

# **2021 ANNUAL REPORT**







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# The Giant Mine Oversight Board at a Glance

## Purpose

The 2015 Giant Mine Remediation Project Environmental Agreement established the Giant Mine Oversight Board (GMOB). GMOB has two purposes:

1. Independently monitor, promote, advise, and support the responsible management of the remediation of the Giant Mine site; and
2. Manage a research program to seek a permanent solution to the arsenic trioxide stored underground at the Giant Mine.

## Mandate

To achieve its purposes, GMOB's mandate is to:

- Monitor and report on the Giant Mine Remediation Project;
- Review, comment, and make recommendations on programs, research, and reports about the Project;
- Support research into a permanent solution for the arsenic trioxide stored underground at the Giant Mine site; and
- Communicate to the public and Parties to the Environmental Agreement about GMOB's activities.

## Vision

GMOB envisions that the remediation of the Giant Mine site including the sub-surface, will be carried out in an environmentally sound, socially responsible, and culturally appropriate manner.

## Governance

GMOB is governed by a six-member Board of Directors. The six Parties to the Giant Mine Remediation Project Environmental Agreement each appoint one member to the Board. Each Director acts independently from the Party making the appointment. The Parties are:

1. Government of Canada, Crown-Indigenous Relations and Northern Affairs Canada
2. Government of the Northwest Territories, Environment and Natural Resources
3. Yellowknives Dene First Nation
4. North Slave Métis Alliance
5. Alternatives North
6. City of Yellowknife

The Government of Canada and the Government of the Northwest Territories are co-proponents of the Giant Mine Remediation Project. They work together as the Giant Mine Remediation Project Team. The co-proponents are referred to as the 'Project Team' throughout this report.

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## Message from the Giant Mine Oversight Board

The Giant Mine Oversight Board (GMOB) is an independent body responsible for overseeing the Giant Mine Remediation Project. GMOB is also tasked with seeking a permanent solution to the arsenic trioxide stored underground at the mine.

Annual reports are one way GMOB is accountable for its work. In this sixth annual report, GMOB describes its project oversight and research activities in 2021 along with outcomes and next steps. Highlights from a mandatory five-year review of GMOB's work are also included. This annual report updates the status of GMOB's recommendations to the Giant Mine Remediation Project Team. GMOB makes four new recommendations as a result of oversight activities in 2021. Two recommendations relate to more active reporting on key indicators of trends; one recommendation encourages improvements to contracting processes; and the other is to permit no further delays in perpetual care planning.

GMOB is pleased that site remediation has begun and regulatory requirements and schedules are being addressed. The Giant Mine Remediation Project Team's overall strong performance can be attributed in part, to meaningful public engagement on engineering and environmental issues. Unfortunately, similarly high quality public engagement activities aren't evident on economic matters. GMOB will conduct a public survey in 2022 to inform improved communications and engagement on economic and other matters related to the Remediation Project.

GMOB continues to strongly support better opportunities for local businesses, employment for residents, and training benefits from the Remediation Project. To enhance understanding and maximize local benefits, GMOB supports better data analyses and reporting; more robust measures to engage local labour and businesses; and growing a northern remediation economy drawing from the Giant Mine Remediation Project experience. In 2022, GMOB looks forward to the release of the Project Team's updated socio-economic strategy and action plan as well as the Government of the NWT's study on the economic potential of a northern remediation economy.

No major environmental concerns arose from the mine site or remediation activities in 2021. GMOB appreciates the Project Team's work to ensure the stability and safety of the mine site. This diligence bodes well for ongoing remediation activities. GMOB is pleased that the Project Team is taking steps to reduce greenhouse gas emissions and will continue to recommend improvements in this area.

The COVID-19 pandemic impacted research programs supported by GMOB. As was the case in 2020, research results in 2021 were limited mainly due to laboratory closures. GMOB looks forward to more robust research activities and results in 2022.

GMOB strongly supports the application of the principles of reconciliation in all elements of the Giant Mine Remediation Project. It is encouraging that more evidence of efforts to reconcile the legacy of Giant Mine was apparent in remediation processes and decisions in 2021.

It has been an interesting year at GMOB. Overall, the Board is encouraged by the progress being made on mine site remediation. On behalf of the GMOB Board of Directors and our Executive Director, I thank the Project Team, the Parties to the Giant Mine Remediation Project Environmental Agreement, and the public for their continued involvement and support for the responsible remediation of the Giant Mine site.

David Livingstone  
Chair, GMOB

## Project Oversight in 2021

For the Giant Mine Oversight Board (GMOB), project oversight involves monitoring, reviewing, and commenting on documents and presentations. It also includes attending meetings, seeking expert advice, making recommendations, and promoting public awareness and engagement. GMOB's project oversight activities fall into seven interrelated areas of responsibility:

- 1. ENVIRONMENT**
- 2. ECONOMY**
- 3. ENGAGEMENT**
- 4. RECONCILIATION**
- 5. PROJECT MANAGEMENT AND PLANNING**
- 6. COMMUNITY HEALTH AND WELLNESS**
- 7. LONG TERM PLANNING**

**Each project oversight responsibility is briefly discussed in terms of:**

- Expectations** → What did GMOB expect?
- Actions** → What actions were taken?
- Outcomes** → What were the outcomes of the actions?
- Next Steps** → What are the next steps?

GMOB's commitments and recommendations are included in next steps. The status of previous GMOB recommendations is described in Appendix A. In 2022, GMOB will expand monitoring and reporting on the recommendations.

To enhance project oversight activities, GMOB recommends that the Project Team undertake more active reporting on key indicators of trends in each of the seven responsibility areas discussed in this section [\(2021-1\)](#).



## ENVIRONMENT

The Type A Water Licence issued by the Mackenzie Valley Land and Water Board in 2020 requires a variety of environmental management and monitoring plans. The Giant Mine Remediation Project Team continued to develop required plans and implement measures to minimize environmental impacts during active remediation.

GMOB's review of monitoring and inspection reports in 2021 raised no significant environmental issues. The Project Team continued its diligence to environmental safety throughout 2021. Diligence to environmental safety appears consistent with previous years although a formal year-to-year monitoring system is needed to confirm this assertion.

### What Does GMOB Expect?

GMOB expects the Project Team to design and implement effective management and monitoring plans in all phases of the Giant Mine Remediation Project. These plans should minimize negative environmental effects of the mine site and remediation activities. GMOB expects the Project Team to modify plans based on monitoring results, adaptive management practices, and new information brought forth by external researchers, community members, and others.

GMOB expects the Project Team to have realistic contingencies in place in the event of unanticipated equipment failure. The need for practical contingencies was highlighted in 2021 as a result of difficulties obtaining parts and equipment during the Covid-19 pandemic.

### What Actions Were Taken?

The Project Team submitted 10 management and monitoring plans and reports to the Mackenzie Valley Land and Water Board (see text box). These plans and reports are required to maintain compliance with the Type A Water Licence. Plans and reports were reviewed by interested parties including GMOB, then approved with or without revision by the Land and Water Board.

The Project Team continued inspections, monitoring, and reporting on air and water quality, and effluent and dust control. The Project Team managed hazardous waste storage areas, wastewater discharge, and dust control on roads and the tailings containment areas. Additional water cannons were obtained in 2021 to improve dust suppression efforts. Public concerns about ice build-up by the Northwest Pond brought to GMOB were passed onto the Project Team. These concerns were addressed in a timely manner so that ice build-up did not become hazardous.

The Aquatic Advisory Committee was established in 2020. It provides guidance on mitigations and monitoring decisions for Baker Creek and Back Bay. The Committee met four times in 2021.

The Giant Mine Working Group provides feedback to the Project Team on remediation plans. Working Group members are: Crown-Indigenous Relations and Northern Affairs Canada, Public Works and Government Services Canada, Government of the Northwest Territories, Environment Canada, Department of Fisheries and Oceans, Alternatives North,

#### Plans and reports submitted to the Mackenzie Valley Land and Water Board in 2021 for review and approval included the:

- Arsenic Trioxide Frozen Shell Management and Monitoring Plan
- Dust Management and Monitoring Plan
- Engagement Plan
- Spill Contingency Plan
- Erosion and Sediment Management and Monitoring Plan
- Waste Management and Monitoring Plan
- Borrow Materials and Explosives Management and Monitoring Plan
- Water Management Plan
- Aquatic Effects Monitoring Program 2020 Annual Report
- Water Licence Annual Report for 2020

Yellowknives Dene First Nation, North Slave Métis Alliance, Health Canada, and the City of Yellowknife. The Working Group met nine times in 2021.

In response to a previous GMOB recommendation (2019-9), the Project Team began tracking and reporting on greenhouse gas emissions from site activities. Three months of tracking data are reported in the *Giant Mine Remediation Project Annual Report 2020-2021*.

