HUMAN HEALTH RISK ASSESSMENT FOR LEGACY ARSENIC CONTAMINATION AROUND YELLOWKNIFE

PLAIN LANGUAGE SUMMARY

Canada

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INTRODUCTION

The Giant and Con Mine sites are former gold mines located in Yellowknife, Northwest Territories (NT) that produced gold until 1999 and 2003, respectively. The processing or roasting of ore, which is the rock and mineral that contained the gold, produced dust containing high levels of arsenic. During the early operation of the mines, it is estimated that more than 20,000 tonnes of arsenic were released to the atmosphere and deposited onto the lands around Yellowknife, Ndilǫ, and Dettah.

Members of the public and local Indigenous peoples expressed concern about what this arsenic, along with other contaminants, might be doing to their health since it is present in areas where they conduct traditional and recreational activities. Therefore, a human health risk assessment (HHRA) was conducted for these areas. This HHRA was led by the Government of the Northwest Territories Department of Environment and Natural Resources (GNWT ENR) and the NT Regional Office of Crown Indigenous Relations and Northern Affairs Canada (CIRNAC). The purpose of the HHRA was to estimate the potential exposures to contaminants in the environment and evaluate the risk of health effects to people using the areas around Yellowknife, Ndilǫ, and Dettah for both traditional and recreational activities, as well as living in cabins or houses on inland lakes within these areas.

This HHRA built upon the information from the Giant Mine Human Health and Ecological Risk Assessment, completed as part of the Giant Mine Remediation Project (GMRP), which looked at exposures and risks to people living in Ndilǫ, Dettah, and Yellowknife and eating fish caught from Yellowknife Bay. The current study examined exposures and health effects for people using areas outside of the communities of Ndilǫ, Dettah, and Yellowknife for recreational and traditional activities, and eating fish caught from inland lakes in these areas. Exposure to people can happen through contact with soil, indoor dust, sediment, and water, as well as eating country and supermarket foods. Arsenic and antimony were identified as the key contaminants to measure in this study.

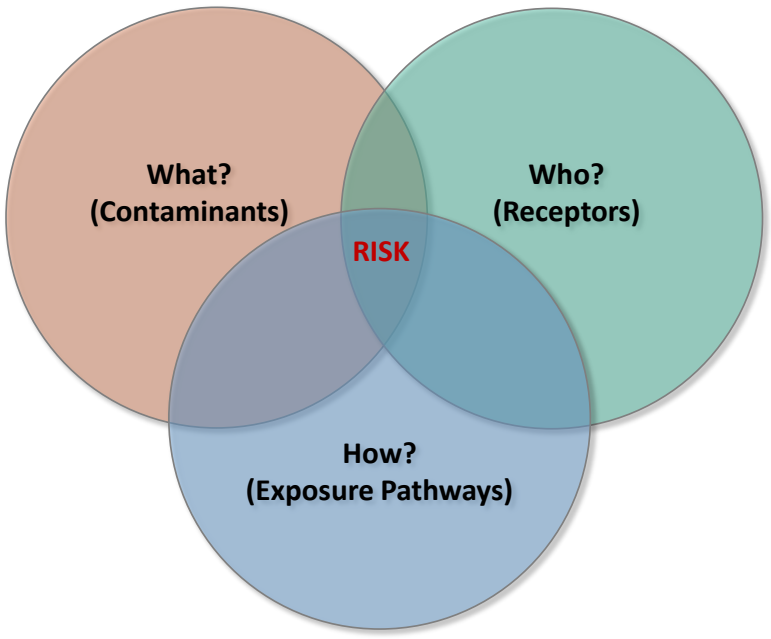
What is a Risk Assessment?

A risk assessment is a scientific process used to answer:

- What are we concerned about?
- Who is being exposed?
- How are they being exposed?

This is shown in Figure 1. All three of these questions need to be answered before determining if there is a risk. Risk assessment looks at exposure across a community and not at any one individual person. The ongoing, separate Yellowknife Health Effects Monitoring Program looks at exposures to individuals, by measuring arsenic concentrations in urine and toenails; the results of that study, together with the risk assessment, will inform future updates to official advice to residents and visitors about precautions they can take to avoid exposure to elevated arsenic around Yellowknife.

Figure 1 What is a risk assessment?



