Health Canada Santé Canada
Environmental Assessment Division
Safe Environments Programme,
HECS Branch, Health Canada
269 Laurier Ave W. AL 4905B
Ottawa, ON, K1A 0K9

November 23, 2007

Ms Stephanie Autut
Manager of Environmental Administration
Nunavut Impact Review Board
P.O. Box 1360
Cambridge Bay, NU, X0B 0C0

Sent by e-mail to sautut@nirb.nunavut.ca

Subject: Health Canada's Comments on the Draft Environmental Impact Statement (DEIS) of the High Lake Project.

Dear Ms. Autut,

Thank you for the opportunity to review the documents relating to the above-mentioned project. Health Canada's (HC's) comments all relate the technical topic of human health, as outlined in NIRB's letter dated August 3, 2007. Note that HC will not be attending the technical meetings for this project taking place November 30 to December 3, but HC will attend the pre-hearing conference December 5 to 7. Should any parties wish to discuss our technical comments below, HC would be happy to respond to questions or comments in writing, or to participate in teleconferences. HC has reviewed the DEIS and Supplemental Information and offers the following technical comments:

Air Quality:

The environmental assessment (EA) appears to be quite comprehensive from a perspective of assessing human health effects related to air quality. The report indicates that adverse health effects to people in the surrounding project area, including on-site workers, are not expected since worker's exposure to particulate matter (PM) is limited as a result of: the work being done in shifts, the two-week rotation cycles off site, and their tendency to remain indoors because of the harsh climate (Volume 4, Section 2). It is clear from the proponent's response to HC's information request that indoor air will be adequately treated to remove air contaminants. However, consideration should be given to limiting the frequency and duration of exposures to workers to airborne dust and particulate matter, especially fine particulate matter ($PM_{2.5}$), while working on the site.

The maximum predicted concentrations in Table 2-7-2 of the air quality assessment (Vol. 4 s. 2) are a health concern with respect to $PM_{2.5}$, since they are well over the threshold. Since workers will be resident at the site, they should be treated as a

local population, and HC is concerned about the potential exposures to this population. Note that diesel combustion is a major source of $PM_{2.5}$, which is considered to have important health effects.

The mitigation measures in Table 2.7-15 appear to be inadequate, considering the level of exceedance (i.e., almost 14 times at the maximum point of impingement) of the $PM_{2.5}$ levels. Almost all of the mitigation measures are directed at Total Suspended Particulate (TSP) which has the least health concerns. HC notes that they will be using low sulphur diesel, but its use is a requirement of federal regulations everywhere in Canada so HC does not consider this a mitigation measure. As well, low-sulphur diesel is not a significant measure by itself to reduce PM emissions: it simply permits the installation of technologies (catalytic converters, particle traps) that reduce PM. The EA has identified some important exceedances of health-based "thresholds" (i.e., the Canada Wide Standard for $PM_{2.5}$) and HC does not see any attempt to reduce these levels. While acknowledging that there is no apparent local population, the workforce will be resident and should be treated as local. Thus, it appears there is a problem with $PM_{2.5}$ The information for $PM_{2.5}$ in Table 2.7-2 is for 98th percentile but the exceedances extend out to 1000m from the project. Therefore, HC does not agree that the exceedances are a result of only occasional issues. This issue needs to be dealt with in greater detail and may require specific mitigation

Noise Impacts:

From the information provided to date, it appears as though any potential noise impacts from the Project would be restricted to on-site workers. The proponent has indicated that applicable occupational standards will be met to avoid any adverse health conditions to workers. With respect to on-site sleeping quarters, the World Health Organization (WHO) Community Noise Guidelines (1999) state that the threshold level for sleep disturbance is an 8 hour average of 30 dBA. Additionally, levels above 45 dBAmax should be avoided for individual events. Therefore, unless the sleeping quarters provide a substantial mitigation of sound levels from outside, workers may experience some sleep disturbance during the operational phase of the project.