### **What Were the Outcomes of the Actions?**

GMOB found no significant environmental issues associated with the mine site or remediation activities in 2021. Water licence and land use permit requirements and schedules were met. Minor issues identified in monitoring and inspection processes were remedied in an appropriate and timely manner.

Monitoring reports found that air quality is consistently good around the mine site, in proximity to the site, and in the region. Monitoring reports also showed that the mine water, surface water, and effluent discharge met the standards set out in the Type A Water Licence. Water and aquatic life monitoring results for Back Bay and Baker Creek found no marked change over previous years with one exception. The Aquatic Effects Monitoring Program identified an increasing trend in the concentration of dissolved iron near the mouth of Baker Creek. The Project Team reported that the concentration of iron is within regulated guidelines considered safe for aquatic life. The Project Team will continue to monitor water quality trends in Baker Creek.

In 2021, a downhole pump in the Northwest Site area failed due to a power brown-out. The pump was not operational for at least seven months. Another working pump and contingency pumps located underground were used in place of the failed pump. Fortunately, the pump failure created no environmental issues but a more timely response to non-operational equipment is needed in the case of similar events in the future. The Project Team has committed to report on lessons learned from this issue. GMOB expects to see this report early in 2022.

In 2020, GMOB recommended that the Project Team develop a short and long-term strategy to proactively reduce greenhouse gas emissions (2020-1). In response, the Project Team committed to:

- Assess and minimize greenhouse gas emissions in the design and operation of the water treatment plant;
- Minimize fuel use and reduce haul distances where possible; and
- Track greenhouse gas emissions on a monthly basis and report annually.

## What Are the Next Steps?

*GMOB will continue to:*

- Review environmental management plans and monitoring reports; and
- Share concerns and issues through direct dialogue with the Project Team and Parties to the Giant Mine Remediation Project Environmental Agreement as well as in comments to the Mackenzie Valley Land and Water Board.

To improve understanding of trends, GMOB will continue to work with the Project Team to identify key environmental indicators. GMOB will support consistent monitoring and reporting on these indicators. Semi-annual monitoring reports are suggested.

Three documents published by the Government of Canada are relevant to the Project Team's commitment to proactively reduce greenhouse gas emissions:

1. *Strategic Assessment of Climate Change*<sup>1</sup> (October 2020),
2. *Draft technical guide related to the strategic assessment of climate change*<sup>2</sup> (August 2021), and
3. *Reporting greenhouse gas emissions data: technical guidance 2020* (2020).<sup>3</sup>

These documents will inform GMOB's oversight with respect to greenhouse gas emissions. These documents can also aid the Project Team's efforts to quantify greenhouse gas emissions and implement mitigation measures and plans to achieve net-zero emissions by 2050.

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1 <https://www.canada.ca/en/services/environment/conservation/assessments/strategic-assessments/climate-change.html#toc3>

2 <https://www.canada.ca/en/environment-climate-change/corporate/transparency/consultations/draft-technical-guide-strategic-assessment-climate-change.html>

3 <https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/facility-reporting/reporting/technical-guidance-2020.html>

## ECONOMY

In the past, GMOB referred to oversight of socio-economic matters related to the Giant Mine Remediation Project. In 2021, the decision was made to rename this oversight responsibility to 'economy' to better reflect the focus of GMOB's work. Matters related to social well-being are discussed elsewhere in this report, particularly Section 6 (Community Health and Wellness).

Throughout 2021, the Parties to the Giant Mine Remediation Project Environmental Agreement worked together to support the Project Team's *Socio-Economic Strategy, 2016-2021* and *Socio-Economic Action Plan, 2018-2021*. The effectiveness of efforts to maximize local benefits is unclear. GMOB continues to promote improved economic data analyses and reporting.

### What Does GMOB Expect?

The Giant Mine Remediation Project is expected to generate significant local business, employment, and training opportunities and benefits. Opportunities and benefits are expected throughout active remediation and care and maintenance of the site. GMOB expects strategies, action plans, and monitoring reports to demonstrate local opportunities and benefits.

GMOB understands the 'remediation economy' to be the structure, capacity, and knowledge of resident businesses and individuals to clean-up and remedy undesirable and/or dangerous conditions created by industrial activity.

GMOB expects the Project Team to continue to monitor and update the *Socio-Economic Strategy, 2016-2021* and *Socio-Economic Action Plan, 2018-2021*. GMOB expects the Project Team to engage with, and seek input from local organizations and the public on maximizing local benefits and mitigating negative impacts of the Remediation Project. Input should be sought and used in decisions on a wide range of economic matters related to the remediation activities. These matters include additional services that may be required to meet the needs of non-resident employees.

In the longer term, GMOB expects that the Giant Mine Remediation Project will enhance the capacity of local businesses to capture the opportunities presented by a northern remediation economy.

### What Actions Were Taken?

GMOB's capacity for overseeing economic matters was enhanced in 2021 with the City of Yellowknife's appointment of a professional economist to the Board.

In 2021, GMOB contracted an independent review of the *Socio-Economic Strategy, 2016-2021* and *Socio-Economic Action Plan, 2018-2021*. The review was shared with the Project Team and discussed at a bilateral meeting.

The Socio-Economic Advisory Body met throughout 2021. The Advisory Body is made up of senior managers from public and Indigenous governments and partners. It provides advice to the Socio-Economic Working Group. The Socio-Economic Working Group coordinates implementation of the *Socio-Economic Strategy, 2016-2021* and *Socio-Economic Action Plan, 2018-2021*. The Working Group met throughout 2021. GMOB is an observer on both the Advisory Body and the Working Group.

Based on an internal survey in 2020, the membership structure of the Socio-Economic Working Group was adjusted in 2021 in an attempt to improve its effectiveness.

A report from a social impact management workshop held in late 2020 was submitted to the Socio-Economic Working Group. GMOB is unclear as to what, if any, follow-up actions were taken in 2021.

In July 2021, the City of Yellowknife wrote to the Government of Canada and the Government of the NWT to express frustration and disappointment with the effectiveness of the Socio-Economic Advisory Body and the Socio-Economic Working Group. The City requested adjustments to socio-economic plans to better maximize local benefits from the Giant Mine Remediation Project. In November 2021, the City considered prioritizing time and resources to ensure that local benefits are maximized and social impacts from the Project are addressed.<sup>4</sup> In response to concerns about the socio-economic performance of the Remediation Project, the Government of the NWT conducted an analysis of relevant data. The analysis concluded that concerns about poor socio-economic performance were not warranted.

The Project Team has initiated the development of a five-year training plan with the Yellowknives Dene First Nation, North Slave Métis Alliance, and the Tłıchǫ Government. As well, the Project Team continues to contribute funds to the Yellowknives Dene First Nation's education and training program, Dechita Naowo.

In 2020, the Yellowknives Dene First Nation and Queen's University conducted a socio-economic survey. The results of this survey have yet to be released although GMOB continues to encourage information sharing.

### **What Were the Outcomes of the Actions?**

The *Giant Mine Remediation Project Annual Report 2020-21* provides annual employment, procurement, and training data. GMOB continues to query economic data analyses and reporting because the full extent of local benefits from the Remediation Project are unclear. In 2021, GMOB brought forward additional information on the NWT labour market and demand arising from capital projects. These data were used in an analysis of the Remediation Project's economic performance so that benefits could be better understood.

GMOB brought local business contract procurement concerns to the Project Team. These concerns were raised with the Socio-Economic Working Group but no remedies are yet apparent. The lack of local non-Indigenous business representation on the Socio-Economic Advisory Body and the Socio-Economic Working Group may contribute to the lack of response to these concerns.

The Socio-Economic Working Group hoped to improve its effectiveness with changes to the membership structure. GMOB is of the opinion that it is too early to discern whether this outcome has been realized.

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4 <https://www.yellowknife.ca/en/city-government/giant-mine-socio-economic-action-plan.aspx>

GMOB continues to support the development of a northern remediation economy, using the Giant Mine Remediation Project as an opportunity to promote and develop local employment, procurement, and training opportunities and capacity. The Government of the NWT has initiated a study of the longer term potential of an NWT remediation economy in terms of potential gross output and domestic product. The study is expected to forecast future demand for remediation goods and services including labour. It should also inform investment planning among local businesses and governments. The results of the study should be available in 2022.

### **What Are the Next Steps?**

GMOB is committed to ensuring widespread understanding of the economic effects of the Giant Mine Remediation Project. To this end, GMOB will continue to:

- Promote awareness of the local business, employment, and training opportunities and benefits within the context of the local and territorial economy; and
- Support the use of a template developed by GMOB advisors in 2020, to assist all parties to better understand the economic performance of the Giant Mine Remediation Project.

