kg ww	65.00%	0.018	0.079	13.440	0.109	0.053	15.155	2.181	5.035	0.224	89.950	0.001

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
AWAR Location - 2014
(table based on Azimuth, 2006)

	Units	COPC Concentrations										
		Inorg-Hg[2]	MeHg[2]	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium	Zinc
Soil (measured)												
Maximum	mg/kg dw	0.002	0.000	0.700	19.700	0.100	22.900	0.108	1.000	2.560	20.300	25.300
Lake Water (measured)												
Maximum	mg/L	0.000	0.000	0.000	0.001	0.000	0.017	0.000	0.000	0.000	0.001	0.003
Sedges (measured)												
Maximum	mg/kg ww	0.008	0.004	0.745	4.550	0.023	13.400	0.008	0.010	0.106	2.070	33.400
Lichen (measured)												
Maximum	mg/kg ww	0.041	0.021	0.287	11.000	0.070	39.000	0.036	0.048	0.506	7.700	37.200
Berries (measured)												
Maximum	mg/kg ww	0.001	0.000	0.076	0.443	0.005	1.100	0.000	0.167	0.007	0.118	2.910
Insects (predicted)[3]												
Maximum	mg/kg dw	0.002	0.000	0.700	19.700	0.100	22.900	0.108	1.000	2.560	20.300	162.516
	mg/kg ww	0.001	0.000	0.245	6.895	0.035	8.015	0.038	0.350	0.896	7.105	56.881

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
External Reference Location - 2014
(table based on Azimuth, 2006)

	Units	Moisture Content[1] (%)	COPC Concentrations										
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Total Mercury
Soil (measured)													
Maximum	mg/kg dw	-	0.170	25.600	46.800	0.540	0.185	174.000	13.800	20.500	14.200	353.000	0.024
Lake Water (measured)													
Maximum	mg/L	-	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.000
Sedges (measured)													
Maximum	mg/kg ww	51.21%	0.012	1.330	51.700	0.078	0.116	37.600	2.100	2.690	1.750	281.000	0.071
Lichen (measured)													
Maximum	mg/kg ww	44.09%	0.021	0.737	25.200	0.084	0.213	60.900	1.460	4.630	4.110	194.000	0.238
Berries (measured)													
Maximum	mg/kg ww	84.06%	0.001	0.041	2.040	0.001	0.016	0.441	0.070	1.060	0.071	17.800	0.003
Insects (predicted)[3]													
Maximum	mg/kg dw		0.170	1.761	46.800	0.540	0.517	174.000	13.800	17.398	1.255	353.000	0.024
	mg/kg ww	65.00%	0.060	0.616	16.380	0.189	0.181	60.900	4.830	6.089	0.439	123.550	0.008

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Measured and Estimated COPC Concentrations
External Reference Location - 2014
(table based on Azimuth, 2006)

		COPC Concentrations										
	Units	Inorg-Hg[2]	MeHg[2]	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium	Zinc
Soil (measured)												
Maximum	mg/kg dw	0.024	0.000	1.180	86.100	0.100	32.300	0.164	1.000	3.200	36.500	89.500
Lake Water (measured)												
Maximum	mg/L	0.000	0.000	0.000	0.001	0.000	0.009	0.000	0.000	0.000	0.001	0.002
Sedges (measured)												
Maximum	mg/kg ww	0.047	0.024	1.940	22.500	0.051	24.700	0.036	0.038	0.320	7.990	35.000
Lichen (measured)												
Maximum	mg/kg ww	0.157	0.081	0.504	33.400	0.119	11.300	0.031	0.072	0.297	3.300	18.500
Berries (measured)												
Maximum	mg/kg ww	0.002	0.001	0.035	0.430	0.005	0.926	0.002	0.322	0.005	0.360	1.990
Insects (predicted)[3]												
Maximum	mg/kg dw	0.024	0.000	1.180	86.100	0.100	32.300	0.164	1.000	3.200	36.500	214.591
	mg/kg ww	0.008	0.000	0.413	30.135	0.035	11.305	0.057	0.350	1.120	12.775	75.107

Notes:

[1] Moisture content for plants represents average of available site-specific data; moisture content for insects based on Azimuth (2006)

[2] Assumed fractions of MeHg in exposure media (see text for details)

Soil (soilmeHg)	0.01	
Plants (plantmeHG)	0.34	
Invertebrates	0.17	
Water	0	Assumed to be zero

[3] Predicted using soil concentration and insect BAF; see Azimuth, 2006)

Appendix D

Toxicity Reference Values and Hazard Quotient Calculation

HQ Calculations for Consumption of Caribou Muscle
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Transfer Factor (beef)			0.0012	0.002	0.00014	0.001	0.0058	0.0055	0.00043	0.01	0.0007
Animal Dose[1]	**Soil**		0.000	0.075	0.073	0.001	0.000	0.125	0.018	0.026	0.032
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.081	0.786	0.001	0.001	0.671	0.026	0.082	0.027
	Lichens	65%	0.001	0.117	1.187	0.006	0.010	1.959	0.099	0.178	0.131
	Berries	5%	0.000	0.000	0.010	0.000	0.000	0.002	0.000	0.003	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.199	1.983	0.007	0.011	2.633	0.126	0.262	0.159
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.019	0.000	0.004	1.154	0.004	0.184	0.010
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.001	0.001	0.118	0.003	0.027	7.181	0.023	1.145	0.060
	Moderate		0.000	0.001	0.056	0.001	0.013	3.395	0.011	0.541	0.028
	Low		0.000	0.000	0.017	0.000	0.004	1.061	0.003	0.169	0.009
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.001	0.002	0.218	0.005	0.049	13.231	0.042	2.110	0.111
	Moderate		0.001	0.001	0.103	0.002	0.023	6.252	0.020	0.997	0.052
	Low		0.000	0.000	0.017	0.000	0.004	1.049	0.003	0.167	0.009
TDI (ug/kg bw·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.6
	Moderate		0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.3
	Low		0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	13.2	0.0	0.0	1.1
	Moderate		0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.5
	Low		0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.1

Notes:

1 - Animal dose per day for onsite area only

2 - Concentration based on time onsite (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Muscle
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
Transfer Factor (beef)			0.0005	0.00609	0.00078	0.001	0.006	0.32	0.008	0.04	0.001
Animal Dose[1]	**Soil**		0.817	0.000	0.000	0.002	0.048	0.000	0.024	0.000	0.001
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
	Sedges	30%	12.955	0.000	0.000	0.072	0.241	0.001	0.189	0.000	0.000
	Lichens	65%	8.378	0.005	0.002	0.025	0.643	0.003	0.587	0.002	0.003
	Berries	5%	0.133	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	21.466	0.005	0.003	0.097	0.885	0.003	0.778	0.002	0.004
Concentration in Animal Tissue[2] (mg/kg wet)			0.557	0.003	0.000	0.005	0.609	0.107	0.479	0.006	0.000
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		3.467	0.016	0.001	0.030	3.792	0.663	2.979	0.035	0.002
	Moderate		1.639	0.008	0.000	0.014	1.793	0.313	1.408	0.016	0.001
	Low		0.512	0.002	0.000	0.004	0.560	0.098	0.440	0.005	0.000
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		6.388	0.029	0.002	0.056	6.987	1.222	5.488	0.064	0.005
	Moderate		3.018	0.014	0.001	0.026	3.301	0.577	2.593	0.030	0.002
	Low		0.506	0.002	0.000	0.004	0.554	0.097	0.435	0.005	0.000
TDI (ug/kg bw·day)			136	0.30	0.20	23000	20	6200	600	0.01	300
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.1	0.0	0.0	0.2	0.0	0.0	3.5	0.0
	Moderate		0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.6	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.1	0.0	0.0	0.3	0.0	0.0	6.4	0.0
	Moderate		0.0	0.0	0.0	0.0	0.2	0.0	0.0	3.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0

