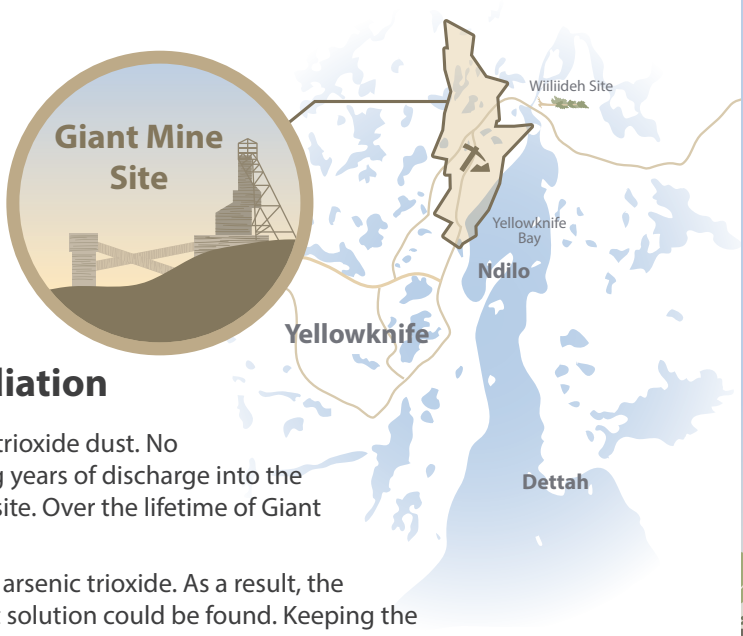
The Challenge at Giant Mine

Finding a permanent solution for stored arsenic trioxide dust.

GIANT MINE Oversight Board

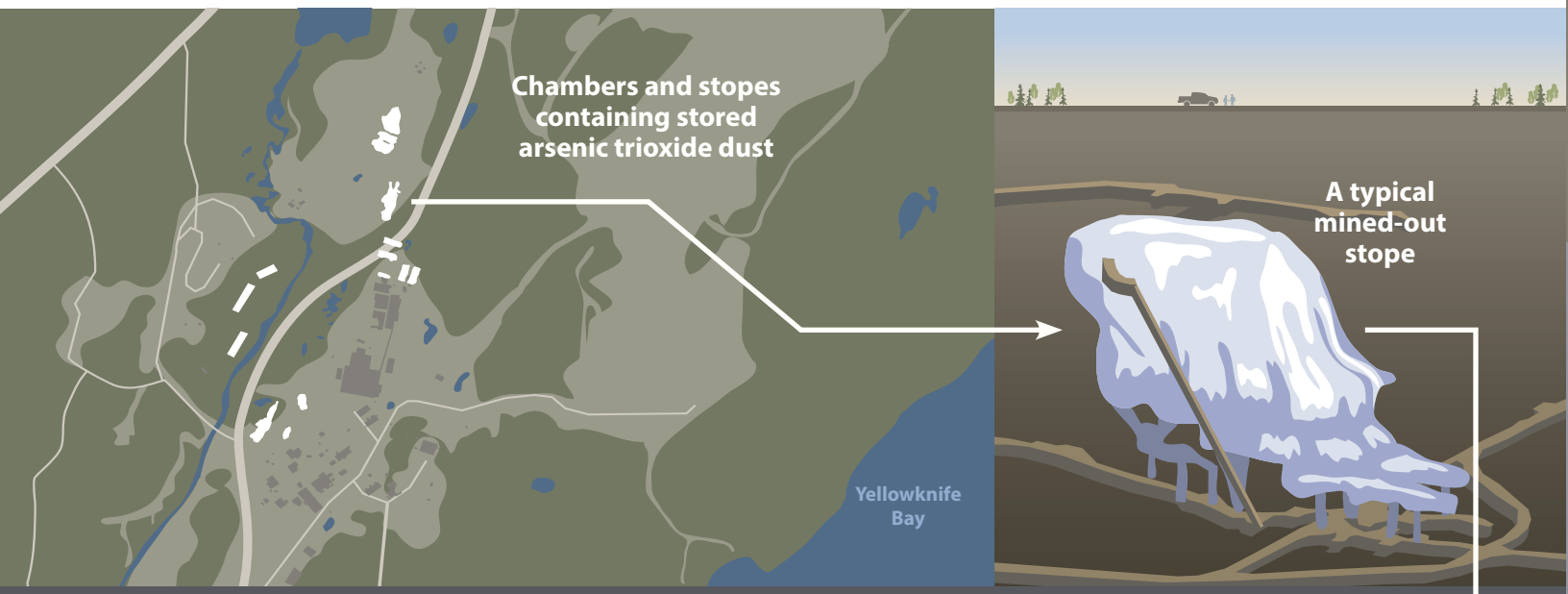
Giant Mine was a gold mine that operated in Yellowknife, NWT from 1948-1999. Upon abandonment, several hundred thousand tonnes of highly toxic arsenic trioxide dust was left in large underground chambers. Cleaning up this dust represents a significant technical challenge which will require the use of emerging or yet undiscovered technologies. While finding a permanent solution for the stored arsenic trioxide won't be easy, it will help alleviate a significant source of concern for local residents and help protect the surrounding land and water for generations to come.