GMOB will continue to work with the Project Team and the Parties to the Giant Mine Remediation Project Environmental Agreement to improve economic data analyses and reporting. The Project Team and City of Yellowknife have expressed their willingness to join in these efforts.

GMOB will continue to bring concerns about contracting processes to the Project Team and advocate for new tools and approaches to addressing these issues. GMOB recommends that the Project Team meet with local contractors to discuss opportunities for improving contracting processes (2021-2). The annual Industry Day might be a time to begin these discussions. In 2022, GMOB will encourage the Project Team to explore new measures to improve opportunities for local businesses to participate in the Remediation Project.

In 2022, GMOB looks forward to the Project Team's updates of the *Socio-Economic Strategy, 2016-2021* and *Socio-Economic Action Plan, 2018-2021*. GMOB urges the Project Team to employ the necessary expertise to ensure updated documents include clear targets, indicators, actions, and expected outcomes appropriate to current local and territorial economic circumstances. GMOB supports an open, transparent process for updating these documents so that implementation progress can be monitored and input can be sought and considered in decisions.

GMOB will continue to strengthen its capacity to oversee the Project Team's economic activities and better discern trends. GMOB will encourage and support the Project Team to more effectively analyze and report on key economic indicators, perhaps on a semi-annual basis.



## ENGAGEMENT

The Giant Mine Remediation Project Team offered quality engagement opportunities for the Parties to the Giant Mine Remediation Project Environmental Agreement. Engagement activities tended to focus on engineering and environmental aspects of the Project. Improvements are needed in engagement on economic matters.

### **What Does GMOB Expect?**

GMOB expects the Parties to the Giant Mine Remediation Project Environmental Agreement and the Project Team to meaningfully and regularly communicate and engage with each other's constituencies and the broader public. At any time, local communities and other northerners should be able to learn about, and express their thoughts on the remediation and care of the Giant Mine site. GMOB expects that public input will be considered in decision-making processes.

### **What Actions Were Taken?**

The Project Team continued to engage with the Parties to the Giant Mine Remediation Project Environmental Agreement. Engagement activities included meetings of the Giant Mine Working Group, Aquatic Advisory Committee, Health Effects Monitoring Program Technical Committee, and Socio-Economic Working Group. The Project Team continued to make resources available to assist the Parties to prepare for, attend, and meaningfully participate in meetings on engineering and environmental matters. Due to public health measures associated with the COVID-19 pandemic, meetings were held virtually. The Project Team also held its annual public meeting virtually.

Throughout 2021, the Project Team shared information about remediation activities in public service announcements, electronic newsletters, its website, and social media posting such as Twitter. Both the Project Team and the City of Yellowknife have webpages dedicated to the Giant Mine Remediation Project. These webpages continue to be improved.

### **What Were the Outcomes of the Actions?**

The *Giant Mine Remediation Project Annual Report 2020-21* lists stakeholder concerns that the Project Team heard through its public engagement activities. The Annual Report also lists the Project Team's responses to these concerns, and the decisions taken or altered as a result of public input. For example, public input informed the decision to complete a pre-construction archeological assessment of the AR1 freeze pad.

GMOB commends the Project Team's efforts to ensure that each of the Parties to the Giant Mine Remediation Project Environmental Agreement is familiar with the technical information provided, in advance of technical and environmental meetings. These efforts include the provision of plain language materials, meetings with individual Parties, and providing access to independent experts. These activities improve understanding of technical information and result in better quality participation and decisions at the meetings. They enable meeting participants to be more confident in asking questions, voicing concerns, and offering advice. In contrast, comparable preparatory measures are

not taken in advance of Socio-Economic Working Group meetings. As a result, engagement in economic matters is less effective. This is evidenced for instance, in Working Group decisions being hindered by the lack of understanding of common terms and concepts such as 'socio-economic', 'benefits' and 'compensation'.

In 2021, the Project Team engaged effectively with the Yellowknife Historical Society (formerly the NWT Mining Heritage Society) and the Great Slave Cruising Club. These engagements contributed to an agreement to work together to minimize disruptions during remediation of the town site and boat launch area.

The Project Team has responded to requests for more informative signage around the mine site. Information signs in English and French have been placed along the highway in the vicinity of Giant Mine.

### **What Are the Next Steps?**

GMOB is committed to improving the effectiveness of communication and engagement on economic matters. GMOB looks forward to working with the Parties to the Giant Mine Remediation Project Environmental Agreement and the Project Team to improve the effectiveness of these activities.

GMOB will conduct a survey to gauge public understanding of the Giant Mine Remediation Project and satisfaction with opportunities for engagement. The public survey will be conducted in early 2022. Survey results will be shared with the Parties and the public. The results will inform future recommendations for engagement and GMOB's own communication strategies.

GMOB is committed to enhancing its capacity to oversee engagement activities and discern trends. GMOB will urge the Project Team to identify key engagement indicators and develop a process to monitor and regularly report on them. Semi-annual reporting on these indicators is suggested.



## RECONCILIATION

Reconciliation with Indigenous communities negatively affected by the historic operations at Giant Mine is an ongoing process. In 2021, the Government of Canada and the Yellowknives Dene First Nation made progress toward an apology and compensation for the harms caused by Giant Mine.

### What Does GMOB Expect?

GMOB expects the remediation and care of Giant Mine to promote and implement many of the actions set out in the reports of the Truth and Reconciliation Commission. In particular, the principles of reconciliation should be considered in all decisions respecting the Giant Mine Remediation Project. GMOB also expects the Government of Canada to respond to repeated requests and previous recommendations for an apology and compensation to the Yellowknives Dene First Nation.

### What Actions Were Taken?

GMOB is mindful of the 94 calls to action issued in 2015 by Canada's Truth and Reconciliation Commission. With these in mind, GMOB continued to urge the Project Team and the Parties to the Giant Mine Remediation Project Environmental Agreement to view remediation and care of Giant Mine as an opportunity for reconciliation.

In late 2020, the Yellowknives Dene First Nation completed a research program relating to its experiences with the Giant Mine and began substantive discussions with Crown-Indigenous Relations and Northern Affairs Canada about an apology and compensation. In a July 9, 2021 press release, the two parties stated that work was underway on four agreements:

1. "A Collaborative Process Protocol Agreement setting out a process to begin negotiations for an apology and compensation for the harms caused by Giant Mine.
2. A Memorandum of Cooperation to advance key socio-economic priorities.
3. A Community Benefits Agreement to ensure that the Yellowknives Dene First Nation obtains socio-economic benefits from the Giant Mine Remediation Project.
4. A Framework to maximize the number of work packages under the Giant Mine Remediation Project that are awarded to Indigenous businesses and formalize the Yellowknives Dene First Nation's role in the Project as the Indigenous group most impacted by Giant Mine."

In 2020-21, the Project Team completed an archaeological impact assessment with the Yellowknives Dene First Nation and North Slave Métis Alliance. The assessment is intended to guide remediation activities related to Baker Creek and Back Bay.

One of the ten principles of reconciliation that guided Canada's Truth and Reconciliation Commission defines reconciliation as a process of healing of relationships that requires public truth sharing, apology, and commemoration that acknowledge and redress past harms.

<https://nctr.ca/records/reports/>

### **What Were the Outcomes of the Actions?**

GMOB finds that understanding and recognition of reconciliation is improving throughout the Giant Mine Remediation Project. Decisions are more often directly linked to the principles of reconciliation rather than the general references made in the past.

In 2021, the Yellowknives Dene First Nation and Crown-Indigenous Relations and Northern Affairs Canada made notable progress on four major agreements designed to repair relationships harmed by Giant Mine.

### **What Are the Next Steps?**

GMOB will continue to promote understanding of reconciliation. To this end, GMOB will urge the Project Team to identify key reconciliation indicators and implement a process to monitor and regularly report on them.

GMOB will continue to monitor work toward reconciliation being undertaken by the Yellowknives Dene First Nation and Crown-Indigenous Relations and Northern Affairs Canada.

## PROJECT MANAGEMENT AND PLANNING

The Mackenzie Valley Land and Water Board Type A Water Licence and land use permit authorize active remediation of the mine site. The Project Team fulfilled the regulatory requirements set out in these authorizations and kept onsite remediation activities on schedule throughout 2021.

### What Does GMOB Expect?

Onsite remediation is the focus of GMOB's oversight of project management and planning. GMOB takes an 'exceptions-based' approach to project management and planning oversight. This means that GMOB responds to noticeable deviations or changes in scope or schedule, and is guided in its analysis by two questions:

1. Scope: did the Project Team implement what it planned?
2. Schedule: were any substantive changes, including slippage, made to the schedule?