Notes:

1 - Animal dose per day for onsite area only

2 - Concentration based on time onsite (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Muscle
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Uranium	Vanadium	Zinc
Transfer Factor (beef)			0.00039	0.0025	0.16
Animal Dose[1]	**Soil**		0.007	0.035	0.090
(mg/kg wet·day)	**Water**		0.000	0.000	0.000
	Sedges	30%	0.002	0.057	1.350
	Lichens	65%	0.030	0.315	1.267
	Berries	5%	0.000	0.001	0.007
	Insects	0%	0.000	0.000	0.000
	Total Food	100%	0.032	0.372	2.624
Concentration in Animal Tissue[2] (mg/kg wet)			0.001	0.060	20.947
Human Dose-Adult	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.005	0.376	130.365
	Moderate		0.002	0.178	61.627
	Low		0.001	0.056	19.258
Human Dose-Toddler	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.009	0.693	240.195
	Moderate		0.004	0.327	113.496
	Low		0.001	0.055	19.043
TDI (ug/kg bw·day)			0.60	5.0	480
Hazard Quotients-Adult	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.3
	Moderate		0.0	0.0	0.1
	Low		0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.5
	Moderate		0.0	0.1	0.2
	Low		0.0	0.0	0.0

Notes:

1 - Animal dose per day for onsite area only

2 - Concentration based on time onsite (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Muscle
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Transfer Factor (beef)			0.0012	0.002	0.00014	0.001	0.0058	0.0055	0.00043	0.01	0.0007
Animal Dose[1]	**Soil**		0.000	0.004	0.052	0.000	0.000	0.058	0.008	0.015	0.007
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.005	0.397	0.000	0.001	0.157	0.012	0.056	0.003
	Lichens	65%	0.001	0.060	1.438	0.003	0.006	1.085	0.105	0.140	0.072
	Berries	5%	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.002	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.066	1.840	0.004	0.006	1.243	0.117	0.198	0.075
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.018	0.000	0.004	0.956	0.003	0.165	0.008
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.001	0.001	0.115	0.002	0.022	5.947	0.022	1.029	0.049
	Moderate		0.000	0.000	0.054	0.001	0.010	2.811	0.010	0.487	0.023
	Low		0.000	0.000	0.017	0.000	0.003	0.879	0.003	0.152	0.007
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.001	0.001	0.211	0.004	0.041	10.958	0.040	1.896	0.090
	Moderate		0.000	0.001	0.100	0.002	0.019	5.178	0.019	0.896	0.042
	Low		0.000	0.000	0.017	0.000	0.003	0.869	0.003	0.150	0.007
TDI (ug/kg bw·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.5
	Moderate		0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.2
	Low		0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.1
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.9
	Moderate		0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.4
	Low		0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.1

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Muscle
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
Transfer Factor (beef)			0.0005	0.00609	0.00078	0.001	0.006	0.32	0.008	0.04	0.001
Animal Dose[1]	**Soil**		0.346	0.000	0.000	0.001	0.027	0.000	0.031	0.000	0.001
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
	Sedges	30%	3.471	0.000	0.000	0.011	0.069	0.000	0.204	0.000	0.000
	Lichens	65%	7.421	0.001	0.001	0.009	0.363	0.002	1.286	0.001	0.002
	Berries	5%	0.079	0.000	0.000	0.000	0.001	0.000	0.003	0.000	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	10.971	0.001	0.001	0.021	0.433	0.003	1.493	0.001	0.002
Concentration in Animal Tissue[2] (mg/kg wet)			0.421	0.002	0.000	0.003	0.539	0.100	0.622	0.005	0.000
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		2.622	0.013	0.001	0.018	3.354	0.624	3.869	0.031	0.002
	Moderate		1.240	0.006	0.000	0.009	1.586	0.295	1.829	0.015	0.001
	Low		0.387	0.002	0.000	0.003	0.496	0.092	0.572	0.005	0.000
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		4.832	0.023	0.002	0.034	6.180	1.150	7.128	0.057	0.004
	Moderate		2.283	0.011	0.001	0.016	2.920	0.543	3.368	0.027	0.002
	Low		0.383	0.002	0.000	0.003	0.490	0.091	0.565	0.005	0.000
TDI (ug/kg bw·day)			136	0.30	0.20	23000	20	6200	600	0.01	300
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.2	0.0	0.0	3.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.5	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.1	0.0	0.0	0.3	0.0	0.0	5.7	0.0
	Moderate		0.0	0.0	0.0	0.0	0.1	0.0	0.0	2.7	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Muscle
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Uranium	Vanadium	Zinc
Transfer Factor (beef)			0.00039	0.0025	0.16
Animal Dose[1]	**Soil**		0.003	0.027	0.034
(mg/kg wet·day)	**Water**		0.000	0.000	0.000
	Sedges	30%	0.002	0.032	0.508
	Lichens	65%	0.017	0.254	1.227
	Berries	5%	0.000	0.000	0.007
	Insects	0%	0.000	0.000	0.000
	Total Food	100%	0.018	0.286	1.743
Concentration in Animal Tissue[2] (mg/kg wet)			0.001	0.055	17.238
Human Dose-Adult	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.004	0.340	107.278
	Moderate		0.002	0.161	50.713
	Low		0.001	0.050	15.848
Human Dose-Toddler	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.007	0.626	197.657
	Moderate		0.003	0.296	93.396
	Low		0.001	0.050	15.671
TDI (ug/kg bw·day)			0.60	5.0	480
Hazard Quotients-Adult	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.2
	Moderate		0.0	0.0	0.1
	Low		0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.4
	Moderate		0.0	0.1	0.2
	Low		0.0	0.0	0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Muscle
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Transfer Factor (beef)			0.0012	0.002	0.00014	0.001	0.0058	0.0055	0.00043	0.01	0.0007
Animal Dose[1]	**Soil**		0.000	0.034	0.063	0.001	0.000	0.234	0.019	0.028	0.019
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.020	0.787	0.001	0.002	0.572	0.032	0.041	0.027
	Lichens	65%	0.001	0.024	0.831	0.003	0.007	2.009	0.048	0.153	0.136
	Berries	5%	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.003	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.045	1.623	0.004	0.009	2.582	0.080	0.196	0.162
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.018	0.000	0.004	1.162	0.003	0.168	0.010
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.001	0.001	0.110	0.002	0.025	7.231	0.020	1.046	0.059
	Moderate		0.000	0.000	0.052	0.001	0.012	3.418	0.009	0.494	0.028
	Low		0.000	0.000	0.016	0.000	0.004	1.068	0.003	0.154	0.009
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.001	0.001	0.203	0.004	0.045	13.322	0.037	1.927	0.109
	Moderate		0.001	0.001	0.096	0.002	0.021	6.295	0.017	0.910	0.052
	Low		0.000	0.000	0.016	0.000	0.004	1.056	0.003	0.153	0.009
TDI (ug/kg bw·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.6
	Moderate		0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.3
	Low		0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	13.3	0.0	0.0	1.1
	Moderate		0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.5
	Low		0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Muscle
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
Transfer Factor (beef)			0.0005	0.00609	0.00078	0.001	0.006	0.32	0.008	0.04	0.001
Animal Dose[1]	**Soil**		0.475	0.000	0.000	0.002	0.116	0.000	0.043	0.000	0.001
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
	Sedges	30%	4.278	0.001	0.000	0.030	0.343	0.001	0.376	0.001	0.001
	Lichens	65%	6.399	0.005	0.003	0.017	1.102	0.004	0.373	0.001	0.002
	Berries	5%	0.045	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.001
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	10.722	0.006	0.003	0.046	1.445	0.005	0.751	0.002	0.004
Concentration in Animal Tissue[2] (mg/kg wet)			0.420	0.003	0.000	0.004	0.703	0.116	0.477	0.005	0.000
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		2.613	0.017	0.001	0.022	4.372	0.725	2.969	0.033	0.002
	Moderate		1.235	0.008	0.001	0.011	2.067	0.343	1.404	0.016	0.001
	Low		0.386	0.002	0.000	0.003	0.646	0.107	0.439	0.005	0.000
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		4.815	0.031	0.002	0.041	8.056	1.335	5.471	0.061	0.004
	Moderate		2.275	0.015	0.001	0.019	3.807	0.631	2.585	0.029	0.002
	Low		0.382	0.002	0.000	0.003	0.639	0.106	0.434	0.005	0.000
TDI (ug/kg bw·day)			136	0.30	0.20	23000	20	6200	600	0.01	300
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.1	0.0	0.0	0.2	0.0	0.0	3.3	0.0
	Moderate		0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.6	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.1	0.0	0.0	0.4	0.0	0.0	6.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.2	0.0	0.0	2.9	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Muscle
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Uranium	Vanadium	Zinc
Transfer Factor (beef)			0.00039	0.0025	0.16
Animal Dose[1]	**Soil**		0.004	0.049	0.121
(mg/kg wet·day)	**Water**		0.000	0.000	0.000
	Sedges	30%	0.005	0.122	0.533
	Lichens	65%	0.010	0.109	0.610
	Berries	5%	0.000	0.001	0.005
	Insects	0%	0.000	0.000	0.000
	Total Food	100%	0.015	0.231	1.148
Concentration in Animal Tissue[2]			0.001	0.053	15.224
(mg/kg wet)					
Human Dose-Adult	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.003	0.327	94.747
	Moderate		0.002	0.155	44.790
	Low		0.001	0.048	13.997
Human Dose-Toddler	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.006	0.603	174.571
	Moderate		0.003	0.285	82.487
	Low		0.001	0.048	13.840
TDI (ug/kg bw·day)			0.60	5.0	480
Hazard Quotients-Adult	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.2
	Moderate		0.0	0.0	0.1
	Low		0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.4
	Moderate		0.0	0.1	0.2
	Low		0.0	0.0	0.0

