

Research Bulletin

NWT Cumulative Impact Monitoring Program

How do Natural Processes Impact Landscape Recovery from Arsenic Contamination Near Yellowknife?

Summary

Decades after the Giant Mine roaster released arsenic into the air, nearby areas are still polluted. We confirmed previous findings that arsenic levels in soil and water remain higher than safety guidelines in places people can easily access. The arsenic trioxide found near Pocket Lake is from the Mine's roaster and easily washes from soil into water, and eventually into lakes when the snow melts or it rains. These results show the land has not recovered from arsenic contamination and it could take up to thousands of years to heal.

Why is This Important?

Pocket Lake is on the traditional lands of the Yellowknives Dene First Nation and North Slave Métis, and close to the communities of Yellowknife, Ndilo, and Dettah. Because arsenic is toxic and some forms (like arsenic trioxide) are worse than others, understanding how arsenic moves through the land and water informs land use and health risk decisions. Understanding how changes in precipitation impacts arsenic movement helps us anticipate how climate change may affect arsenic concentrations in soil and water.

What Did We Do?

Soils

We took soil samples at different depths to learn how much arsenic was there and to identify the form of arsenic. We added clean water to some soil samples and shook them for 24 hours to mimic rain and snowmelt over time. We then tested the water to see how much arsenic had been released from the soil to the water.

Water

We took water samples during snowmelt from different areas that drain into Pocket Lake to understand where and how much arsenic is washing off the land. We also collected and tested water found in small gaps between soil particles to study arsenic in water held within soil.



Stanley MacKenzie, YKDFN, sampling snow for chemical analysis.
(Credit: M. Palmer)



What Did We Find?

Soil and water samples had arsenic levels higher than safety guidelines and the Pocket Lake area may pose a human health risk to those that frequent the area. Arsenic concentrations in soil ranged between 100 mg/kg to 2400 mg/kg, much higher than the Canadian Soil Quality Guideline of 12 mg/kg. We found:

- More arsenic was in the top 5 cm of soil and that it was mostly arsenic trioxide. Less arsenic was found deeper in the soil.
- Arsenic moves easily from soil to water.
- Water samples from snowmelt and soil surface runoff had high arsenic concentrations. Areas with more soil had higher concentrations but even runoff from areas with bedrock contained arsenic.



Map of the study area near Yellowknife. The outline of the catchment area that drains water from rain or snowmelt into Pocket Lake is marked by the white line.

What Does This Mean?

The land near Giant Mine is still polluted from ore roasting. Arsenic remains in the soil and flows into lakes. Recovery is very slow. Our findings can help decision-making, such as improving signage about risk, or advising local remediation projects.

For More Information

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Jamieson, H.E., Maitland, K.M., Oliver, J.T., Palmer, M.J. (2017). *Regional distribution of arsenic in near-surface soils in the Yellowknife area*. NWT Geological Survey Open File 2017-3.

Palmer, M.J., Richardson, M., Chételat, J., Spence, C., Connon, R., Jamieson, H.E. (2024). *Watershed hydrology mediates the recovery of an arsenic impacted subarctic landscape*, *Environmental Pollution*, 358: 124480.

GNWT Health and Social Services Advisory on Arsenic in Lakes Around Yellowknife at <https://www.hss.gov.nt.ca/en/newsroom/arsenic-lake-water-around-yellowknife>

NWT CIMP is a source of environmental monitoring and research. The program coordinates, conducts and funds the collection, analysis and reporting of information related to NWT environmental conditions. If you're conducting environmental monitoring and research, consider sharing your information with northern residents and decision-makers in a Bulletin.