### What Actions Were Taken?

The Giant Mine Remediation Project has moved into the active remediation phase. This requires the submission of various management and monitoring plans to the Mackenzie Valley Land and Water Board. In addition to the plans identified in the previous environment section, the Project Team submitted plans for underground stabilization and the construction of the AR1 freeze area and the non-hazardous waste landfill. Construction of the AR1 freeze pad and the non-hazardous waste landfill began following plan approvals in August 2021. All aspects of the revised Underground Design Plan (version 1.2) were approved in early July 2021 with the exception of section 5.4 and all other references to mine water levels. Engagement continues on mine water levels with the next opportunity for comment anticipated during the Underground Design Plan update at the end of February 2022.

The Project Team continues to finalize several management and monitoring plans. Where plans are not yet finalized, the Project Team continued care and maintenance activities. The Project Team continued to ensure that the site was stable and posed no environmental or safety risks.

### What Were the Outcomes of the Actions?

The construction of the non-hazardous landfill and the AR1 freeze pad are currently behind schedule. Nevertheless, the Project Team expects to complete these two projects on time.

The Project Team's care and maintenance activities continued in areas where active remediation has yet to begin. The Project Team continued to improve the core care and maintenance tasks necessary for the stability and safety of the mine site.

### What Are the Next Steps?

GMOB will continue to review the plans and reports required by the Mackenzie Valley Land and Water Board. GMOB's comments will be posted on the GMOB and the Board websites.

The Type A Water Licence requires the Project Team to submit an annual report (condition B.20) to the Mackenzie Valley Land and Water Board. The report must provide a summary of all site activities including reclamation work undertaken in the previous year. The report must also provide a schedule of anticipated activities and planned submissions to the Board to 2031. The annual report will be publicly available on the Mackenzie Valley Land and Water Board's website. It will be a useful tool for monitoring the progress of the Giant Mine Remediation Project.

The Project Team's annual water licence report will inform GMOB's project management and planning oversight activities. The report will be helpful in tracking progress, identifying deviations in schedules, and discerning trends. GMOB recommends that the Project Team identify key project management and planning indicators that can be consistently monitored and reported in the annual report and the Project Team's upcoming *Status of the Environment Report* (2021-3).

## COMMUNITY HEALTH AND WELLNESS

The Project Team and Parties to the Giant Mine Remediation Project Environmental Agreement continued to inform local residents about the current risks of legacy arsenic around Yellowknife, Ndilo, and Dettah. GMOB is planning a public survey in 2022 to better understand the effectiveness of these efforts.

### What Does GMOB Expect?

GMOB expects that local residents should have ready access to information. Local residents should also have ready access to GMOB, the Project Team, and the Parties to the Giant Mine Remediation Project Environmental Agreement. Ready access to information should enable local residents to gain a reasonable understanding of the:

- Closure and Reclamation Plan and its implications for future land uses;
- Current and future risks to public health related to dust, runoff, construction, and contaminated soils associated with the Giant Mine area; and
- Activities that are safe to pursue in the area during and after remediation such as hiking, consuming fish, and using the boat launch.

As discussed in the previous economic section, GMOB expects the Giant Mine Remediation Project to bring maximum economic benefits and minimal negative effects to local residents and their ways of life.

### What Actions Were Taken?

The Health Effects Monitoring Program involves the study of human health effects of arsenic and other contaminants resulting from the Giant Mine Remediation Project. The Program continued on schedule in 2021. The Project Team communicated study results to the public on an ongoing basis, mainly through radio announcements and brochures.

In June 2021, the GNWT and CIRNAC jointly released the final report and a plain language summary of the *Human Health Risk Assessment for Legacy Arsenic Contamination Around Yellowknife*<sup>5</sup>. GMOB submitted comments on the assessment report. Work will continue in this regard in 2022.

The Aurora Research Institute and Queen's University are conducting the *Yellowknife Garden Metals Study: Arsenic and Mining Associated Metals in Local Garden Produce in the Yellowknife Area*. The study analyzes the amount of arsenic and other mining related contaminants (antimony, cadmium, lead, manganese, copper, zinc, and vanadium) in backyard garden soils and produce in Yellowknife, Ndilo, Dettah, and surrounding area. Summary results from samples collected in 2020 were released in 2021. Additional sampling and analyses were completed in 2021. The study is scheduled to be completed in March 2022.

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5 <https://nwtresearch.com/yellowknife-garden-metals-study>

In 2021, the Government of the NWT's Department of Environment and Natural Resources and Department of Health and Social Services released a plain language brochure entitled "*Arsenic: Yellowknife, Ndilq, Dettah*"<sup>6</sup>. The brochure describes sources of arsenic and high and low risk areas for outdoor activities including harvesting. The brochure is publicly available on the Government of the NWT's website.

The Project Team installed information signage around the mine site. Public signage is in English and French.

In October 2020, public concerns were raised about the toxicity of dust from tailings at the Giant Mine site. These concerns led to research into the chemical composition of the dust. The research titled "*Geochemical characterization of dust from arsenic-bearing tailings, Giant Mine, Canada*" was summarized and reported in *Blowing in the Wind*.<sup>7</sup> The research will inform public information and remediation activities.

Travel and in-person meeting restrictions due to the Covid-19 pandemic delayed the *Hoèla Weteèts'eèdeè: Understanding Community Well-being around Giant Mine Study* (also known as 'the stress study'). Nevertheless, progress was made in 2021 to finalize the study plan, receive university ethics approval, and revise research instruments. The study is scheduled to begin early in 2022.

### **What Were the Outcomes of the Actions?**

The Project Team and GMOB have websites that contain information about all phases of the Giant Mine Remediation Project. These websites enable the public and participating agencies and governments to access information at any time. In addition, research studies, signage, and plain language information materials are widely available. These materials inform local residents and other members of the public, the Project Team, and the Parties to the Giant Mine Remediation Project Environmental Agreement about remediation activities especially with respect to the risks of historic arsenic contamination.

GMOB cannot state with any confidence whether information available and shared is improving the general public's understanding of the Giant Mine Remediation Project or expected outcomes of it. For example, GMOB is unclear whether local residents understand that the Closure and Reclamation Plan does not remediate certain undisturbed areas of the mine site even in places where there are high levels of arsenic. More specifically, it is unclear whether local residents understand that after remediation, certain undisturbed areas will be fenced off and completely unavailable to residents in perpetuity. One of the fenced off areas is immediately adjacent to the town site.

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6 [https://www.enr.gov.nt.ca/sites/enr/files/resources/remediation\\_arsenic\\_brochure\\_english\\_web\\_0.pdf](https://www.enr.gov.nt.ca/sites/enr/files/resources/remediation_arsenic_brochure_english_web_0.pdf)

7 <https://www.lightsource.ca/public/news/2021-22-q4-jan-march/blowing-in-the-wind.php>

## **What Are the Next Steps?**

Regular monitoring and reporting on key community health and wellness indicators will improve understanding and oversight of activities and trends on these matters. GMOB will urge the Project Team to identify key community health and wellness indicators, and implement a process to regularly monitor and report on them.

GMOB will conduct a public survey early in 2022 to gain an understanding of public awareness of current remediation and post-remediation plans, activities, risks, and expected outcomes.

Survey results will inform GMOB's communications activities and recommendations.

GMOB will work with the Project Team and the Government of the NWT to develop a user-friendly post-remediation land use map and potentially, a 3D model of the mine site after remediation. The map and 3D model will be a resource to help residents visualize the mine site after reclamation and the areas that will be available for public use. GMOB will ensure that these resources are consistent with existing public materials describing legacy arsenic levels around Yellowknife. An example of these materials is NWT Health and Social Services maps that show where it is safe to drink, swim, and consume fish. The map and the mine site model will be installed at the GMOB office.

Signage around the mine site improves information for local communities. GMOB suggests that adding contact information to the signs would be helpful in cases where the public sees something of concern when in the area. An example of a public concern would be observations of dust blowing off the tailings ponds.

## LONG TERM PLANNING

Roles and responsibilities for onsite land use planning were clarified in 2021. No apparent progress was made on either an onsite land use plan or a perpetual care plan.

### What Does GMOB Expect?

GMOB expects the timely development and implementation of a site-specific land use plan. GMOB also expects a perpetual care plan to be completed as required by the Giant Mine Remediation Project Environmental Agreement. The first draft of a perpetual care plan was scheduled for June 2020 but that target date was not met. GMOB expects there will be no further delays in developing a perpetual care plan. GMOB recognizes that the plan will be a 'living document' that will be amended as needed. GMOB expects that public governments will guarantee adequate funds over the long-term to implement a Giant Mine perpetual care plan once it has been developed and approved.

GMOB expects that the lessons learned in remediation and site maintenance will be foundational to growing a northern remediation economy as discussed in the previous economic section.