Health Canada's recommendation is that if technically and economically feasible, noise in workers' quarters be mitigated to a level as close as is reasonable to the World Health Organization's Community Noise Guidelines' threshold level for sleep disturbance.

Impact on Country Foods:

HC notes that the proposed project, particularly the coastal area, is within the traditional territory of local Inuit who use the area for travel, hunting, fishing, gathering, and trapping. The coastal area is used year-round for such activities while inland areas are used less frequently. However, the construction of the all-season road may increase travel into inland areas in search of country foods.

The concentrations of chemicals of potential concern (COPCs) in traditional plants and game were quantified using models that estimated uptake from predicted air concentrations. Similarly, COPC concentrations in fish were modelled using predicted changes in surface water quality. Equations and assumptions employed by the United

States Environmental Protection Agency (USEPA) to predict environmental media concentrations were applied. Although the predictive modelling procedures employed by Intrinsik seem reasonable, the expertise and competencies of HC lie in the conduct of human health risk assessments (HHRAs) of contaminants in food when empirical data are provided. As such, the suitability and application of predictive models were not reviewed.

Our comments below are based on the following assumptions:

- The COPCs associated with the proposed activities were identified correctly; and
- The methods used to predict the concentrations of chemical contaminants in traditional foods and environmental media yielded representative and reliable results.

Baseline Data

Data deficiencies with respect to the fish data are noted. Baseline samples from reference/control sites are not available for fish. Furthermore, there are no data on the baseline levels of PAHs in fish from either reference or project-related sites. Although it is unclear from Appendix B, it appears that the muscle tissue of lake trout from only the Kennarctic River drainage control (Duck Lake) was sampled. We are uncertain if the Kennarctic River drainage control is in the same area as the mouth of the Kennarctic River - the latter area was identified in the report as the primary area of fish harvest by Inuit. Lastly, only fish muscle data were employed in the HHRA and we question whether or not other parts of the fish (i.e. liver) may be consumed by local Inuit.

Chemical Specific Comments

Antimony:

Increases in fish muscle concentrations of antimony, of approximately four times greater than baseline values, were predicted due to proposed project emissions into lakes surrounding the mine. Consequently, the provided toxicological reference value for antimony of 0.40 µg/kg bw/day (from the USEPA's Integrated Risk Information System (IRIS) database) for toddlers and adults would be exceeded given the consumption values employed in the HHRA. However, HC finds that the toxicological reference value for antimony of 0.40 µg/kg bw/day is a conservative reference value, and HC concludes that the actual risk may be overestimated.

Barium:

Based on the baseline conditions and the toxicological reference value for barium of 16.0 µg/kg bw/day (derived from the 1990 review by HC's Drinking Water Quality Program) that was used in the HHRA, the risk quotient was predicted to be greater than 1 for Inuit toddlers and adults. However, HC finds that the toxicological reference value for barium of 16.0 µg/kg bw/day is a conservative reference value, and HC concludes that the actual risk may be overestimated.

Inorganic Arsenic:

In the HHRA, it was conservatively assumed that country foods contain 37% inorganic arsenic (ATSDR, 2005). This conversion factor could be refined for specific food types given the information that is available in the primary literature concerning the proportion of inorganic arsenic in foods. For example, recent data published by the UK

FSA (2005) indicate that a maximum of approximately 3% of the total arsenic in finfish is present in inorganic species and Schoof et al. (1999) reports that the majority of arsenic in fruits and vegetables is inorganic. Although applying specific conversion factors for individual foods may not result in any significant changes to the assessment, references to published articles that discuss the ratios of inorganic to total arsenic in various foods are provided at the end of this document for information purposes.

In the HHRA, the exposure to 0.006 µg/kg bw/day of arsenic was considered to present a significant cancer risk (i.e. greater than 1 in 10^5). However, from a food perspective, this exposure is considered to be conservative (based on Chu et al 2006). HC concludes that the actual risk may be overestimated.