HUMAN HEALTH RISK ASSESSMENT

Locations Considered

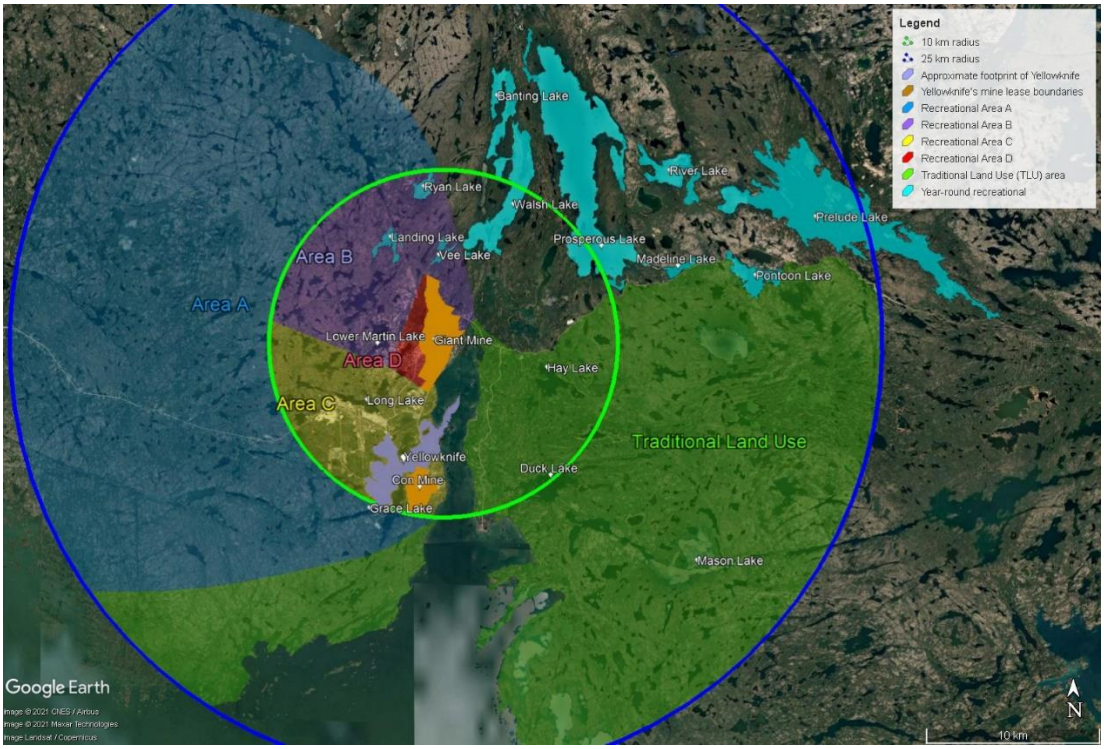
Engagement with the public and members of the Yellowknives Dene First Nation (YKDFN) and the North Slave Métis Alliance (NSMA) was conducted at in-person meetings and through an on-line survey. The study area covers lands used by the YKDFN since time immemorial and more recently by the NSMA. The mining activities in the area changed the ways and areas in which the land was used. Information was collected to determine where people carry out recreational and traditional activities today and how often they do these activities. Some key areas were identified through this engagement as shown in Figure 2:

- Area A: The western study area between the 10 km to 25 km radius of the Giant Mine site. Local Indigenous peoples reported fishing in many of the small unnamed lakes within this area, particularly west of Yellowknife along Highway 3.
- Area B: The northwestern study area, within a 10 km radius of the Giant Mine site, where Martin, Vee, and Ryan lakes are the most commonly visited lakes.
- Area C: The western study area within a 10 km radius of the Giant Mine site, surrounding the City of Yellowknife and close to Con Mine. The only lake identified for fishing in this area was Long Lake.
- Area D: The area directly west and closest to the Giant Mine site along the Ingraham Trail. People told us that there was low use of this area and it was limited mainly to hiking and running.

A specific traditional land use (TLU) area was identified within a 25 km radius to the southeast of the Giant Mine site where current traditional land uses by local Indigenous peoples occur. People said that they fish in and harvest around Duck and Mason lakes, and harvest around Hay Lake. The area to the southwest of Con Mine was also identified during engagement as an area used for traditional activities; therefore, it was included in the definition of the current TLU area for the purposes of the assessment.

People also indicated that they live or visit houses and/or cabins on inland lakes to the north and east of Yellowknife, including Vee, Landing, Ryan, Walsh, Banting, Prosperous, Madeline, Pontoon, Prelude, and River lakes.