### What Actions Were Taken?

In 2019, GMOB recommended the development of a land use plan for the Giant Mine site (2019-8). GMOB continues to be frustrated by the lack of concrete action on an onsite land use plan. In its March 2021<sup>8</sup> response to a GMOB letter, the Government of the NWT stated that:<sup>9</sup>

- The City of Yellowknife has the "authority to prepare a community plan and approve zoning bylaws."
- The City of Yellowknife's *2020 Community Plan* says that "after remediation is complete, the City will re-evaluate opportunities for development of this area only if it is deemed safe to do so..."<sup>10</sup>
- The Department of Lands will be the "lead for the GNWT's input into regional land use planning."

With regard to the perpetual care plan, no substantive work was completed in 2021. GMOB expects that planning for the perpetual care of the Giant Mine site will be more than two years behind the schedule set out in the Environmental Agreement. Also, no progress was made on securing a commitment to long-term funding for the perpetual care of the mine site.

8 <https://www.ntassembly.ca/tailed-documents/letter-dated-february-23-2021-giant-mine-oversight-board-minister-lands-regarding>

9 <https://gmob.ca/wp-content/uploads/2021/04/2021-03-29-Minister-of-Lands-GNWT-to-Giant-Mine-Oversight-Board-re-Land-Use-Plan-Giant-Mine-site.pdf>

10 <https://www.yellowknife.ca/bylaws/Bylaw/Details/ae597a36-2b88-467a-b856-2ccbd06b6ac6>



In its 2020 annual report, GMOB promoted the development of a northern remediation economy. GMOB envisions this economy would benefit from the lessons learned and capacity built during the remediation and the long-term care and maintenance of the Giant Mine site. In 2021, GMOB met with the Premier of the NWT, the NWT Minister of Industry Trade and Investment, the Yellowknives Dene First Nation's Det'on Cho Corporation, and others to promote the economic and capacity-building opportunities presented by an NWT remediation economy.

### **What Were the Outcomes of the Actions?**

The Government of the NWT's March 2021 letter clarified roles and responsibilities for site-specific land use planning. The City of Yellowknife has the main responsibility for land use planning for the mine site. However according to the City's *2020 Community Plan*, land use planning will not begin until active remediation of the site is completed.

No specific commitments were made as a result of GMOB's meetings with leaders about a northern remediation economy. As noted in the previous economic section, GMOB is aware that the Government of the NWT and the Government of Canada are studying the potential impacts and opportunities of a future northern remediation economy.

As shown in the text box, GMOB has actively advocated for action on a perpetual care plan. It is a concern that this plan continues to fall behind schedule.

#### **GMOB's advocacy on a perpetual care plan for the Giant Mine site includes:**

- On July 7, 2020, GMOB responded positively to the Giant Mine Remediation Project Team's request for an extension to the deadline for developing a perpetual care plan framework.
- On February 25, 2021, GMOB provided feedback to the Project Team on a perpetual care plan framework.
- On May 17, 2021, GMOB expressed concern about the pace of the work on a perpetual care plan and recommended that a contractor be hired to draft a request for proposals for a plan. The Giant Mine Remediation Project Team rejected the recommendation.
- On September 29, 2021, the Project Team notified GMOB of a delay in the planned Perpetual Care Plan Task Force workshop to develop a request for proposals for a perpetual care plan.
- On October 18, 2021, GMOB wrote to the Giant Mine Remediation Project Team to recommend that a contract be issued immediately to develop a request for proposals for a perpetual care plan. GMOB also recommended that the proposed request for proposals be reviewed and finalized by the Task Force. This recommendation was not supported.

### **What Are the Next Steps?**

GMOB does not agree that onsite land use planning should be delayed until after remediation is completed. GMOB will continue to encourage onsite land use planning in tandem with active remediation given that:

1. The Project Team has already provided information about the post-remediation landscape (i.e., what areas will be accessible or not for residents' use); and
2. Parallel land use planning and remediation processes provide greater opportunities to make adjustments that will unlikely to be possible after remediation is completed.

It is expected that a request for proposals to develop a perpetual care plan will be issued by May 2022. GMOB is hopeful that inefficiencies associated with a committee-based approach to drafting the request for proposals will not create further delays. GMOB strongly recommends that the Project Team permit no further delays in the preparation of an appropriate perpetual care plan [\(2021-4\)](#).

To improve capacity to oversee long-term planning activities and discern trends, GMOB will encourage the Project Team to identify key indicators and implement a process to regularly monitor and report on them.

## GMOB RESEARCH PROGRAM

GMOB's research program has three parts:

1. Directly funded research with TERRE-NET partners;
2. Additional, complementary research with TERRE-NET partners that is made possible by leveraging funds from external sources; and
3. Funding proposals from non-TERRE-NET researchers.

### What Does GMOB Expect?

A total of 237,000 tonnes of arsenic trioxide dust are stored in 14 underground chambers at the Giant Mine site. A range of technical solutions to manage potential environmental impacts associated with the dust were evaluated. It was determined that the 'frozen block' method was the most appropriate technical solution then available. This method involves freezing the dust and the surrounding rock in each of the underground chambers. However, freezing the arsenic trioxide dust should not be viewed as the final solution. Emerging technologies should continue to be investigated. Article 7 of the 2015 Giant Mine Remediation Environmental Agreement tasks GMOB with supporting research into technical approaches that could lead to a permanent solution to render the arsenic trioxide dust non-toxic.

### What Actions Were Taken?

Throughout 2021, GMOB worked on each part of its research strategy. The actions taken are summarized here.

#### 1. Directly funded research

GMOB continued to fund multiple arsenic trioxide stabilization research projects through its TERRE-NET partners. The research projects include:

1. Assessing the chemical and physical properties of the arsenic dust.
2. Chemically changing the arsenic dust into a less toxic and more stable sulphide mineral.
3. Mixing the arsenic dust into a cement paste backfill.
4. Assessing the stability of arsenic glass.

Details on the four TERRE-NET research projects and progress to date are described in Appendix B.

Toward Environmentally Responsible Resource Extraction Network (TERRE-NET) is an integrated network of leading academics from universities across Canada. One of TERRE-NET's goals is to manage hazardous mine wastes.

## **2. Additional research projects**

With the support of GMOB, TERRE-NET applied to the Natural Sciences and Engineering Research Council of Canada for funding for three additional research projects. The application was successful. As a result, three more TERRE-NET projects were added to the research program:

1. Stability of iron arsenate phases – chemically changing arsenic dust into a less toxic and more stable arsenic iron mineral.
2. Biogenic sulfide precipitation – using microbes to change arsenic dust into a less toxic and more stable arsenic sulphide mineral.
3. Implementation and application of Sb isotope systems – using antimony as a substitute for arsenic to identify geochemical processes related to the weathering of arsenic dust.

Summaries of the three additional TERRE-NET research projects are included in Appendix B.

## **3. Consideration of proposals from independent researchers**

GMOB worked with an expert panel to develop and implement a standardized research proposal template and proposal assessment methodology. Using these tools, GMOB reviewed six research proposals that had previously been submitted. This review resulted in one proponent being invited to re-submit its research proposal using the GMOB proposal template. Five other proposals were rejected for a variety of reasons including the apparent closure of the proponent agency.

To support the three-part research program, GMOB identified the need to review current extraction technologies. This review will be undertaken in consideration of possible future remediation and processing of the arsenic trioxide dust. GMOB also identified the need for a plain language document or infographic describing why the research program was set up and what research is currently being done. The document would target the general public.

## **What Were the Outcomes of the Actions?**

Progress on the four directly funded TERRE-NET research projects has been slower than expected due to the COVID-19 pandemic. The temporary closure of TERRE-NET laboratories during the pandemic has had the greatest impact. Nevertheless, preliminary findings in 2021 are encouraging and will inform GMOB's research program in the future.

In 2020, GMOB secured vitrified arsenic samples for testing by TERRE-NET researchers. These samples were delivered to the TERRE-NET research team at the University of Waterloo in early 2021 and are currently being tested.

In late 2021, the Natural Sciences and Engineering Research Council of Canada approved the funding proposal for three additional research projects. Progress on these projects will be reported in 2022.

Over the past year, GMOB improved its capacity to review proposals from independent researchers. This was done by: establishing an independent expert panel; developing a standardized research proposal template; and defining a clear methodology for assessing unsolicited proposals.

GMOB met with Crown-Indigenous Relations and Northern Affairs Canada and TERRE-NET to develop a plan to extract additional arsenic trioxide samples for use in future research. GMOB contracted the University of Greenwich Wolfson Centre for Bulk Solids Handling Technology for a state of knowledge review of extraction methods that might be considered for handling the arsenic trioxide stored underground at the mine site. Given the occupational exposure risks associated with arsenic trioxide, GMOB consulted with Cameco Corporation regarding its use of innovative technologies for the safe extraction of highly radioactive uranium from sub-surface mines in Saskatchewan.