Manganese:

Manganese is a ubiquitous element that is considered to be essential for normal physiologic functioning. The toxicological reference value utilised for the HHRA, 0.14 mg/kg bw/day, is based on the US Environmental Protection Agency's (EPA) oral reference dose. This reference dose was estimated from the upper range of dietary manganese intake for the general population that was not associated with adverse health effects; however, the EPA described that intakes above the reference dose would not necessarily be associated with toxicity. Furthermore, individual requirements for, as well as adverse reactions to, manganese may be highly variable. The World Health Organization has reported that the average daily exposure to manganese in the diet ranges from 2.0 to 8.8 mg (WHO 1973)

The HHRA predicted manganese risk quotients greater than 1 in toddlers and adults in the full exposure scenario and in toddlers under the reduced exposure scenario. However, the exceedances are largely due to baseline exposures to traditional plants since predicted project emissions were negligible. The 95th percentile concentrations of manganese reported on a dry weight basis in Labrador tea and crowberry were 1565 mg/kg and 576 mg/kg, respectively, and intakes were assumed to be equivalent to that of leafy vegetables (67 g/day and 137 g/day for toddlers and adults, respectively). It is recommended that specific consumption data of commodities representative of the Inuit diet should be obtained.

Mercury:

The HHRA predicted that baseline concentrations of methyl mercury would exceed a risk quotient of 1 for Inuit toddlers and adults, however, concentrations of methyl mercury were not expected to increase as a result of project emissions. According to Table B1-1, baseline data for fish sampled from the Kennarctic River drainage control (n=13) had a 95th percentile concentration of 0.91 ppm total mercury and an average concentration of 0.38 ppm total mercury. However, on pages 68-69 of the document, the average and 95th percentile baseline concentrations of total mercury in fish muscle from the local study area were reported to be 0.24 mg/kg and 0.54 mg/kg, respectively. Please clarify this discrepancy.

Although these average total mercury concentrations are lower than Canada's 0.5 ppm standard for total mercury in fish sold at the retail level, they may be higher than that considered to be safe for Inuit who subsist on these fish. For example, HC's First Nations and Inuit Health Branch suggest that fish consumed by subsistence populations should contain no more than 0.2 ppm total mercury. The TDI for methyl mercury utilised in the HHRA was 0.1 µg/kg bw, however, HC recommends a provisional TDI of 0.20

µg/kg bw for sensitive subgroups including children and woman of childbearing age and 0.47 µg/kg bw for adults of the general population (Health Canada 2007). Cursory calculations indicate that even if the average concentration and daily fish consumption recommended by HC for subsistence finfish eaters (20 g/day toddlers and 40 g/day adults) are applied, HC's TDI for methyl mercury would still be exceeded for toddlers and women of childbearing age. Although the TDI is predicted to be exceeded due to baseline conditions, continued surveillance of methyl mercury in edible portions of fish commonly consumed by the Inuit population in the High Lake Mine area, along with obtaining representative consumption information, is recommended throughout the life of the project. HC notes that monitoring of mercury in fish is required under the *Metal Mining Effluent Regulations.*

Polycyclic Aromatic Hydrocarbons:

- Although the incremental lifetime cancer risks (ILCRs) predicted by the proponent for polycyclic aromatic hydrocarbons (PAHs) were below 1 in 10^5, we have the following comments regarding the method used in the HHRA. The ILCRs predicted for PAHs were calculated using toxic equivalency factors (TEFs) in order to the rank cancer potency relative to benzo(a)pyrene (B(a)P); however, the TEFs were not specified in the HHRA. Please provide the TEFs and the source of these numbers. Contributions from the low molecular weight PAHs: acenaphthene, anthracene, fluoranthene, naphthalene and pyrene were included in the ILCRs, however, HC does not consider them to be carcinogenic. In addition, the oral slope factor for B(a)P of 2.3 $(mg/kg\ bw/day)^{-1}$ to calculate the potential cancer risk was used for the HHRA is considered to be conservative. HC concludes that the actual risks may be overestimated.

