

# GIANT MINE Oversight Board



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**GMOB Comments re Human Health Risk Assessment for Legacy Contamination  
Around Yellowknife Final Report**

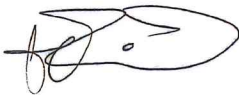
Alex;

Please find attached comments from GMOB regarding the recent Human Health Risk Assessment for Legacy Contamination around Yellowknife Final Report.

We appreciated the ability to review and comment on the document.

If you have any questions in this regard, please let us know.

Regards,



Ben Nind

**2021 08 24**

**GMOB Comments**

**Human Health Risk Assessment for Legacy Contamination Around Yellowknife**

CanNorth presented their HHRA in May and the preliminary report was distributed in June 2021. The results are summarized here (from the executive summary):

**Results**

The risks for non-carcinogenic health effects from exposure to antimony in the study area were examined and found to be negligible.

Arsenic was identified as the key concern from a health perspective and it is considered to cause cancer; therefore, the risk assessment evaluated the incremental, above background, risk from exposure to arsenic in soil, indoor dust (in cabins/houses), water, sediment, and country foods in the area. The results of this assessment for arsenic demonstrate that:

- occasional recreational (for example hiking, running, swimming) and traditional activities represent risks in the very low to low risk range (equivalent to having dental and chest x-rays or a partial CT scan on an annual basis) and can safely continue;
- living on the inland lakes in the study area and eating food from the area also represents a very low risk;
- drinking water from lakes with arsenic concentrations below the drinking water guideline, such as Walsh, Banting, Prosperous, Madeline, Pontoon, Prelude, River, Hay, Duck, and Mason lakes, is safe as long as you boil or treat the water;
- people should not drink water from Landing and Ryan lakes as the arsenic concentrations are above the drinking water guideline;
- eating lake whitefish from lakes in the study area represents a very low risk;
- people can eat the eyes, skin/fatty layer, and organs of fish from inland lakes as it represents a very low risk;
- eating about 3 northern pike in a year from Ryan Lake represents a very low risk which increases to a low risk if you eat twice as much;
- a lower risk is associated with eating whitefish or trout from Mason Lake than from eating northern pike and burbot from the lake;
- berries collected around the Yellowknife area are safe to eat; and

- mushrooms can be eaten outside of 10 km from the legacy mining areas with the exception of mushrooms from the Tricholomataceae family including pine mushrooms (tricholoma), common funnel mushrooms (clitocybe), and white mushrooms (matsutake) which should only be consumed if collected from greater than 25 km from the legacy mining areas.

The Chief Public Health Office identified mercury as a constituent of interest in fish and requested that it be evaluated in the HHRA. The study determined that mercury in fish in all of the inland lakes was below the Health Canada Maximum limit of 0.5 mg/kg wet weight (ww) for retail fish with the exception of 1 large northern pike sample from Mason Lake and 14 out of 18 northern pike samples in Lower Martin Lake. All lake whitefish samples in Lower Martin Lake were below the Health Canada Maximum Limit for retail fish. The Chief Public Health Office has issued an advisory for eating northern pike in Lower Martin Lake.

The separate analysis of exposure to arsenic in Arctic grayling that was conducted in response to concerns from local Indigenous peoples found that exposure to arsenic from eating Arctic grayling from Baker Creek does not represent a health concern and that people can continue to eat Arctic grayling caught in the Yellowknife area.

The results of the separate evaluation of workers exposed along the Ingraham Trail/Highway 4 indicate there are negligible risks from exposure to arsenic in soil while conducting various roadwork activities in the vicinity of the Giant Mine. Workers should nonetheless follow safe work practices, including the use of personal protection and safety equipment as required by the employer. The use of gloves on the job will further minimize the dermal exposure to arsenic in soil.

The HHRA follows Health Canada guidance, and in general uses assumptions about various exposure scenarios that are either specified by Health Canada or were derived from a dietary survey that was conducted as part of the Giant Mine Remediation Project HHRA.

Two main issues have been raised:

- 1) Assumptions re: fish consumption at traditional use areas. William Lines sent a note to GMOB regarding the concern in the YKDFN about the HHRA using fish data from camps for only a small portion of fish consumed, with the rest coming from Yellowknife Bay. Two concerns were highlighted:
  - a. Quantity of fish consumed per year
  - b. Source of fish. Yellowknife Bay fish have lower concentrations of As or Hg than those caught in the named lake.
- 2) Assumptions and calculations re: background soil values for As. The HHRA uses values of 114 mg/kg for Yellowknife municipal area / greenstone belt and 41 mg/kg for outside of Yellowknife boundaries up to 25 km away from either Giant or Con mines. The concentration used for Yellowknife and greenstone belt is

higher than what was used in the GMRP HHERA (94 mg/kg). The background values are obtained from a Stantec report entitled “Yellowknife Background Soil Arsenic Review” Dec 4, 2020, for GNWT. The CanNorth HHRA states that details on the background derivation are in Appendix D, however, the Appendices were not attached to the HHRA report that was forwarded by GNWT.