GMOB worked with an independent contractor to develop two plain language infographic sheets. These infographics explain why the research program was set up and describe the current research initiatives.

### **What Are the Next Steps?**

GMOB expects that the Covid-19 pandemic will continue to challenge the research program in 2022. Nevertheless, the current plan is to extract the additional arsenic trioxide samples required for the research program in the spring of 2023.

GMOB will continue to meet with Crown-Indigenous Relations and Northern Affairs Canada and TERRE-NET on the research program. GMOB will regularly update plain language infographics and continue to post research results on the website.

GMOB and TERRE-NET members will continue to seek additional research funding through external sources. GMOB will invite independent research proposals and investigate potential linkages with other expert groups. As proposals are submitted, the independent expert panel will be convened periodically to evaluate the proposals and make recommendations to GMOB. As research activities advance, GMOB expects that further work will be required on extraction technologies.

## FIVE-YEAR REVIEW

The 2015 Giant Mine Remediation Project Environmental Agreement (section 2.3) sets out GMOB's mandate. It is shown in the text box.



### **The Oversight Body shall, in a manner consistent with this Agreement:**

- promote public awareness of the Project, disseminate information about the Project, and promote public engagement in processes related to the Project;
- provide such independent advice to the Co-Proponents on the management of the Project as the Oversight Body considers appropriate;
- provide such independent advice to regulatory authorities, the Parties, the public, and to whomever else the Oversight Body considers appropriate, on the monitoring and management of the Project; and
- manage the program for research toward a permanent solution for dealing with arsenic at the Giant Mine site as set out in Article 7 ("Active Research Toward a Permanent Solution for Arsenic") and section 8.2 ("Research Results").

After the first five years of operation, section 9.3 of the Environmental Agreement requires a review of GMOB's progress in fulfilling its mandate. A similar review is required after ten years of operation. The initial five-year review was completed in February 2021.<sup>11</sup> The independent, third-party review included input from the Parties to the Giant Mine Remediation Project Environmental Agreement and the general public. The review concluded that overall, GMOB is fulfilling its mandate. Seven recommendations were put forward in the review to improve GMOB's effectiveness. The recommendations and GMOB's progress on them follow.

**Recommendation #1:** GMOB continue to view the Project through several lenses, including engineering, socio-economic, and cultural.

**Progress:** As evidenced in GMOB's annual reports, a multi-sectoral lens continues to be applied to oversight activities.

**Recommendation #2:** GMOB should develop a 'dashboard' or some other tracking tool so that the fate of each annual recommendation may be easily followed.

**Progress:** GMOB began to track the status of recommendations in its 2020 Annual Report and will continue this practice (see Appendix A).

<sup>11</sup> [https://gmob.ca/wp-content/uploads/2021/03/2021-02-11\\_GMOB\\_Final-Report\\_V1.pdf](https://gmob.ca/wp-content/uploads/2021/03/2021-02-11_GMOB_Final-Report_V1.pdf)

**Recommendation #3:** GMOB should consider ways to provide its collective input on an on-going basis.

**Progress:** In addition to the annual reports and annual meetings, GMOB will continue to share its concerns and perspectives throughout the year. In 2021, GMOB shared its findings regarding mechanisms for strengthening economic analyses and reporting and held a follow-up meeting with the Project Team. In 2022, GMOB will continue urging the Project Team to actively monitor and report on key indicators in order to better discern trends and identify appropriate mitigations.

**Recommendation #4:** GMOB needs to publicize its actions to develop a permanent solution to the arsenic trioxide dust stored underground at the Giant Mine.

**Progress:** The GMOB website dedicates a page to the Arsenic Trioxide Management Research Program. Opportunities to better promote the progress of the research program such as regular newsletters will be investigated. The results of the planned 2022 public survey will likely identify other opportunities and venues to promote the research program and the progress being made.

**Recommendation #5:** GMOB should continue to improve its communication efforts with the public.

**Progress:** GMOB is currently revamping its website and office signage and displays. GMOB's future communications efforts will be informed by the 2022 public survey. Other sources of advice will continue to be sought.

**Recommendation #6:** GMOB needs to develop an overall vision for the public repository of records.

**Progress:** GMOB will complete an archive strategy in 2022. In addition, GMOB has begun discussions with the Government of the NWT to determine where its archive will fit within the perpetual care repository plan.

**Recommendation #7:** GMOB, the Project Team, and the Parties need to consider ways in which they can increase their collaboration in dealing with all aspects of the legacy of the Giant Mine.

**Progress:** GMOB continues to work with the Project Team and the Parties to the 2015 Giant Mine Remediation Project Environmental Agreement on the logistics for the repository of materials related to the multi-faceted legacy of Giant Mine. For example, GMOB works with the Yellowknives Dene First Nation and the North Slave Métis Alliance to identify and share historical documents. GMOB also works with the Yellowknife Historical Society, the NWT Archives, and the National Archives of Canada to the same end. GMOB has entered into an agreement with the Yellowknife Historical Society for access to its collection of Giant Mine documents. GMOB has begun to digitize and catalogue this information to make it publicly accessible through its website.





# APPENDICES

## APPENDIX A

### The Status of Previous Recommendations

The status of previous GMOB recommendations is assessed as follows:

- **Addressed:** Actions were taken to implement the recommendation. Actions may be completed or showing evidence of progress toward completion in the foreseeable future. Even though a recommendation may be assessed as 'addressed', GMOB will continue to monitor the matter in question with the view to understanding the outcomes of actions taken.
- **In Progress:** Actions were taken to implement the recommendation but progress is insufficient to determine if completion can be anticipated in the future.
- **Not Addressed:** The party to whom the recommendation was directed either did not accept and/or did not act on the recommendation.
- **Not Addressed and No Longer Relevant:** GMOB has concluded that the recommendation is no longer relevant in current circumstances.

YEAR and RECOMMENDATION #	TOPIC	STATUS
<b>Environment</b>		
2016-7A/B 2017-10 2018-9	Improve integration, monitoring, and reporting on environmental activities.	<b>In Progress:</b> Management and monitoring plans have been completed and approved or are being prepared. With the Remediation Project now in the active remediation phase, continual monitoring of plan development and implementation will be required.
2019-9	Reduce greenhouse gas emissions where feasible, consider offsets, and report annually.	<b>In Progress:</b> The Giant Mine Remediation Project Team has committed to annual reporting and reductions where feasible. However, commitments fall short of current federal government policies.
2020-1	Develop a short and long-term strategy that sets targets and commits to action to proactively reduce greenhouse gas emissions.	<b>In Progress:</b> The Giant Mine Remediation Project Team has committed to a greenhouse gas assessment for the water treatment plant design; limiting fuel use; reducing haul distances for borrow; tracking greenhouse gas emissions on a monthly basis; and annual reporting on emissions. GMOB is monitoring these commitments and assessing them within the context of current federal government policies.

YEAR and RECOMMENDATION #	TOPIC	STATUS
<b>Economy</b>		
2016-11	Apply a structured framework from a community health and well-being perspective to evaluating social, economic, and cultural aspects of the Remediation Project.	<b>Addressed:</b> Improvements in public engagement and communications especially for various studies and plans indicate that this framework isn't needed.
2017-1 2018-1	Develop and implement a socio-economic strategy to ensure northerners, particularly local Indigenous people are positively impacted by the Project.	<b>Addressed:</b> The strategy developed has an implementation plan to guide monitoring. However, the effectiveness of this response is unclear. GMOB will continue its monitoring of the responses to this recommendation.
2019-1	Appoint a special envoy to work with the various interests to develop and implement an integrated economic strategy.	<b>Not Addressed:</b> The Giant Mine Remediation Project Team has not provided a qualified independent or internal lead for socio-economic reporting. The process of updating the <i>Socio-Economic Strategy, 2016-2021</i> is an opportunity to engage this expertise.
2020-2	Use the findings of GMOB's independent review to improve outcomes and reporting on its <i>Socio-Economic Strategy, 2016-2021</i> as well as strategy renewals and updates.	<b>Not Addressed:</b> The Giant Mine Remediation Project Team responded to GMOB's independent review and recommendations but offered no commitments. The proposed update of the <i>Socio-Economic Strategy, 2016-2021</i> provides an opportunity to make progressive change.
2020-3	Bring forth socio-economic considerations identified in the Perpetual Care Plan framework into the goals of the Perpetual Care Plan.	<b>Not Addressed:</b> The Socio-Economic Working Group has not addressed any perpetual care planning considerations. The development of a perpetual care plan continues to be delayed.
2020-4	Ensure northerners have central roles in the care, maintenance, and management of the Giant Mine site into the future.	<b>Not Addressed:</b> The development of a perpetual care plan continues to be delayed.
<b>Engagement</b>		
2016-3A 2017-2 2018-3	Give priority to engagement and communications with the public and the Parties to the Giant Mine Remediation Project Environmental Agreement.	<b>In Progress:</b> Public engagement and communications continue to improve although it is unclear the degree to which the general public is aware of and supports Remediation Project activities and planned outcomes.