Notes:
1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Kidney
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Transfer Factor											
Feed-to-muscle (beef)			0.00004	0.002	0.0002	0.001	0.0004	0.0055	0.0001	0.009	0.0004
Muscle-to-kidney (caribou)			1.17	6.45	40.87	2.33	2049.03	0.52	10.52	2.06	33.19
Animal Dose[1]	**Soil**		0.000	0.075	0.073	0.001	0.000	0.125	0.018	0.026	0.032
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.081	0.786	0.001	0.001	0.671	0.026	0.082	0.027
	Lichens	65%	0.001	0.117	1.187	0.006	0.010	1.959	0.099	0.178	0.131
	Berries	5%	0.000	0.000	0.010	0.000	0.000	0.002	0.000	0.003	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.199	1.983	0.007	0.011	2.633	0.126	0.262	0.159
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.001	1.109	0.001	0.606	0.595	0.009	0.342	0.184
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.045	0.000	0.025	0.024	0.000	0.014	0.008
	Moderate		0.000	0.000	0.020	0.000	0.011	0.011	0.000	0.006	0.003
	Low		0.000	0.000	0.011	0.000	0.006	0.006	0.000	0.003	0.002
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.081	0.000	0.044	0.043	0.001	0.025	0.013
	Moderate		0.000	0.000	0.040	0.000	0.022	0.022	0.000	0.012	0.007
	Low		0.000	0.000	0.020	0.000	0.011	0.011	0.000	0.006	0.003
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for onsite+near-site area only

2 - Concentration based on time in onsite+near-site area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Kidney
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
Transfer Factor											
Feed-to-muscle (beef)			0.0005	0.00609	0.00609	0.001	0.005	0.1	0.008	0.04	0.001
Muscle-to-kidney (caribou)			0.85	104.63	104.63	44.20	1.68	19.25	5.27	14.90	3.88
Animal Dose[1]	**Soil**		0.817	0.000	0.000	0.002	0.048	0.000	0.024	0.000	0.001
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
	Sedges	30%	12.955	0.000	0.000	0.072	0.241	0.001	0.189	0.000	0.000
	Lichens	65%	8.378	0.005	0.002	0.025	0.643	0.003	0.587	0.002	0.003
	Berries	5%	0.133	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	21.466	0.005	0.003	0.097	0.885	0.003	0.778	0.002	0.004
Concentration in Animal Tissue[2] (mg/kg wet)			0.474	0.269	0.138	0.215	0.853	0.641	2.522	0.083	0.002
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.019	0.011	0.006	0.009	0.035	0.026	0.103	0.003	0.000
	Moderate		0.009	0.005	0.003	0.004	0.016	0.012	0.046	0.002	0.000
	Low		0.005	0.003	0.001	0.002	0.008	0.006	0.025	0.001	0.000
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.034	0.020	0.010	0.016	0.062	0.047	0.183	0.006	0.000
	Moderate		0.017	0.010	0.005	0.008	0.031	0.023	0.092	0.003	0.000
	Low		0.009	0.005	0.003	0.004	0.016	0.012	0.046	0.002	0.000
TDI (ug/kg wet·day)			136	0.30	0.20	23000	20	6200	600	0.01	300
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.6	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0

Notes:

1 - Animal dose per day for onsite+near-site area only

2 - Concentration based on time in onsite+near-site area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Kidney
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Uranium	Vanadium	Zinc
Transfer Factor					
Feed-to-muscle (beef)			0.0002	0.0025	0.1
Muscle-to-kidney (caribou)			3.23	4.33	0.95
Animal Dose[1]	**Soil**		0.007	0.035	0.090
(mg/kg wet·day)	**Water**		0.000	0.000	0.000
	Sedges	30%	0.002	0.057	1.350
	Lichens	65%	0.030	0.315	1.267
	Berries	5%	0.000	0.001	0.007
	Insects	0%	0.000	0.000	0.000
	Total Food	100%	0.032	0.372	2.624
Concentration in Animal Tissue[2]			0.001	0.262	12.397
(mg/kg wet)					
Human Dose-Adult	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.000	0.011	0.509
	Moderate		0.000	0.005	0.228
	Low		0.000	0.003	0.123
Human Dose-Toddler	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.000	0.019	0.902
	Moderate		0.000	0.010	0.451
	Low		0.000	0.005	0.225
TDI (ug/kg wet·day)			0.60	5.0	480
Hazard Quotients-Adult	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.0	0.0
	Moderate		0.0	0.0	0.0
	Low		0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.0	0.0
	Moderate		0.0	0.0	0.0
	Low		0.0	0.0	0.0

Notes:
1 - Animal dose per day for onsite+near-site area only

2 - Concentration based on time in onsite+near-site area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Kidney
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor												
Feed-to-muscle (beef)			0.00004	0.002	0.0002	0.001	0.0004	0.0055	0.0001	0.009	0.0004	0.0005
Muscle-to-kidney (caribou)			1.17	6.45	40.87	2.33	2049.03	0.52	10.52	2.06	33.19	0.85
Animal Dose[1]	**Soil**		0.000	0.004	0.052	0.000	0.000	0.058	0.008	0.015	0.007	0.346
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.005	0.397	0.000	0.001	0.157	0.012	0.056	0.003	3.471
	Lichens	65%	0.001	0.060	1.438	0.003	0.006	1.085	0.105	0.140	0.072	7.421
	Berries	5%	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.002	0.000	0.079
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.066	1.840	0.004	0.006	1.243	0.117	0.198	0.075	10.971
Concentration in Animal Tissue[2]			0.000	0.001	1.076	0.001	0.502	0.493	0.008	0.307	0.148	0.358
(mg/kg wet)												
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.044	0.000	0.021	0.020	0.000	0.013	0.006	0.015
	Moderate		0.000	0.000	0.020	0.000	0.009	0.009	0.000	0.006	0.003	0.007
	Low		0.000	0.000	0.011	0.000	0.005	0.005	0.000	0.003	0.001	0.004
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.078	0.000	0.037	0.036	0.001	0.022	0.011	0.026
	Moderate		0.000	0.000	0.039	0.000	0.018	0.018	0.000	0.011	0.005	0.013
	Low		0.000	0.000	0.020	0.000	0.009	0.009	0.000	0.006	0.003	0.007
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10	136
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:
1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area
(33%) plus time at external reference (67%).
See text.