The Stantec report discusses data that was collected and reported through two primary mechanisms: Geological Survey of Canada (GSG), and Jamieson et al. 2017. The GSG samples were collected in 1999, 2000, and 2001. Samples considered for this purpose were collected between 10 – 70 cm below the surface. The Jamieson data was collected in 2015, 2016, and 2017. Only data from samples 10 – 40 cm below surface were used. The primary assumption in this data survey, and in the background As derivation for the GMRP HHERA, is that arsenic found deeper than 10 cm below the surface would not be influenced by historical arsenic trioxide emissions from either Giant or Con. Therefore, it would be considered to be naturally occurring arsenic.

The Stantec report provides general statistical analyses of both sets of data separately and combined, and also looks at the stats with and without data from less than 5 km from either mine stack. The report does not state or recommend which concentration statistics should be used as background values. In the off-site HHRA, CanNorth appears to use the 95<sup>th</sup> UCLM (upper confidence limit of the mean) for the combined data sets which incorporate the data within 5 km of the mine stacks. Without the Appendix to further explain why they chose these values, we can't comment further.

A recent publication by Mike Palmer and others (Palmer et al. 2021<sup>1</sup>) used the same samples as described in Jamieson 2017. In this paper, the authors used mineralogical, geospatial and statistical methods to estimate the geochemical background for arsenic. The authors effectively are testing the hypothesis (assumption) that arsenic found deeper than 10 cm below the surface has not been influenced by emissions from the mines. The mineralogical analysis differentiates between naturally occurring As minerals such as arsenopyrite and anthropogenic As<sub>2</sub>O<sub>3</sub>. They found that most As in surface soils within 15km of Yellowknife is hosted within arsenic trioxide, and this signature extends to deeper soils. The authors conclude that regional background As is between 0.25 – 15 mg/kg for all areas except for volcanic sources (Yellowknife greenstone belt), which has an upper threshold of 30 mg/kg. The non-volcanic background is roughly equivalent to the CCME assumed background of 10 mg/kg. The Palmer study has introduced new evidence into the discussion and evaluation of background in the Yellowknife area. It is very important to evaluate how this new evidence affects the current derivation of adjusted background values for the area, and a review of the results of the GMRP HHERA in light of the new evidence.

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<sup>1</sup> <https://doi.org/10.1016/j.scitotenv.2021.145926>

In the offsite HHRA, CanNorth mentions the Palmer publication and states that it supports their use of the CCME as the background value for areas > 25 km from the roaster stacks. However, this is a misunderstanding of the results and intent of the Palmer study: they showed that the mine roaster stack emissions continue to have much greater influence on soil arsenic concentrations, both in distance from the mines and in depth below the surface, than has been considered up to now.

There are some differences in the data incorporated in the Palmer paper vs the Stantec report:

- sample depth:
  - o Palmer et al use the “public health layer” (soil <10 cm depth) in their overall statistical analysis after removing mine-influenced samples,
  - o whereas Stantec uses data from 10 – 70 cm depth with the assumption that they were unaffected by roaster emissions.
- statistics
  - o Stantec statistics are based on a requirement of parametric data distribution (i.e. normal or log-normal distribution);
  - o Palmer et al. state that *“The application of statistical techniques requires careful consideration of the data distribution and since geochemical data are rarely normally or lognormally distributed many parametric methods (e.g. use of the mean and standard deviation) are typically not appropriate. Estimates using non-parametric methods are much more robust against the influence of extreme outliers that are often present in geochemical datasets.”*

The effect of these differences on the derivation of background values needs to be evaluated.

This discussion also needs to extend to the GNWT re-evaluation of As background in the Yellowknife area, new derivation of residential and industrial land use soil guidelines. This discussion should extend to whether the currently planned residential clean-up criteria for the Giant Mine townsite of 160 mg/kg remains appropriate given the new scientific evidence regarding the As background in the region.

The GMRP project team has addressed this in a preliminary manner – that the project has a water license to proceed with the remediation plan as filed, and that the results of the original HHERA provide sufficient evidence that remediating to 160 mg/kg is protective of health.

#### Additional comments

1. The report assume teens eat 91% as much as adults and provides a reference, however anecdotal experience suggests that this age group generally eats a lot more than adults. This percentage value should be re-examined.

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2. A question of seasonal effects to fish tissue concentrations. I.e. might they be higher or lower in winter (under ice) in response to potential changes in water chemistry. This may need further research to put it into context for the study.