YEAR and RECOMMENDATION #	TOPIC	STATUS
<b>Engagement CONTINUED</b>		
2016-9 2017-3 2018-2 2019-2	Ensure all Parties to the Giant Mine Remediation Project Environmental Agreement have adequate resources to fully participate in all aspects of the Project.	<b>Addressed:</b> Proposal-based funding is addressing resource needs of the various Parties.
2018-4 2019-3	More information and engagement from the City of Yellowknife that ensures citizens know about social and economic benefits.	<b>Addressed:</b> The City of Yellowknife developed and regularly updates a Giant Mine information webpage.
2020-6	The City of Yellowknife make the website interactive to enable Yellowknife residents to provide their input to the Project.	<b>Addressed:</b> The City of Yellowknife's webpage includes a contact email.
2020-5	Identify indicators to enable the measurement of the effectiveness of engagement and communications activities.	<b>Not Addressed:</b> The Giant Mine Remediation Project Team has not responded to this recommendation.

<b>Reconciliation</b>		
2016-3B 2017-4 2018-5 2019-4	Respond to the requests from the Yellowknives Dene First Nation for an apology and compensation.	<b>In Progress:</b> There has been reported progress in the negotiations between the Government of Canada and the Yellowknives Dene First Nation regarding an apology and compensation.

<b>Project Management and Planning</b>		
2016-2	Develop performance measures to enable monitoring of the Remediation Project.	<b>In Progress:</b> The Type A Water Licence granted by the Minister of Northern Affairs on September 18, 2020, in accordance with the <i>Mackenzie Valley Resource Management Act</i> , partially addressed the need for indicators. Additional work on indicators for the <i>Status of the Environment Report</i> is underway.
2016-4	Develop a Traditional Knowledge Strategy.	<b>Not Addressed:</b> The Government of the NWT funded the <i>Yellowknives Dene First Nation Traditional Knowledge Study</i> in 2017/18 but no formal traditional knowledge strategy for the Remediation Project has been released.
2016-5A	Identify foreseeable additional advanced remedial work required prior to full remediation.	<b>Addressed:</b> Achieved through ongoing monitoring, application of lessons learned and responsiveness to change.
2016-5B	Develop, monitor, and report on a risk profile of the site.	<b>Addressed:</b> Achieved through ongoing monitoring and communication of trends in the risk profile.

YEAR and RECOMMENDATION #	TOPIC	STATUS
<b>Project Management and Planning CONTINUED</b>		
2016-6	Identify and mitigate delays in remediation planning.	<b>Addressed:</b> Due to regulatory approvals, active remediation began in 2021.
2016-10	Consider options to a government-driven and controlled approach to the Project.	<b>Not Addressed:</b> No action was taken aside from contracting the Main Project Manager.
2017-5 2018-6 2019-5	Provide a five-year project plan and critical path to link and integrate aspects of the Project.	<b>Not Addressed:</b> No explicit action was taken although the Project now has regulatory authority to proceed with full reclamation within specific parameters and timelines. As such, this is no longer relevant.
2017-6 2018-7	Describe the Main Construction Manager's responsibilities.	<b>Addressed:</b> Responsibilities are articulated.
2017-7	Provide results of Independent Peer Review Panel on remediation and stabilization of arsenic dust.	<b>Addressed:</b> The Panel provided results on one occasion.
2017-8 2018-8	Complete measures five and six in the Mackenzie Valley's Environmental Impact Review Board's Report of Environmental Assessment.	<b>In Progress:</b> The Quantitative Risk Assessment is being conducted and results will be integrated on an ongoing basis into plans for the Remediation Project.
2017-9	Mackenzie Valley Land and Water Board to consider an interim water license.	<b>Not Addressed:</b> Rejected by the Mackenzie Valley Land and Water Board and the Project Team. This recommendation is no longer relevant.

<b>Health and Wellness</b>		
2016-8 2017-12 2018-11 2019-7	Deal with offsite contamination issues including land use, safety, public health, and environmental concerns.	<b>In Progress:</b> Risk assessment work and improved public engagement and communications are progressing to address these issues.
2016-12 2017-11 2018-10	Communicate effectively on studies that address arsenic contamination and risk and health studies.	<b>In Progress:</b> Improved public engagement and communications are progressing to address these issues.
2018-4 2019-3	Improve the City of Yellowknife's engagement of local residents in all aspects of the Remediation Project.	<b>Addressed:</b> The City of Yellowknife has developed and regularly updates its Giant Mine information webpage which includes a contact email.

YEAR and RECOMMENDATION #	TOPIC	STATUS
<b>Health and Wellness</b> CONTINUED		
2020-7	Continue to improve engagement and communications activities to ensure that local people: a) are not experiencing unnecessary stress or fear due to dust coming off the Giant Mine site, and b) understand the three main types of site remediation standards - residential, industrial, undisturbed – and how they apply to the site.	<b>In Progress:</b> Improved public engagement and communications are progressing to address these issues.

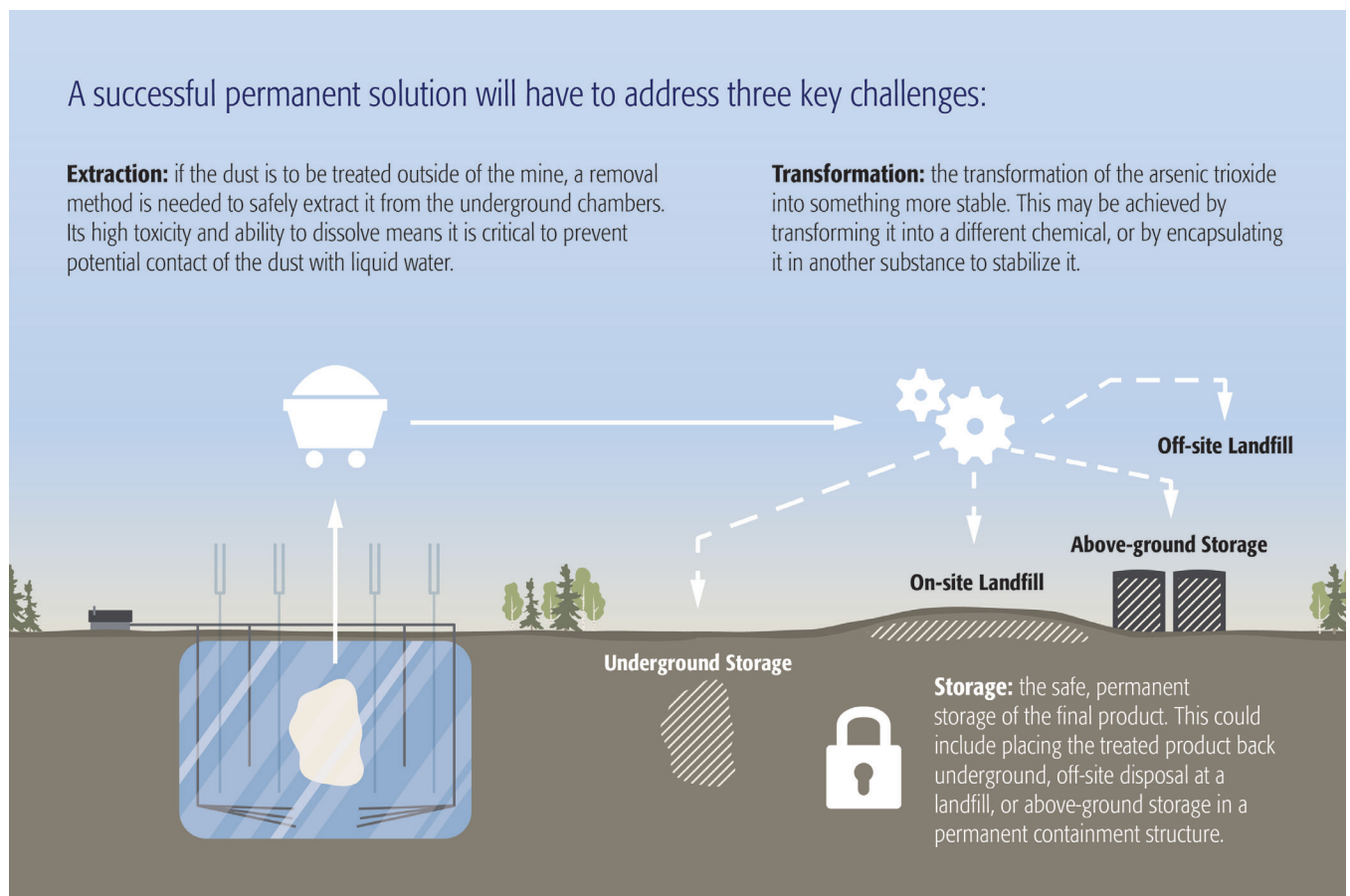
<b>Long Term Planning</b>		
2017-8	Complete measure six in the Mackenzie Valley's Environmental Impact Review Board's Report of Environmental Assessment.	<b>Addressed:</b> While this measure was addressed, GMOB considers the outcome unsatisfactory.
2019-6	Use legislation to guarantee long-term funding.	<b>Not Addressed:</b> No progress has been made on long-term funding.
2019-8	Develop a land-use plan for the site.	<b>Not Addressed:</b> No progress has been made to develop an onsite land-use plan.