From production, to abandonment, to remediation

The mining of the gold at Giant Mine resulted in the creation of arsenic trioxide dust. No processes were available at the time to deal with the dust, and following years of discharge into the air it was stored in a network of 14 underground chambers at the mine site. Over the lifetime of Giant Mine, 237,000 tonnes of this dust were collected and stored.

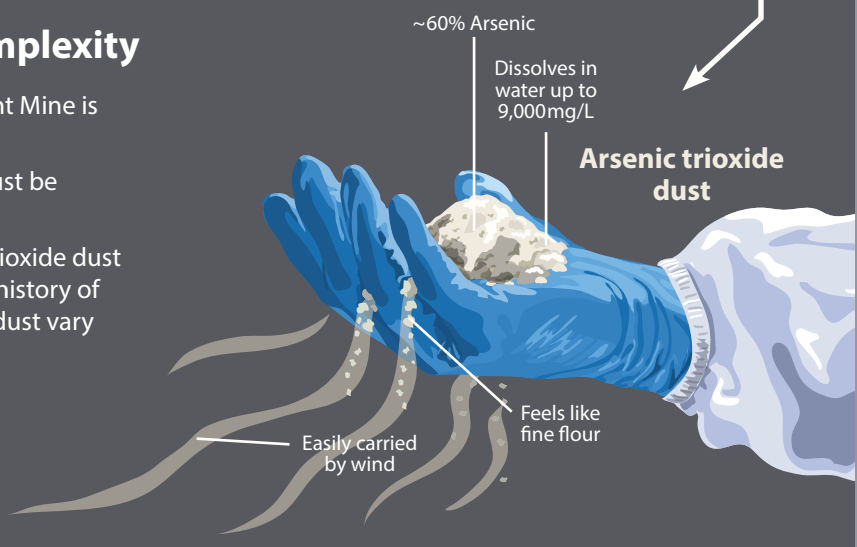
Moving the dust poses risks to the community due to the toxicity of the arsenic trioxide. As a result, the government decided to freeze the dust in place until a more permanent solution could be found. Keeping the dust frozen is intended to prevent it from dissolving into groundwater and spreading into the surrounding area.



A challenge with multiple layers of complexity

The challenge of dealing with the arsenic trioxide dust at Giant Mine is complex for several reasons:

- **The quantity of the dust:** All 237,000 tonnes of dust must be managed to fully address the hazard.
- **The physical characteristics of the dust:** The arsenic trioxide dust at Giant Mine resembles a fine flour. Because of the long history of the mine, the precise composition and properties of the dust vary across Giant Mine.
- **The storage condition of the dust:** The dust is stored below-ground in fourteen chambers: some purpose-built, and some in large mined-out stopes.