Other comments on foods:

HC has considered the issue of heavy metal contamination of lichens along the road where the concentrate (mine and mill product) is hauled. This may be a source of contamination in the food chain, as shown by experience with similar mines in Alaska (the Red Dog base metal mine).

The report would benefit from a discussion on whether indirect (caribou consuming lichen) or direct (Inuit consuming vegetation - i.e. berries, herbs, traditional plant species) routes of exposure are likely along the roadway corridor. Do local Inuit consume vegetation and/or game, whose habitat range includes the roadway corridor, in high frequency and/or magnitude? If this is the case, HC suggests that collection of baseline data be considered for the country foods along the roadsides that are directly consumed by humans. For any sampling conducted, HC recommends that samples of the same country foods that are taken from the project site also be taken from a control/reference site.

Unless the extent of the metal contamination is very high, the indirect route of human exposure to contaminants would not likely represent a significant health risk. Potentially greater health risks would arise if vegetation from the roadway corridor is harvested and consumed by local populations. If the local Inuit do consume this vegetation frequently, an estimation of the risk to human health should be considered.

There may be a potential issue of dioxin and furan emissions from the incinerator. HC supports recommendations for stack emission measurements (as suggested in the incineration management plan proposed by Environment Canada) to

determine if dioxins and furans may be an issue. If the results of emissions measurements of dioxins and furans indicate incinerators are a significant source of dioxins and furans, HC suggests modelling environmental deposition or monitoring soil/vegetation near the incinerator site. Such modelling or monitoring results can then be assessed to determine if country foods monitoring is warranted.

In the HHRA, dioxins and furans from waste incineration were dismissed as a COPC based on the rationale that the type of incinerator that will be installed will not produce substantial emissions. As mentioned in Environment Canada's information requests of Sept. 17, more information is needed on this issue to evaluate potential impact of dioxin and furan emissions. Management of waste (e.g., waste segregation and operator training) is needed to prevent accumulation of dioxins and furans in the food chain.

It was indicated that at the termination of the project, the landscape will be reclaimed and open pit mines will be backfilled and capped with a permanent layer of mine rock or formed as a lake. HC has some concerns about possible metal contamination in such a lake and the subsequent effects on country foods that may frequent it should it be formed (eg. avian game species, terrestrial mammals). Additionally, any seepage of contaminated water from such a lake into local surface waters could impact the contaminant levels in fish. The report should include a discussion of these issues and how they may impact human health.

In summary, the report indicates that the establishment of the metal mine and related infrastructure may not result in a significant increase in health risks above those presented by baseline conditions. However, the fact that the baseline concentrations of some metals in the study area are elevated, such that potential risks to human health may already exist, indicates that efforts should be made to prevent the additional contamination of country foods. This argument is strengthened by the fact that country foods were found to be one of the more significant sources of human exposure to COPCs out of all the exposure pathways that were evaluated.

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Water Quality and Drinking Water

The High Lake Project has the potential to affect water and sediment quality as it relates to drinking water sources (Volume 5, Section 3). The impacts of the High Lake Project on surface water and sediment quality are predicted by the proponent to be of

low to moderate magnitude and not significant. HC recommends that all the mitigation measures, such as limiting the extent of development, construction of the tailings impoundment, treatment of water during construction and operations, treatment of deep groundwater, seasonal discharge of compliant effluent, use of double liners and permafrost aggradations and an adaptive management plan, be followed as described in the DEIS.

Regarding section 3.1.4 (page 21) more information is needed on possible changes to groundwater as it could affect drinking water, since underground mining beneath the permafrost layer will occur.

Thank you for the opportunity to participate in the environmental assessment process for this project. Should you have any further questions or comments, please feel free to contact me at (613) 948-2875 or by email at Carolyn_Dunn@hc-sc.gc.ca

Sincerely,

Carolyn Dunn

cc: Kathleen Hedley, HC – National Capital Region

Appendix A
References Pertaining to Inorganic Arsenic in Foods

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