HQ Calculations for Consumption of Caribou Kidney
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor												
Feed-to-muscle (beef)			0.00609	0.00609	0.001	0.005	0.1	0.008	0.04	0.001	0.0002	0.0025
Muscle-to-kidney (caribou)			104.63	104.63	44.20	1.68	19.25	5.27	14.90	3.88	3.23	4.33
Animal Dose[1]	**Soil**		0.000	0.000	0.001	0.027	0.000	0.031	0.000	0.001	0.003	0.027
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.000	0.011	0.069	0.000	0.204	0.000	0.000	0.002	0.032
	Lichens	65%	0.001	0.001	0.009	0.363	0.002	1.286	0.001	0.002	0.017	0.254
	Berries	5%	0.000	0.000	0.000	0.001	0.000	0.003	0.000	0.000	0.000	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.001	0.021	0.433	0.003	1.493	0.001	0.002	0.018	0.286
Concentration in Animal Tissue[2] (mg/kg wet)			0.213	0.109	0.130	0.755	0.603	3.276	0.075	0.001	0.001	0.236
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.009	0.004	0.005	0.031	0.025	0.134	0.003	0.000	0.000	0.010
	Moderate		0.004	0.002	0.002	0.014	0.011	0.060	0.001	0.000	0.000	0.004
	Low		0.002	0.001	0.001	0.007	0.006	0.032	0.001	0.000	0.000	0.002
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.016	0.008	0.009	0.055	0.044	0.238	0.005	0.000	0.000	0.017
	Moderate		0.008	0.004	0.005	0.027	0.022	0.119	0.003	0.000	0.000	0.009
	Low		0.004	0.002	0.002	0.014	0.011	0.060	0.001	0.000	0.000	0.004
TDI (ug/kg wet·day)			0.30	0.20	23000	20	6200	600	0.01	300	0.60	5.0
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Notes:
1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Kidney
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor			
Feed-to-muscle (beef)			0.1
Muscle-to-kidney (caribou)			0.95
Animal Dose[1]	**Soil**		0.034
(mg/kg wet·day)	**Water**		0.000
	Sedges	30%	0.508
	Lichens	65%	1.227
	Berries	5%	0.007
	Insects	0%	0.000
	Total Food	100%	1.743
Concentration in Animal Tissue[2] (mg/kg wet)			10.202
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.418
	Moderate		0.188
	Low		0.101
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.742
	Moderate		0.371
	Low		0.185
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:
1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Kidney
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor												
Feed-to-muscle (beef)			0.00004	0.002	0.0002	0.001	0.0004	0.0055	0.0001	0.009	0.0004	0.0005
Muscle-to-kidney (caribou)			1.17	6.45	40.87	2.33	2049.03	0.52	10.52	2.06	33.19	0.85
Animal Dose[1]	**Soil**		0.000	0.034	0.063	0.001	0.000	0.234	0.019	0.028	0.019	0.475
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.020	0.787	0.001	0.002	0.572	0.032	0.041	0.027	4.278
	Lichens	65%	0.001	0.024	0.831	0.003	0.007	2.009	0.048	0.153	0.136	6.399
	Berries	5%	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.003	0.000	0.045
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.045	1.623	0.004	0.009	2.582	0.080	0.196	0.162	10.722
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.001	1.034	0.001	0.558	0.599	0.008	0.312	0.181	0.357
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.042	0.000	0.023	0.025	0.000	0.013	0.007	0.015
	Moderate		0.000	0.000	0.019	0.000	0.010	0.011	0.000	0.006	0.003	0.007
	Low		0.000	0.000	0.010	0.000	0.006	0.006	0.000	0.003	0.002	0.004
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.075	0.000	0.041	0.044	0.001	0.023	0.013	0.026
	Moderate		0.000	0.000	0.038	0.000	0.020	0.022	0.000	0.011	0.007	0.013
	Low		0.000	0.000	0.019	0.000	0.010	0.011	0.000	0.006	0.003	0.006
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10	136
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Kidney
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor												
Feed-to-muscle (beef)			0.00609	0.00609	0.001	0.005	0.1	0.008	0.04	0.001	0.0002	0.0025
Muscle-to-kidney (caribou)			104.63	104.63	44.20	1.68	19.25	5.27	14.90	3.88	3.23	4.33
Animal Dose[1]	**Soil**		0.000	0.000	0.002	0.116	0.000	0.043	0.000	0.001	0.004	0.049
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	Sedges	30%	0.001	0.000	0.030	0.343	0.001	0.376	0.001	0.001	0.005	0.122
	Lichens	65%	0.005	0.003	0.017	1.102	0.004	0.373	0.001	0.002	0.010	0.109
	Berries	5%	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.001	0.000	0.001
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.006	0.003	0.046	1.445	0.005	0.751	0.002	0.004	0.015	0.231
Concentration in Animal Tissue[2] (mg/kg wet)			0.284	0.145	0.159	0.984	0.701	2.514	0.079	0.001	0.001	0.228
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.012	0.006	0.007	0.040	0.029	0.103	0.003	0.000	0.000	0.009
	Moderate		0.005	0.003	0.003	0.018	0.013	0.046	0.001	0.000	0.000	0.004
	Low		0.003	0.001	0.002	0.010	0.007	0.025	0.001	0.000	0.000	0.002
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.021	0.011	0.012	0.072	0.051	0.183	0.006	0.000	0.000	0.017
	Moderate		0.010	0.005	0.006	0.036	0.025	0.091	0.003	0.000	0.000	0.008
	Low		0.005	0.003	0.003	0.018	0.013	0.046	0.001	0.000	0.000	0.004
TDI (ug/kg wet·day)			0.30	0.20	23000	20	6200	600	0.01	300	0.60	5.0
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.1	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Kidney
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor			
Feed-to-muscle (beef)			0.1
Muscle-to-kidney (caribou)			0.95
Animal Dose[1]	**Soil**		0.121
(mg/kg wet·day)	**Water**		0.000
	Sedges	30%	0.533
	Lichens	65%	0.610
	Berries	5%	0.005
	Insects	0%	0.000
	Total Food	100%	1.148
Concentration in Animal Tissue[2] (mg/kg wet)			9.010
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.370
	Moderate		0.166
	Low		0.089
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.655
	Moderate		0.328
	Low		0.164
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Liver
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor												
Feed-to-muscle (beef)			0.00004	0.002	0.0002	0.001	0.0004	0.0055	0.0001	0.009	0.0004	0.0005
Muscle-to-kidney (caribou)			0.82	0.64	2.66	0.87	286.95	0.78	18.59	13.73	250.01	0.68
Animal Dose[1]	**Soil**		0.000	0.075	0.073	0.001	0.000	0.125	0.018	0.026	0.032	0.817
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.081	0.786	0.001	0.001	0.671	0.026	0.082	0.027	12.955
	Lichens	65%	0.001	0.117	1.187	0.006	0.010	1.959	0.099	0.178	0.131	8.378
	Berries	5%	0.000	0.000	0.010	0.000	0.000	0.002	0.000	0.003	0.000	0.133
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.199	1.983	0.007	0.011	2.633	0.126	0.262	0.159	21.466
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.072	0.000	0.085	0.896	0.016	2.274	1.383	0.379
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.003	0.000	0.003	0.037	0.001	0.093	0.057	0.016
	Moderate		0.000	0.000	0.001	0.000	0.002	0.016	0.000	0.042	0.025	0.007
	Low		0.000	0.000	0.001	0.000	0.001	0.009	0.000	0.023	0.014	0.004
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.005	0.000	0.006	0.065	0.001	0.165	0.101	0.028
	Moderate		0.000	0.000	0.003	0.000	0.003	0.033	0.001	0.083	0.050	0.014
	Low		0.000	0.000	0.001	0.000	0.002	0.016	0.000	0.041	0.025	0.007
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10	136
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0

