Human Health

1. How are people exposed to arsenic?

Everyone is exposed to some level of arsenic because it occurs naturally in all foods, water, and the environment. Higher levels of arsenic can be found in certain areas, such as the Yellowknife area, due to industrial activity and the natural geology of the area. People are exposed to arsenic through ingestion, inhalation and dermal absorption. This can occur by eating and drinking, accidental soil ingestion or gulping water when swimming, and breathing in air and dust. Absorption through the skin is minimal. Arsenic is also present in tobacco and is inhaled with cigarette smoke.

Generally, the highest source of arsenic exposure is food. Foods such as fish, rice, seaweed, mushrooms and poultry have higher arsenic levels; however the forms of arsenic in these foods can vary. Some forms are more harmful than others.

2. How does arsenic affect human health?

As far as we know, the human body does not require arsenic for any function. The health risks and effects of exposure to arsenic in humans depend on the chemical form, the amount we are exposed to and the duration of the exposure. Inorganic arsenic is of greatest concern for potential health effects. An example of inorganic arsenic is arsenic trioxide, which was a by-product of the gold roasting process that occurred historically in the Yellowknife, Ndilǫ and Dettah area. Organic arsenic is less of a concern for potential health effects. An example of organic arsenic is arsenobetaine, which is a form of arsenic that can be found in fish. Arsenobetaine is less harmful than inorganic arsenic.

Effects from acute toxicity (a brief exposure to a very high level) of inorganic arsenic may include vomiting, abdominal pain and diarrhea. Numbness and tingling of the extremities, muscle cramping and death may also occur in extreme cases.

Chronic (over a long period of time) exposure to toxic forms of arsenic can cause bladder, kidney, liver, lung and skin cancers. It can also lead to other problems with the skin, such as lesions (wounds), changes in the colour of the skin, and hard patches on the palms and soles of the feet. Arsenic exposure has also been associated with developmental effects, cardiovascular disease, neurotoxicity and diabetes.

3. Has there been a human health study on the effects of arsenic around Yellowknife?

Several human health risk assessments have been completed to estimate the health risks from arsenic contamination in the Yellowknife, Ndilǫ, and Dettah area.

A risk assessment was completed by SENES Consultants in 2006[1], and was updated in 2010 in support of the Environmental Assessment process for the Giant Mine. No significant public health concerns were identified at the time. However, the Mackenzie

Valley Environmental Impact Review Board recommended that a comprehensive quantitative human health risk assessment be conducted.

This resulted in the Giant Mine Remediation Project (GMRP) contracting out a Human Health and Ecological Risk Assessment (HHERA), which was completed in January 2018 by Canada North Environmental Services Limited Partnership (CanNorth)[2]. The HHERA looked at the presence of contaminants in the environment (specifically in country foods, soil, sediment and water) and evaluated the different ways that people could potentially be exposed to arsenic and other contaminants. Arsenic was identified as the contaminant of concern. The HHERA results indicated very low risk of developing cancer from arsenic exposure for Yellowknife, Ingraham Trail and Dettah residents and low risk of developing cancer from arsenic exposure for Ndilǫ residents. The very low risk level is similar to the risks associated with getting one dental x-ray performed, while the low risk level is similar to the risks associated with getting one partial CT scan.

There have also been several human biomonitoring studies which looked at arsenic in people in the Yellowknife, Ndilǫ and Dettah areas. The Department of National Health and Welfare conducted studies in 1951, 1965 and 1975 looking at arsenic in children and adults, while gold mining (and release of arsenic into the environment) was still active in the region. In 1977, another study was conducted by the National Indian Brotherhood and the United Steelworkers of America, specifically looking at arsenic in First Nations children and mine workers.

Listed below are current and ongoing initiatives focused on human health:

1) The Health Effects Monitoring Program (HEMP), Giant Mine Remediation Project – Ongoing

The purpose of the HEMP is to make sure the remediation activities to take place at Giant Mine will not have a negative impact on people's health. Specifically, it will establish current or baseline levels of arsenic exposure among residents in Ndilǫ, Dettah, and Yellowknife before remediation work begins. Then, during remediation, new monitoring results will be compared to the baseline to ensure that participants' arsenic levels are not increasing because of work being done at the former Giant Mine site.

The HEMP study involves the collection of human biological samples, including toenail clippings, saliva, and urine. The study looks at factors that could affect exposure levels, such as age, gender, drinking water sources, consumption patterns of fish, wild game, edible plants and mushrooms, and local produce, recreational water use, occupation, and smoking.