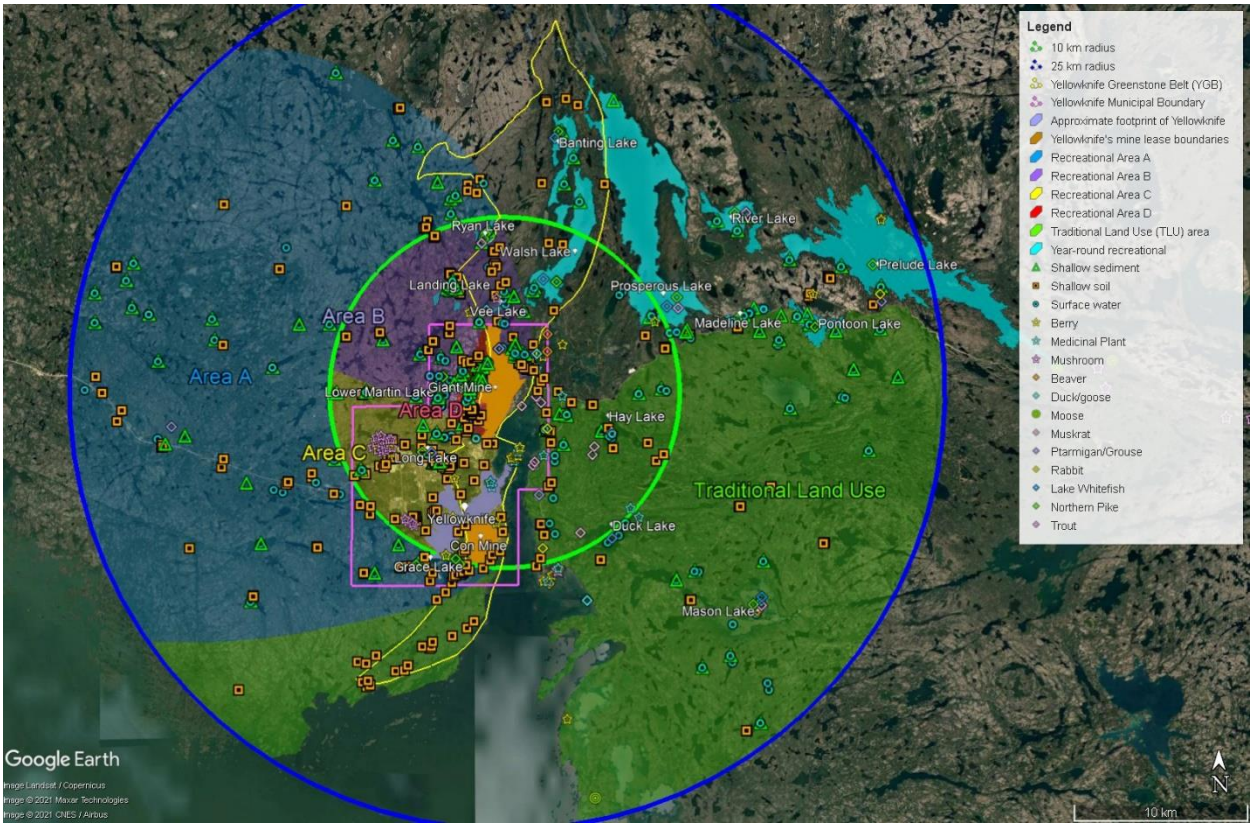
Figure 2 Study Locations



Data

The HHRA used available data from studies on soil, sediments, and surface water to determine exposures in the areas described above. Data on country foods collected from the community for the GMRP were used in the HHRA. This included samples of berries, mushrooms, muskrat, rabbit, ptarmigan/grouse, duck, and moose. Fish samples were collected in some inland lakes by members of the YKDFN and through a study by GNWT ENR. Representatives of the YKDFN shared their concerns about needing to also test fish eyes, organs, and the fatty layer under the skin, in addition to fish flesh, as these parts of the fish are also eaten. Therefore, these different parts of the fish that were caught from Mason Lake and Duck Lake were analyzed for contaminants. There was a lack of data available for muskrats within the TLU area, so muskrat samples were collected from Duck Lake and Hay Lake, and other harvesting areas in the Yellowknife Bay area. As seen from Figure 3, there were a lot of samples used in the assessment.

Figure 3 Sample Locations



Scenarios

Occasional exposures from recreational activities in areas A, B, C, and D were studied. This included people hunting, harvesting, and participating in outdoor activities such as running, hiking, camping, and swimming a few times a week during months with no snow cover. Exposures from eating locally caught fish and periodically drinking water from inland lakes in these areas were also considered. Exposures within the TLU area while harvesting, hunting, and fishing in Duck and Mason Lakes were also evaluated.