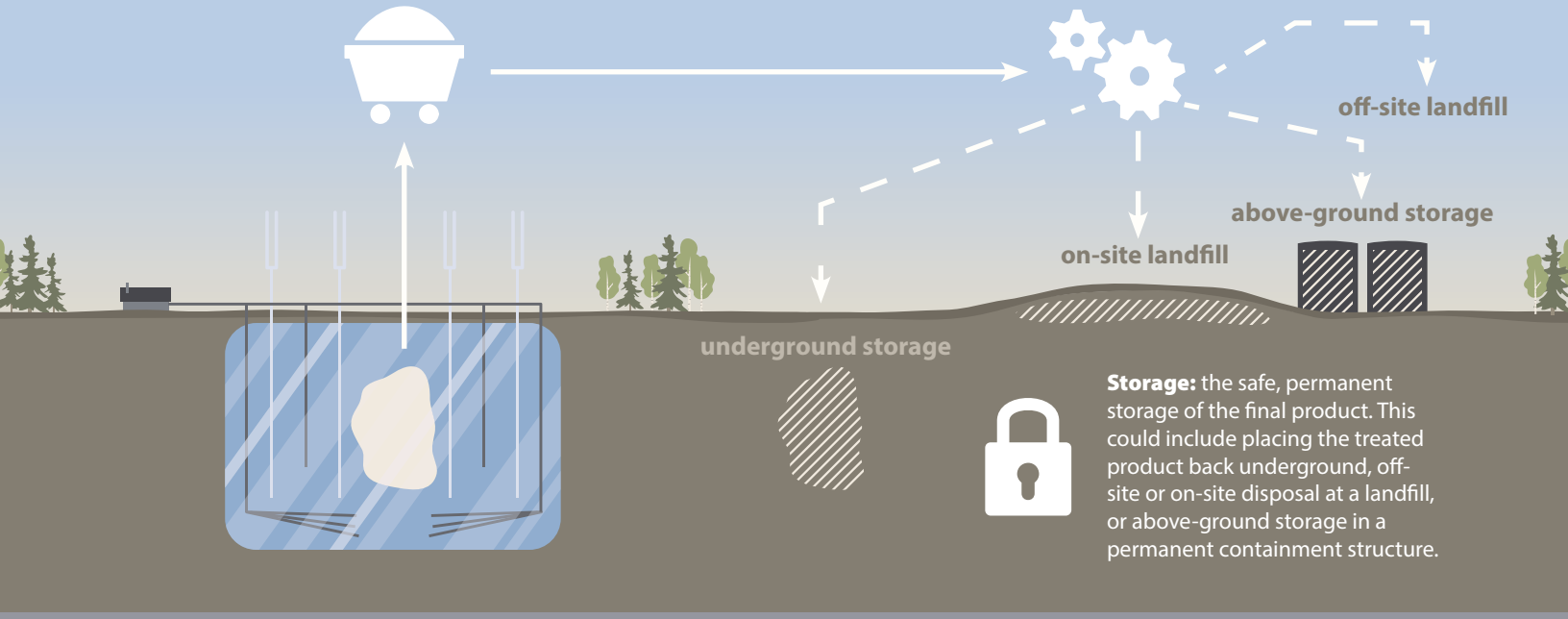
The pursuit of a permanent solution

The Giant Mine Oversight Board (GMOB) is a non-profit organization tasked with finding a permanent solution for the stored arsenic trioxide dust at Giant Mine. As part of its role, GMOB actively reviews and funds research and innovations that may assist in addressing the challenges at the Giant Mine site. GMOB, therefore, welcomes new ideas and accepts outside proposals from independent researchers or companies.

A successful permanent solution will have to address three key challenges:

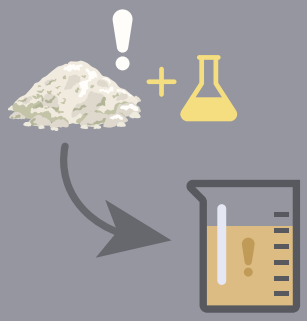
Extraction: if the dust is to be treated above ground, a removal method is needed to safely extract it from the underground chambers. The potential toxicity impacts to workers and the environment is a critically important consideration when evaluating extraction techniques.

Transformation: the transformation of the arsenic trioxide into something more stable. This may be achieved by transforming it into a different chemical, or by encapsulating it in another substance to stabilize it.

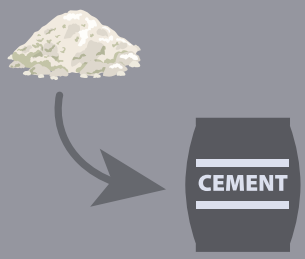


Storage: the safe, permanent storage of the final product. This could include placing the treated product back underground, off-site or on-site disposal at a landfill, or above-ground storage in a permanent containment structure.

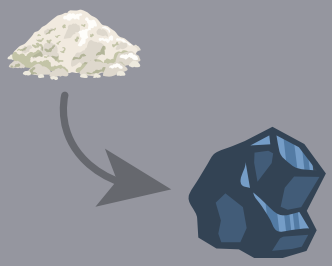
Given the complex nature of the challenge, a permanent solution will likely involve the integration of several technologies. GMOB is currently partnered with several research teams evaluating methods for stabilizing the arsenic trioxide. These include:



Chemically changing the arsenic into a less toxic sulphide



Mixing the dust into a cement paste backfill



Turning the dust into a type of glass

These research projects are currently answering questions such as how completely the arsenic trioxide can be transformed using each method, how strong the final products are, and whether they will release arsenic trioxide into the environment over time. Such questions are essential for evaluating the safety and feasibility of any given method for dealing with the arsenic trioxide dust. GMOB is working to a future when community members can feel confident knowing that no more arsenic trioxide will be released from Giant Mine.

If you have a research proposal you'd like to share for review and consideration, or have any questions about GMOB and its research program, please reach out to us.

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