Participants are selected either through statistically-supported random sampling or voluntary participation. Baseline sampling occurred in 2017 and 2018. In 2019, individual results were returned to participants, and community meetings were held to present the population-level results to the public. A report on the baseline results is available on the HEMP website (http://www.ykhemp.ca)[3]. Analysis of the baseline

data is ongoing. The next wave of sampling is scheduled for 2022 and will focus on children.

2) Stress Study, Giant Mine Remediation Project– Ongoing

While the direct effects of arsenic exposure are being evaluated through the above-mentioned studies, Measure 10 of the Mackenzie Valley Environmental Impact Review Board's Environmental Assessment requires the GMRP to also evaluate the indirect effects of potential exposures to arsenic on wellness, including stress. The GMRP is currently developing the scope of work for the study in collaboration with its stakeholders. Implementation of the study will take place in 2020. The study will assess the level and distribution of chronic psychological stress for people in Yellowknife, Ndilǫ and Dettah, related coping behaviors, and specific stressors causing chronic stress.

3) Human Health Risk Assessment, Government of the Northwest Territories and Government of Canada – Ongoing

The Government of the Northwest Territories (GNWT) and the Government of Canada are working together to carry out a Human Health Risk Assessment (HHRA) on legacy contamination in the Yellowknife area. The purpose of the HHRA is to examine, and determine the risks associated with exposure to legacy arsenic and other contaminants in soil, water, sediment, fish, country foods, air, dust, plants and mushrooms. The HHRA will examine areas outside of the GMRP site boundaries, predominantly to the west of the Giant and Con Mine sites that are known to have been impacted by legacy arsenic. The HHRA will also assess areas where people use the land for recreational use along the Ingraham Trail and for traditional use within a 25 km radius around Yellowknife. The HHRA is assessing these areas, which were not included in the above-mentioned HHERA (2018), for land users from Yellowknife, Ndilǫ and Dettah. The draft HHRA report will be presented in the winter of 2019/2020.

4. How does HSS notify the public of any risks associated with contaminants in the Yellowknife, Ndilǫ and Dettah area?

Information is provided to residents through a public health advisory issued by the Chief Public Health Officer. The advisory provides information to residents and visitors about precautions they can take to reduce exposure to arsenic in the environment in the Yellowknife area. This includes advice on activities such as swimming, fishing, drinking water, gardening, and harvesting. This information is circulated to community governments, media and the public, and is posted on the Department's website in the advisory section.

Other stakeholders, such as the City of Yellowknife or the Department of Industry, Tourism & Investment, may decide to post signs in locations with elevated contaminant levels, particularly in areas of regular public use, such as parks and trails. Signs are currently posted at the Prospector Trail, Frame Lake, Jackfish Lake, Kam Lake and Rat Lake. Other agencies may choose to include information in other publications,

such as the NWT Fishing Guide issued by the Department of Environment and Natural Resources.

The Chief Public Health Officer will continue to update health messaging based on the latest available research and monitoring, and will continue to work with our partners to keep the public informed.

KEY MESSAGES

- Health risks from exposure to arsenic depend on the form of arsenic, the amount you are exposed to, and how long you are exposed to it.
- Long-term exposure to arsenic can lead to increased risk for several types of cancer, skin problems, and potentially several other health effects (developmental, cardiovascular, neurological).
- Health risk assessments have been conducted to assess risks of exposure to arsenic in the Yellowknife, Ndilǫ and Dettah area. The information from these assessments helps to inform the advice that is issued by the Chief Public Health Officer.
- A human biomonitoring project will continue to monitor levels of arsenic in people who live in Yellowknife, Ndilǫ and Dettah. This study will look at health effects over time and investigate exposure sources.
- The Chief Public Health Officer has issued a Public Health Advisory that provides advice to residents of Yellowknife, Ndilǫ and Dettah to reduce risks from exposure to arsenic.

1 – SENES [SENES Consultations Ltd.]. 2006. Tier 2 risk assessment, Giant Mine remediation project. Final report prepared for Department of Indian Affairs and Northern Development, January.

2 - Canada North Environmental Services. (2018). Giant Mine Human Health and Ecological Risk Assessment, Final Report. Prepared for: Public Services and Procurement Canada – Western Region, Project No. 2385.

3 – H.M. Chan et al. (2019). Health effects monitoring program in Ndilo, Dettah and Yellowknife – Progress Report: Results from the phase I baseline study (2017-2018). Prepared for: Crown-Indigenous Relations and Northern Affairs Canada. http://www.ykhemp.ca/reports.php