Notes:

1 - Animal dose per day for onsite+near-site area only

2 - Concentration based on time in onsite+near-site area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Liver
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor												
Feed-to-muscle (beef)			0.00609	0.00609	0.001	0.005	0.1	0.008	0.04	0.001	0.0002	0.0025
Muscle-to-kidney (caribou)			15.00	15.00	153.49	1.21	2.28	1.28	2.51	9.44	2.61	5.85
Animal Dose[1]	**Soil**		0.000	0.000	0.002	0.048	0.000	0.024	0.000	0.001	0.007	0.035
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.000	0.072	0.241	0.001	0.189	0.000	0.000	0.002	0.057
	Lichens	65%	0.005	0.002	0.025	0.643	0.003	0.587	0.002	0.003	0.030	0.315
	Berries	5%	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.000	0.000	0.001
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.005	0.003	0.097	0.885	0.003	0.778	0.002	0.004	0.032	0.372
Concentration in Animal Tissue[2] (mg/kg wet)			0.039	0.020	0.745	0.614	0.076	0.613	0.014	0.004	0.001	0.353
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.002	0.001	0.031	0.025	0.003	0.025	0.001	0.000	0.000	0.014
	Moderate		0.001	0.000	0.014	0.011	0.001	0.011	0.000	0.000	0.000	0.006
	Low		0.000	0.000	0.007	0.006	0.001	0.006	0.000	0.000	0.000	0.003
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.003	0.001	0.054	0.045	0.006	0.045	0.001	0.000	0.000	0.026
	Moderate		0.001	0.001	0.027	0.022	0.003	0.022	0.001	0.000	0.000	0.013
	Low		0.001	0.000	0.014	0.011	0.001	0.011	0.000	0.000	0.000	0.006
TDI (ug/kg wet·day)			0.30	0.20	23000	20	6200	600	0.01	300	0.60	5.0
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for onsite+near-site area only

2 - Concentration based on time in onsite+near-site area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Liver
Onsite + Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor			
Feed-to-muscle (beef)			0.1
Muscle-to-kidney (caribou)			1.11
Animal Dose[1]	**Soil**		0.090
(mg/kg wet·day)	**Water**		0.000
	Sedges	30%	1.350
	Lichens	65%	1.267
	Berries	5%	0.007
	Insects	0%	0.000
	Total Food	100%	2.624
Concentration in Animal Tissue[2]			14.510
(mg/kg wet)			
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.595
	Moderate		0.267
	Low		0.144
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		1.055
	Moderate		0.528
	Low		0.264
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:

1 - Animal dose per day for onsite+near-site area only

2 - Concentration based on time in onsite+near-site area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Liver
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor												
Feed-to-muscle (beef)			0.00004	0.002	0.0002	0.001	0.0004	0.0055	0.0001	0.009	0.0004	0.0005
Muscle-to-kidney (caribou)			0.82	0.64	2.66	0.87	286.95	0.78	18.59	13.73	250.01	0.68
Animal Dose[1]	**Soil**		0.000	0.004	0.052	0.000	0.000	0.058	0.008	0.015	0.007	0.346
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.005	0.397	0.000	0.001	0.157	0.012	0.056	0.003	3.471
	Lichens	65%	0.001	0.060	1.438	0.003	0.006	1.085	0.105	0.140	0.072	7.421
	Berries	5%	0.000	0.000	0.005	0.000	0.000	0.001	0.000	0.002	0.000	0.079
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.066	1.840	0.004	0.006	1.243	0.117	0.198	0.075	10.971
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.070	0.000	0.070	0.742	0.015	2.044	1.117	0.287
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.003	0.000	0.003	0.030	0.001	0.084	0.046	0.012
	Moderate		0.000	0.000	0.001	0.000	0.001	0.014	0.000	0.038	0.021	0.005
	Low		0.000	0.000	0.001	0.000	0.001	0.007	0.000	0.020	0.011	0.003
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.005	0.000	0.005	0.054	0.001	0.149	0.081	0.021
	Moderate		0.000	0.000	0.003	0.000	0.003	0.027	0.001	0.074	0.041	0.010
	Low		0.000	0.000	0.001	0.000	0.001	0.013	0.000	0.037	0.020	0.005
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10	136
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Liver
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor												
Feed-to-muscle (beef)			0.00609	0.00609	0.001	0.005	0.1	0.008	0.04	0.001	0.0002	0.0025
Muscle-to-kidney (caribou)			15.00	15.00	153.49	1.21	2.28	1.28	2.51	9.44	2.61	5.85
Animal Dose[1]	**Soil**		0.000	0.000	0.001	0.027	0.000	0.031	0.000	0.001	0.003	0.027
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	Sedges	30%	0.000	0.000	0.011	0.069	0.000	0.204	0.000	0.000	0.002	0.032
	Lichens	65%	0.001	0.001	0.009	0.363	0.002	1.286	0.001	0.002	0.017	0.254
	Berries	5%	0.000	0.000	0.000	0.001	0.000	0.003	0.000	0.000	0.000	0.000
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.001	0.001	0.021	0.433	0.003	1.493	0.001	0.002	0.018	0.286
Concentration in Animal Tissue[2] (mg/kg wet)			0.031	0.016	0.452	0.544	0.072	0.796	0.013	0.003	0.001	0.319
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.001	0.001	0.019	0.022	0.003	0.033	0.001	0.000	0.000	0.013
	Moderate		0.001	0.000	0.008	0.010	0.001	0.015	0.000	0.000	0.000	0.006
	Low		0.000	0.000	0.004	0.005	0.001	0.008	0.000	0.000	0.000	0.003
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.002	0.001	0.033	0.040	0.005	0.058	0.001	0.000	0.000	0.023
	Moderate		0.001	0.001	0.016	0.020	0.003	0.029	0.000	0.000	0.000	0.012
	Low		0.001	0.000	0.008	0.010	0.001	0.014	0.000	0.000	0.000	0.006
TDI (ug/kg wet·day)			0.30	0.20	23000	20	6200	600	0.01	300	0.60	5.0
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Liver
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor			
Feed-to-muscle (beef)			0.1
Muscle-to-kidney (caribou)			1.11
Animal Dose[1]	**Soil**		0.034
(mg/kg wet·day)	**Water**		0.000
	Sedges	30%	0.508
	Lichens	65%	1.227
	Berries	5%	0.007
	Insects	0%	0.000
	Total Food	100%	1.743
Concentration in Animal Tissue[2] (mg/kg wet)			11.941
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.490
	Moderate		0.220
	Low		0.118
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.868
	Moderate		0.434
	Low		0.217
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Caribou Liver
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic*	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor												
Feed-to-muscle (beef)			0.00004	0.002	0.0002	0.001	0.0004	0.0055	0.0001	0.009	0.0004	0.0005
Muscle-to-kidney (caribou)			0.82	0.64	2.66	0.87	286.95	0.78	18.59	13.73	250.01	0.68
Animal Dose[1]	**Soil**		0.000	0.034	0.063	0.001	0.000	0.234	0.019	0.028	0.019	0.475
(mg/kg wet·day)	**Water**		0.00000	0.00001	0.00013	0.00000	0.00000	0.00001	0.00000	0.00005	0.00001	0.00013
	Sedges	30%	0.0002	0.0202	0.7870	0.0012	0.0018	0.5724	0.0320	0.0410	0.0266	4.2777
	Lichens	65%	0.001	0.024	0.831	0.003	0.007	2.009	0.048	0.153	0.136	6.399
	Berries	5%	0.00000	0.00010	0.00518	0.00000	0.00004	0.00112	0.00018	0.00269	0.00018	0.04516
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.0009	0.0447	1.6234	0.0040	0.0088	2.5822	0.0803	0.1964	0.1624	10.7217
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.067	0.000	0.078	0.902	0.014	2.076	1.361	0.286
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.003	0.000	0.003	0.037	0.001	0.085	0.056	0.012
	Moderate		0.000	0.000	0.001	0.000	0.001	0.017	0.000	0.038	0.025	0.005
	Low		0.000	0.000	0.001	0.000	0.001	0.009	0.000	0.021	0.013	0.003
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.005	0.000	0.006	0.066	0.001	0.151	0.099	0.021
	Moderate		0.000	0.000	0.002	0.000	0.003	0.033	0.001	0.076	0.050	0.010
	Low		0.000	0.000	0.001	0.000	0.001	0.016	0.000	0.038	0.025	0.005
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10	136
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0