Year-round exposure to residents of houses and/or cabins on inland lakes in the study area were studied on Vee, Landing, Ryan, Walsh, Banting, Prosperous, Madeline, Pontoon, Prelude, and River lakes. While there is also day use of the inland lakes with cabins and/or houses, this would be less than the exposure to people living in these areas.

Exposures Considered

The HHRA evaluated exposures from drinking water, touching and transferring soils into their mouth and touching indoor dust (which comes from outdoor soil being brought inside by shoes and by airborne dust), drinking lake water and skin contact with water and sediment while wading or swimming in lakes, and eating supermarket food and country food (fish, wild game, berries, and mushrooms) from the areas. It should be noted that advice from the NWT Chief Public Health Office is to not drink untreated water from lakes.

Figure 4 How are people exposed?

What are the results?

The HHRA determined that arsenic was the key concern from a health perspective. Antimony exposures do not pose a health risk. Therefore, the following results are focused on arsenic.

Arsenic exposure can cause cancer; therefore, the HHRA looked at the risk of developing cancer from arsenic levels that are above background in soil, indoor dust, water, sediment, and country foods in the area. Background concentrations were generally identified based on data collected from greater than 25 km from the Giant Mine site.

The overall results of the HHRA determined that the risks of developing cancer from exposure to arsenic in the study area were low and similar to the risks from medical procedures such as annual x-rays at the dentist or having one CT scan.

It should be noted that the Office of the Chief Public Health Officer provides official advice on use of lakes within the study area by residents and visitors to avoid exposure to elevated arsenic levels in the area. The advice is based on the most current environmental and human health data and is adjusted as more information becomes available from ongoing monitoring or research activities[1] .

Recreational Areas

The results of the HHRA for recreational use of the study areas found that:

- There is very low risk to people who live in Yellowknife and surrounding communities who enjoy all types of recreational areas within the study area and beyond. This includes fishing, hunting, harvesting, berry picking, swimming, boating, hiking, and camping.
- There is very low risk to people living on the inland lakes, for example Vee, Landing, Ryan, Walsh, Banting, Prosperous, Madeline, Pontoon, Prelude, and River lakes, who eat country foods from the area.
- Mushrooms can continue to be collected from outside of 10 km from the Con/Giant mine areas, with the exception of mushrooms from the Tricholomataceae family which should only be eaten if collected from greater than 25 km from the legacy mining areas.

[1] Up to date information can be found on the GNWT HSS website: https://www.hss.gov.nt.ca/en/newsroom/arsenic-lake-water-around-yellowknife

Traditional Areas

Risks are low for local Indigenous peoples who have a traditional lifestyle that includes hunting, fishing, and gathering within the study area and the Great Slave Lake area. Locally harvested traditional foods are a healthy, and often preferred, alternative to supermarket foods. The following activities represent a very low risk:

- Eating fish from inland lakes, and Great Slave Lake in the study area, including their eyes, skin/fatty layer, and organs.
- Eating berries from around the Yellowknife area (but in areas away from the immediate vicinity of the mines).
- Eating large and small mammals such as moose, rabbits, muskrat and beaver, as well as land birds such as grouse or ptarmigan, and waterfowl from around the Yellowknife area.

Arctic grayling from Baker Creek were collected in 2020 to address the concerns from the local Indigenous peoples about the risk of eating Arctic grayling that have spent time in Baker Creek. The information collected and studied determined that the risks from eating Arctic grayling that have been in Baker Creek are low.

Additional Analyses

There have been concerns expressed about swimming and wading on the shores of Ndilǫ and Latham Island and at Long Lake beach. The results from the GMRP risk assessment determined that these activities pose a very low risk and can continue to be enjoyed safely.

The GNWT Health and Social Services (GNWT HSS) identified mercury as a constituent of interest in fish and requested that it be evaluated in the HHRA. The study determined that mercury concentrations in fish from all of the inland lakes were 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 from Mason Lake and 14 out of 18 northern pike from Lower Martin Lake. All lake whitefish in Lower Martin Lake were below the Health Canada maximum limit for retail fish. GNWT HSS has issued an advisory for eating northern pike in Lower Martin Lake.

At the request of the GNWT Department of Infrastructure, a separate evaluation was also completed to assess risks for outdoor workers along the Ingraham Trail/Highway 4, between Yellowknife and the Yellowknife River. The results tell us that workers are not at risk from arsenic exposure. However, workers should follow safe work practices, including wearing standard personal protection and using safety equipment.