## APPENDIX B

### Overview of GMOB Funded Research

Article 7 of the Giant Mine Remediation Environmental Agreement tasks GMOB with undertaking research into technical approaches that do not require constant and forever care and maintenance of the arsenic trioxide at the mine site. As shown in the figure below, a permanent solution must address three key challenges: extraction of the dust, transformation to a much less toxic material, and safe storage of the final product.

#### Key Challenges to Address for a Permanent Solution to Arsenic Trioxide Dust Stored Underground at Giant Mine



In 2018, GMOB partnered with a consortium of experts referred to as TERRE-NET. TERRE-NET is an integrated network of leading academics from universities across Canada who work toward managing mine tailings and mitigating contamination. One of their goals is to find sustainable ways to deal with environmental challenges associated with the resource sector, including the management of hazardous mine wastes. These experts work in various scientific and social science fields. TERRE-NET is headquartered at the University of Waterloo. At this time, GMOB has asked TERRE-NET to focus on technology that will transform the arsenic trioxide into a stable, much less toxic material. This approach is the most efficient use of GMOB's resources as there is little other stabilization research taking place elsewhere in the world that focuses specifically on arsenic trioxide.

A summary of the TERRE-NET research projects and progress to date follows.



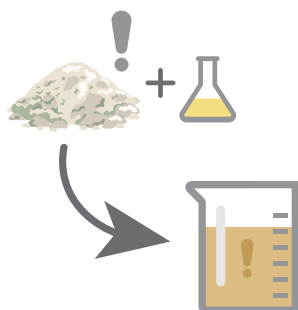
## PROJECT 1

### Understanding the important chemical properties of the arsenic trioxide dust from Giant Mine

**Why this is important?** There is evidence of important differences in the composition of arsenic trioxide dust that was created over the many years that Giant Mine operated. The differences are due to dissimilarities in the rock that was mined and the exact conditions used for roasting the ore. When a way to treat and stabilize the arsenic trioxide dust is found, it is necessary to ensure that it will work for all the dust stored across the site, regardless of these differences.

**Research Team:** University of Saskatchewan and Queen's University

**Progress to date:** The research confirms that the toxic dust contains many substances other than arsenic trioxide. The additional substances continue to be identified by chemical composition and properties including structure or solubility. Identification of the various substances will inform other research projects focused on ways to stabilize the arsenic trioxide.



## PROJECT 2

### Chemically changing the arsenic trioxide into a less toxic material that doesn't dissolve as easily in water

**Why this is important?** While freezing the arsenic trioxide dust prevents it from entering local ground or surface water sources, it does not permanently change it into a non-toxic material. The goal of this project is to alter the form of arsenic from arsenic trioxide to arsenic trisulphide. Arsenic trisulphide is much more stable in the environment than arsenic trioxide because it doesn't dissolve as easily in water.

**Research Team:** University of Ottawa

**Progress to date:** Researchers initially hoped that it would be possible to transform arsenic from the trioxide form to the trisulphide form without having to dissolve the dust in water first. Unfortunately, researchers have confirmed that it will be necessary to dissolve all the arsenic trioxide dust in water before chemically treating it with hydrogen sulphide gas and forming the less toxic arsenic trisulphide. Work is underway to understand the optimal conditions for the chemical reaction and for possible ways to produce hydrogen sulphide gas onsite if this method becomes feasible.



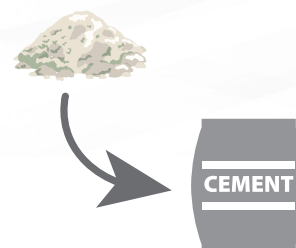
## PROJECT 3

### Stabilizing arsenic trioxide dust by mixing it with cement

**Why this is important?** More than 20 years ago, some research was completed to look at the feasibility of stabilizing the arsenic trioxide dust by mixing it with cement. Results from that time were variable and further research was discontinued due to the acceptance of the frozen block method of storage. This research project revisits this idea with a focus on ways to make a cement-based paste backfill with the arsenic trioxide dust. If stable, the paste could be deposited into the underground of the mine.

**Research Team:** University of Alberta and the Université du Québec en Abitibi-Témiscamingue

**Progress to date:** Research to date has focused on making samples of paste backfill with different ratios of arsenic trioxide dust and cement. The research team has also tried different conditions for curing the cement mix to maximize stability. In the coming year, researchers will test the stability and leaching characteristics of the different cement mixtures.



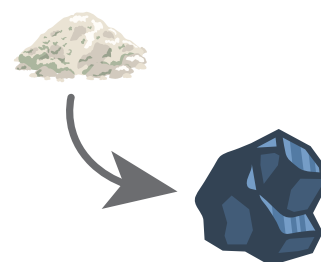
## PROJECT 4

### Transforming arsenic trioxide dust into a type of glass

**Why this is important?** The 2017 *State of Knowledge Report* that GMOB commissioned identified a promising method of stabilizing arsenic trioxide by transforming it into a type of glass through a process called vitrification. This method is being used in other countries to stabilize arsenic trioxide dust produced from mining. With the understanding that the exact composition of arsenic trioxide dust varies from mine site to mine site, GMOB thought it would be useful to have samples of the Giant Mine arsenic trioxide vitrified and then have researchers at TERRE-NET test the long-term stability of the product. The vitrification of the dust is being performed by a Canadian company called Dundee Sustainable Technologies.

**Research Team:** University of Waterloo

**Progress to date:** In 2020, Dundee Sustainable Technologies initiated the vitrification of three sets of arsenic trioxide samples. This work was completed in 2021. TERRE-NET's researchers have begun to analyze the vitrified product. This work will include tests to enable understanding of the stability of material over time.



**In 2021, external funding secured through the Natural Sciences and Engineering Research Council of Canada created three additional and complementary TERRE-NET research projects. These projects are:**

## **PROJECT 5**

### **Chemically changing arsenic trioxide dust into a less toxic and more stable arsenic iron mineral**

**Why this is important?** As discussed in Projects 2 and 6, freezing the arsenic trioxide dust chambers prevents entry of the contaminant into ground or surface water sources. Freezing does not permanently change the dust into a non-toxic material. The goal of this project is to alter the form of arsenic from arsenic trioxide to an arsenic-bearing iron mineral that is much more stable in the environment than arsenic trioxide.

**Research Team:** University of Saskatchewan

**Progress to date:** This project is scheduled to begin in mid-2022.

## **PROJECT 6**

### **Using microbes to change arsenic dust into a less toxic and more stable arsenic sulphide mineral**

**Why this is important?** As discussed in Projects 2 and 5, freezing the arsenic trioxide dust chambers prevents entry of the contaminant into ground or surface water sources. It does not permanently change the dust into a non-toxic material. The goal of this project is to alter the form of arsenic from arsenic trioxide to an arsenic-bearing sulphide mineral. Arsenic-bearing sulphides can be much more stable in the environment than arsenic trioxide.

**Research Team:** University of Waterloo

**Progress to date:** This project is scheduled to begin in mid-2022.

## **PROJECT 7**

### **Using antimony as a substitute for arsenic to identify geochemical processes related to the weathering of arsenic dust**

**Why this is important?** Understanding the processes that are involved in chemical transformation of the arsenic trioxide dust is critical to finding a permanent stabilization solution. Isotopes are a common and powerful tool that can be used to enhance understanding of chemical changes. However, arsenic has only one isotope and cannot be used for this purpose. Antimony is present in the arsenic trioxide, behaves in a similar manner to arsenic, and has isotopes that can be used to trace chemical processes associated with the stabilization experiments.

**Research Team:** University of Waterloo

**Progress to date:** Research to date has focused on an analytical method for using antimony as a proxy for arsenic. Once this method is established and refined, samples of Giant Mine water and from the other research projects will be analyzed to monitor progress during arsenic trioxide stabilization.



## GMOB Board of Directors



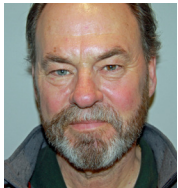
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