Notes:
1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Liver
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor												
Feed-to-muscle (beef)			0.00609	0.00609	0.001	0.005	0.1	0.008	0.04	0.001	0.0002	0.0025
Muscle-to-kidney (caribou)			15.00	15.00	153.49	1.21	2.28	1.28	2.51	9.44	2.61	5.85
Animal Dose[1]	**Soil**		0.000	0.000	0.002	0.116	0.000	0.043	0.000	0.001	0.004	0.049
(mg/kg wet·day)	**Water**		0.00000	0.00000	0.00000	0.00004	0.00000	0.00061	0.00000	0.00000	0.00000	0.00003
	Sedges	30%	0.0007	0.0004	0.0295	0.3425	0.0008	0.3760	0.0005	0.0006	0.0049	0.1216
	Lichens	65%	0.005	0.003	0.017	1.102	0.004	0.373	0.001	0.002	0.010	0.109
	Berries	5%	0.00000	0.00000	0.00009	0.00109	0.00001	0.00235	0.00000	0.00082	0.00001	0.00091
	Insects	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total Food	100%	0.0059	0.0030	0.0462	1.4453	0.0047	0.7511	0.0016	0.0038	0.0147	0.2314
Concentration in Animal Tissue[2] (mg/kg wet)			0.041	0.021	0.551	0.708	0.083	0.611	0.013	0.004	0.001	0.308
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.002	0.001	0.023	0.029	0.003	0.025	0.001	0.000	0.000	0.013
	Moderate		0.001	0.000	0.010	0.013	0.002	0.011	0.000	0.000	0.000	0.006
	Low		0.000	0.000	0.005	0.007	0.001	0.006	0.000	0.000	0.000	0.003
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.003	0.002	0.040	0.052	0.006	0.044	0.001	0.000	0.000	0.022
	Moderate		0.001	0.001	0.020	0.026	0.003	0.022	0.000	0.000	0.000	0.011
	Low		0.001	0.000	0.010	0.013	0.002	0.011	0.000	0.000	0.000	0.006
TDI (ug/kg wet·day)			0.30	0.20	23000	20	6200	600	0.01	300	0.60	5.0
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:
1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Caribou Liver
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor			
Feed-to-muscle (beef)			0.1
Muscle-to-kidney (caribou)			1.11
Animal Dose[1]	**Soil**		0.121
(mg/kg wet·day)	**Water**		0.00010
	Sedges	30%	0.5328
	Lichens	65%	0.610
	Berries	5%	0.00505
	Insects	0%	0.000
	Total Food	100%	1.1481
Concentration in Animal Tissue[2] (mg/kg wet)			10.546
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.433
	Moderate		0.194
	Low		0.104
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.767
	Moderate		0.383
	Low		0.192
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:
1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
Onsite - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Transfer Factor (chicken)			0.006	0.830	0.019	0.400	1.750	0.800	0.970	0.500	0.800
Animal Dose[1]	**Soil**		0.000	0.050	0.048	0.001	0.000	0.053	0.012	0.018	0.021
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	50%	0.000	0.023	0.826	0.001	0.001	0.379	0.016	0.047	0.014
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.000	0.003	0.033	0.000	0.000	0.013	0.001	0.014	0.001
	Insects	5%	0.000	0.002	0.030	0.000	0.000	0.033	0.008	0.010	0.001
	Total Food	100%	0.000	0.028	0.889	0.001	0.001	0.425	0.025	0.070	0.017
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.001	0.035	0.002	0.008	1.176	0.095	0.087	0.065
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.011	0.001	0.003	0.382	0.031	0.028	0.021
	Moderate		0.000	0.000	0.006	0.000	0.001	0.216	0.017	0.016	0.012
	Low		0.000	0.000	0.001	0.000	0.000	0.030	0.002	0.002	0.002
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.000	0.001	0.021	0.001	0.005	0.705	0.057	0.052	0.039
	Moderate		0.000	0.000	0.012	0.001	0.003	0.399	0.032	0.030	0.022
	Low		0.000	0.000	0.002	0.000	0.000	0.057	0.005	0.004	0.003
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
	Moderate		0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.4
	Moderate		0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
	Low		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Notes:

1 - Animal dose per day for time onsite only

HQ Calculations for Consumption of Canada Goose Muscle
Onsite - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
2 - Concentration based on time onsite (33%) plus time at external reference (67%). See text.										

HQ Calculations for Consumption of Canada Goose Muscle
Onsite - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
Transfer Factor (chicken)			0.050	0.030	0.030	0.180	0.001	9.700	0.080	0.800	0.800
Animal Dose[1]	**Soil**		0.329	0.000	0.000	0.001	0.032	0.000	0.016	0.000	0.001
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
	Sedges	50%	6.480	0.000	0.000	0.076	0.140	0.000	0.178	0.000	0.000
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.374	0.000	0.000	0.001	0.006	0.000	0.010	0.000	0.001
	Insects	5%	0.205	0.000	0.000	0.001	0.020	0.000	0.010	0.000	0.001
	Total Food	100%	7.059	0.000	0.000	0.077	0.166	0.001	0.198	0.000	0.002
Concentration in Animal Tissue[2] (mg/kg wet)			0.597	0.000	0.000	0.017	0.001	0.018	0.060	0.001	0.009
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.194	0.000	0.000	0.006	0.000	0.006	0.020	0.000	0.003
	Moderate		0.110	0.000	0.000	0.003	0.000	0.003	0.011	0.000	0.002
	Low		0.015	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.358	0.000	0.000	0.010	0.000	0.011	0.036	0.001	0.005
	Moderate		0.203	0.000	0.000	0.006	0.000	0.006	0.020	0.000	0.003
	Low		0.029	0.000	0.000	0.001	0.000	0.001	0.003	0.000	0.000
TDI (ug/kg wet·day)			136	0.30	0.20	23000	20	6200	600	0.01	300
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for time onsite only

HQ Calculations for Consumption of Canada Goose Muscle
Onsite - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference	Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
2 - Concentration based on time onsite (33%) plus time at external reference (67%). See text.										

HQ Calculations for Consumption of Canada Goose Muscle
Onsite - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Uranium	Vanadium	Zinc
Transfer Factor (chicken)			0.750	2.000	0.470
Animal Dose[1]	**Soil**		0.004	0.023	0.060
(mg/kg wet·day)	**Water**		0.000	0.000	0.000
	Sedges	50%	0.002	0.042	0.515
	Lichens	0%	0.000	0.000	0.000
	Berries	45%	0.000	0.003	0.040
	Insects	5%	0.003	0.014	0.113
	Total Food	100%	0.005	0.059	0.668
Concentration in Animal Tissue[2] (mg/kg wet)			0.015	0.608	0.723
Human Dose-Adult	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.005	0.198	0.235
	Moderate		0.003	0.112	0.133
	Low		0.000	0.015	0.018
Human Dose-Toddler	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.009	0.365	0.434
	Moderate		0.005	0.206	0.245
	Low		0.001	0.029	0.035
TDI (ug/kg wet·day)			0.60	5.0	480
Hazard Quotients-Adult	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.0	0.0
	Moderate		0.0	0.0	0.0
	Low		0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.0
	Moderate		0.0	0.0	0.0
	Low		0.0	0.0	0.0

Notes:

1 - Animal dose per day for time onsite only

HQ Calculations for Consumption of Canada Goose Muscle
Onsite - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference	Uranium	Vanadium	Zinc
2 - Concentration based on time onsite (33%) plus time at external reference (67%). See text.				

HQ Calculations for Consumption of Canada Goose Muscle
Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor (chicken)			0.006	0.830	0.019	0.400	1.750	0.800	0.970	0.500	0.800	0.050
Animal Dose[1]	**Soil**		0.000	0.021	0.037	0.001	0.000	0.083	0.008	0.010	0.011	0.545
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	50%	0.000	0.085	0.730	0.001	0.001	0.706	0.028	0.086	0.029	13.616
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.000	0.000	0.056	0.000	0.000	0.003	0.000	0.012	0.000	0.757
	Insects	5%	0.000	0.001	0.023	0.000	0.000	0.052	0.005	0.008	0.001	0.340
	Total Food	100%	0.000	0.086	0.808	0.001	0.002	0.761	0.033	0.106	0.029	14.713
Concentration in Animal Tissue[2]			0.000	0.001	0.034	0.002	0.008	1.370	0.097	0.096	0.067	0.856
(mg/kg wet)												
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.011	0.001	0.003	0.446	0.032	0.031	0.022	0.279
	Moderate		0.000	0.000	0.006	0.000	0.001	0.252	0.018	0.018	0.012	0.157
	Low		0.000	0.000	0.001	0.000	0.000	0.035	0.002	0.002	0.002	0.022
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.020	0.001	0.005	0.822	0.058	0.058	0.040	0.514
	Moderate		0.000	0.000	0.012	0.001	0.003	0.465	0.033	0.033	0.023	0.291
	Low		0.000	0.000	0.002	0.000	0.000	0.066	0.005	0.005	0.003	0.042
TDI (ug/kg wet·day)			0.40	0.30	200	2.0	1.0	1.0	1.4	91	0.10	136
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.4	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for near-site area only

2 - Concentration based on time near-site (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor (chicken)			0.030	0.030	0.180	0.001	9.700	0.080	0.800	0.800	0.750	2.000
Animal Dose[1]	**Soil**		0.000	0.000	0.001	0.032	0.000	0.014	0.000	0.001	0.003	0.017
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	50%	0.000	0.000	0.052	0.253	0.001	0.198	0.000	0.000	0.003	0.060
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.000	0.000	0.000	0.005	0.000	0.013	0.000	0.002	0.000	0.000
	Insects	5%	0.000	0.000	0.001	0.020	0.000	0.008	0.000	0.001	0.002	0.011
	Total Food	100%	0.000	0.000	0.053	0.277	0.001	0.219	0.000	0.003	0.005	0.071
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.014	0.001	0.019	0.061	0.001	0.009	0.014	0.615
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.005	0.000	0.006	0.020	0.000	0.003	0.005	0.200
	Moderate		0.000	0.000	0.003	0.000	0.003	0.011	0.000	0.002	0.003	0.113
	Low		0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.016
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.009	0.001	0.011	0.037	0.001	0.005	0.008	0.369
	Moderate		0.000	0.000	0.005	0.000	0.006	0.021	0.000	0.003	0.005	0.209
	Low		0.000	0.000	0.001	0.000	0.001	0.003	0.000	0.000	0.001	0.030
TDI (ug/kg wet·day)			0.30	0.20	23000	20	6200	600	0.01	300	0.60	5.0
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for near-site area only

2 - Concentration based on time near-site (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
Near-site - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor (chicken)			0.470
Animal Dose[1]	**Soil**		0.039
(mg/kg wet·day)	**Water**		0.000
	Sedges	50%	1.419
	Lichens	0%	0.000
	Berries	45%	0.027
	Insects	5%	0.102
	Total Food	100%	1.549
Concentration in Animal Tissue[2] (mg/kg wet)			0.990
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.322
	Moderate		0.182
	Low		0.025
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.594
	Moderate		0.336
	Low		0.048
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:

1 - Animal dose per day for near-site area only

2 - Concentration based on time near-site (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
Transfer Factor (chicken)			0.006	0.830	0.019	0.400	1.750	0.800	0.970	0.500	0.800	0.050
Animal Dose[1]	**Soil**		0.000	0.003	0.034	0.000	0.000	0.039	0.006	0.010	0.005	0.231
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	50%	0.000	0.006	0.418	0.000	0.001	0.165	0.012	0.059	0.003	3.648
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.000	0.000	0.027	0.000	0.000	0.007	0.001	0.013	0.000	0.448
	Insects	5%	0.000	0.000	0.022	0.000	0.000	0.024	0.003	0.008	0.000	0.144
	Total Food	100%	0.000	0.006	0.466	0.001	0.001	0.196	0.017	0.081	0.004	4.240
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.001	0.030	0.001	0.007	1.048	0.085	0.088	0.050	0.500
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.010	0.000	0.002	0.341	0.028	0.029	0.016	0.163
	Moderate		0.000	0.000	0.005	0.000	0.001	0.193	0.016	0.016	0.009	0.092
	Low		0.000	0.000	0.001	0.000	0.000	0.027	0.002	0.002	0.001	0.013
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.018	0.001	0.004	0.629	0.051	0.053	0.030	0.300
	Moderate		0.000	0.000	0.010	0.000	0.002	0.356	0.029	0.030	0.017	0.170
	Low		0.000	0.000	0.001	0.000	0.000	0.051	0.004	0.004	0.002	0.024
TDI (ug/kg wet·day)			0.4	0.30	200	2.00	1.00	1.00	1.40	91.0	0.10	136.00
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.3	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin	Uranium	Vanadium
Transfer Factor (chicken)			0.030	0.030	0.180	0.001	9.700	0.080	0.800	0.800	0.750	2.000
Animal Dose[1]	**Soil**		0.000	0.000	0.001	0.018	0.000	0.021	0.000	0.001	0.002	0.018
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	Sedges	50%	0.000	0.000	0.012	0.073	0.000	0.214	0.000	0.000	0.002	0.033
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.000	0.000	0.001	0.006	0.000	0.016	0.000	0.002	0.000	0.002
	Insects	5%	0.000	0.000	0.000	0.011	0.000	0.013	0.000	0.001	0.001	0.011
	Total Food	100%	0.000	0.000	0.013	0.090	0.000	0.243	0.000	0.003	0.003	0.046
Concentration in Animal Tissue[2] (mg/kg wet)			0.000	0.000	0.010	0.001	0.017	0.063	0.001	0.009	0.013	0.584
Human Dose-Adult	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.003	0.000	0.006	0.020	0.000	0.003	0.004	0.190
	Moderate		0.000	0.000	0.002	0.000	0.003	0.012	0.000	0.002	0.002	0.107
	Low		0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.015
Human Dose-Toddler	*Consumption Rate*											
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.006	0.000	0.010	0.038	0.001	0.006	0.008	0.351
	Moderate		0.000	0.000	0.003	0.000	0.006	0.021	0.000	0.003	0.004	0.198
	Low		0.000	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.001	0.028
TDI (ug/kg wet·day)			0.30	0.20	23000.00	20.0	6200.00	600.00	0.01	300	0.60	5.00
Hazard Quotients-Adult	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*											
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
AWAR Location - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Zinc
Transfer Factor (chicken)			0.470
Animal Dose[1]	**Soil**		0.023
(mg/kg wet·day)	**Water**		0.000
	Sedges	50%	0.534
	Lichens	0%	0.000
	Berries	45%	0.042
	Insects	5%	0.091
	Total Food	100%	0.667
Concentration in Animal Tissue[2] (mg/kg wet)			0.711
Human Dose-Adult	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.231
	Moderate		0.131
	Low		0.018
Human Dose-Toddler	*Consumption Rate*		
(ug/kg body weight·day)	**Heavy**		0.427
	Moderate		0.241
	Low		0.034
TDI (ug/kg wet·day)			480
Hazard Quotients-Adult	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0
Hazard Quotients-Toddler	*Consumption Rate*		
(unitless)	**Heavy**		0.0
	Moderate		0.0
	Low		0.0

Notes:

1 - Animal dose per day for AWAR area only

2 - Concentration based on time in AWAR area (33%) plus time at external reference (67%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Transfer Factor (chicken)			0.006	0.830	0.019	0.400	1.750	0.800	0.970	0.500	0.800
Animal Dose[1]	**Soil**		0.000	0.023	0.042	0.000	0.000	0.156	0.012	0.018	0.013
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	50%	0.000	0.021	0.827	0.001	0.002	0.602	0.034	0.043	0.028
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.000	0.001	0.029	0.000	0.000	0.006	0.001	0.015	0.001
	Insects	5%	0.000	0.001	0.026	0.000	0.000	0.097	0.008	0.010	0.001
	Total Food	100%	0.000	0.023	0.883	0.002	0.002	0.705	0.042	0.068	0.030
Concentration in Animal Tissue[2] (mg/kg wet)			0.0000	0.0008	0.0351	0.0016	0.0089	1.3787	0.1062	0.0865	0.0680
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.011	0.001	0.003	0.449	0.035	0.028	0.022
	Moderate		0.000	0.000	0.006	0.000	0.002	0.254	0.020	0.016	0.012
	Low		0.000	0.000	0.001	0.000	0.000	0.035	0.003	0.002	0.002
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.000	0.000	0.021	0.001	0.005	0.827	0.064	0.052	0.041
	Moderate		0.000	0.000	0.012	0.001	0.003	0.468	0.036	0.029	0.023
	Low		0.000	0.000	0.002	0.000	0.000	0.067	0.005	0.004	0.003
TDI (ug/kg wet·day)			0.4	0.30	200	2.00	1.00	1.00	1.40	91.0	0.10
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
	Moderate		0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.4
	Moderate		0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2
	Low		0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

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Parameter	Dietary Preference		Manganese	Inorg Hg	MeHg	Molybdenum	Nickel	Selenium	Strontium	Thallium	Tin
Transfer Factor (chicken)			0.050	0.030	0.030	0.180	0.001	9.700	0.080	0.800	0.800
Animal Dose[1]	**Soil**		0.317	0.000	0.000	0.001	0.077	0.000	0.029	0.000	0.001
(mg/kg wet·day)	**Water**		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sedges	50%	4.496	0.001	0.000	0.031	0.360	0.001	0.395	0.001	0.001
	Lichens	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Berries	45%	0.256	0.000	0.000	0.000	0.006	0.000	0.013	0.000	0.005
	Insects	5%	0.198	0.000	0.000	0.001	0.048	0.000	0.018	0.000	0.001
	Total Food	100%	4.950	0.001	0.000	0.032	0.414	0.001	0.427	0.001	0.006
Concentration in Animal Tissue[2] (mg/kg wet)			0.5267	0.0000	0.0000	0.0120	0.0010	0.0201	0.0730	0.0013	0.0107
Human Dose-Adult	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.171	0.000	0.000	0.004	0.000	0.007	0.024	0.000	0.003
	Moderate		0.097	0.000	0.000	0.002	0.000	0.004	0.013	0.000	0.002
	Low		0.013	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.000
Human Dose-Toddler	*Consumption Rate*										
(ug/kg body weight·day)	**Heavy**		0.316	0.000	0.000	0.007	0.001	0.012	0.044	0.001	0.006
	Moderate		0.179	0.000	0.000	0.004	0.000	0.007	0.025	0.000	0.004
	Low		0.026	0.000	0.000	0.001	0.000	0.001	0.004	0.000	0.001
TDI (ug/kg wet·day)			136.00	0.30	0.20	23000.00	20.0	6200.00	600.00	0.01	300
Hazard Quotients-Adult	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*										
(unitless)	**Heavy**		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
	Moderate		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Low		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

HQ Calculations for Consumption of Canada Goose Muscle
External Reference - 2014

(modified from Azimuth, 2006)

Parameter	Dietary Preference		Uranium	Vanadium	Zinc
Transfer Factor (chicken)			0.750	2.000	0.470
Animal Dose[1]	**Soil**		0.003	0.033	0.080
(mg/kg wet·day)	**Water**		0.000	0.000	0.000
	Sedges	50%	0.005	0.128	0.560
	Lichens	0%	0.000	0.000	0.000
	Berries	45%	0.000	0.005	0.029
	Insects	5%	0.002	0.020	0.120
	Total Food	100%	0.007	0.153	0.709
Concentration in Animal Tissue[2] (mg/kg wet)			0.0148	0.7451	0.7419
Human Dose-Adult	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.005	0.242	0.241
	Moderate		0.003	0.137	0.136
	Low		0.000	0.019	0.019
Human Dose-Toddler	*Consumption Rate*				
(ug/kg body weight·day)	**Heavy**		0.009	0.447	0.445
	Moderate		0.005	0.253	0.252
	Low		0.001	0.036	0.036
TDI (ug/kg wet·day)			0.60	5.00	480
Hazard Quotients-Adult	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.0	0.0
	Moderate		0.0	0.0	0.0
	Low		0.0	0.0	0.0
Hazard Quotients-Toddler	*Consumption Rate*				
(unitless)	**Heavy**		0.0	0.1	0.0
	Moderate		0.0	0.1	0.0
	Low		0.0	0.0	0.0

Notes:

1 - Animal dose per day for external reference area only

2 - Concentration based on time at external reference (100%). See text.

ILCR for Arsenic
in Caribou Muscle, Kidney, Liver and Canada Goose Muscle
Onsite, Near-site, AWAR and External Reference Locations
2014

Parameter	Dietary Preference	Caribou Muscle			Caribou Kidney			Caribou Liver			Canada Goose Muscle			
		Onsite	AWAR	External Reference	Onsite	AWAR	External Reference	Onsite	AWAR	External Reference	Onsite	Offsite	AWAR	External Reference
Human Dose- Adult														
(ug/kg ·day)	Heavy	1.34E-03	7.09E-04	7.39E-04	5.70E-05	3.02E-05	3.14E-05	5.68E-06	3.01E-06	3.13E-06	3.05E-04	1.68E-04	1.66E-04	2.48E-04
	Moderate	6.33E-04	3.35E-04	3.49E-04	2.55E-05	1.35E-05	1.41E-05	2.55E-06	1.35E-06	1.41E-06	1.72E-04	9.49E-05	9.39E-05	1.40E-04
	Low	1.98E-04	1.05E-04	1.09E-04	1.38E-05	7.28E-06	7.59E-06	1.37E-06	7.27E-07	7.57E-07	2.39E-05	1.31E-05	1.30E-05	1.94E-05
Slope Factor (mg/kg·day)$^{-1}$		1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
ILCR-Adult														
(unitless)	Heavy	2.41E-06	1.28E-06	1.33E-06	1.03E-07	5.43E-08	5.66E-08	1.02E-08	5.42E-09	5.64E-09	5.49E-07	3.02E-07	2.99E-07	4.46E-07
	Moderate	1.14E-06	6.04E-07	6.29E-07	4.60E-08	2.43E-08	2.54E-08	4.59E-09	2.43E-09	2.53E-09	3.10E-07	1.71E-07	1.69E-07	2.52E-07
	Low	3.56E-07	1.89E-07	1.96E-07	2.48E-08	1.31E-08	1.37E-08	2.47E-09	1.31E-09	1.36E-09	4.30E-08	2.36E-08	2.34E-08	3.49E-08