



# Mackenzie Valley Environmental Impact Review Board

*Terms of Reference*  
*for the*  
*Environmental Assessment*  
*of the*  
*Indian and Northern Affairs Canada*  
*Giant Mine Remediation Plan*  
*EA0809-001*

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## List of Acronyms

DAR- Developer's Assessment Report  
MVLWB- Mackenzie Valley Land and Water Board  
ToR- Terms of Reference  
MVRMA- Mackenzie Valley Resource Management Act

## 1 Introduction

This document provides instructions to the Contaminants and Remediation Directorate, Indian and Northern Affairs Canada (the developer) for producing the Developer's Assessment Report (DAR) for the environmental assessment of the Giant Mine Remediation Project. It describes the information required for the environmental assessment.

### *1.1 Development Referral*

On October 19, 2007, the developer submitted an application for a water license (MV2007L8-0031) to the Mackenzie Valley Land and Water Board (MVLWB). The application was to complete the reclamation of the Giant Mine site over a period of up to 10 years. The application was deemed complete by the MVLWB on October 26, 2007. The MVLWB proceeded to conduct its preliminary screening pursuant to the *MVRMA*. On February 21, 2008, the MVLWB determined that the development was not likely to be a cause of significant adverse environmental impacts or public concern and decided to proceed with the regulatory process.

Notwithstanding the MVLWB preliminary screening decision, on March 31, 2008 the City of Yellowknife referred the Giant Mine Remediation Plan to environmental assessment. This referral was made under section 126(2)(d) of the *Mackenzie Valley Resource Management Act*. The City cited potential adverse environmental impacts within its municipal boundaries as reasons for the referral, and provided additional information describing potential public concern.

The Review Board began its environmental assessment of the development on April 7, 2008.

### *1.2 Legal Context*

This environmental assessment is subject to the requirements of Part 5 of the *MVRMA*. It is also subject to the Review Board's *Rules of Procedure*. Guideline documents setting out the Review Board's environmental assessment process and expectations are available on the Review Board's web site ([www.reviewboard.ca](http://www.reviewboard.ca)) or by contacting the Review Board office for further information.

The Review Board has developed these *Terms of Reference* (ToR) based on an examination of information from the following sources:

- The public record of the Preliminary Screening process

- All submissions by parties to the public registry of the ongoing environmental assessment process, including the developer's Giant Mine Remediation Plan
- Issues highlighted during a scoping session held June 17, 2008 and a scoping hearing held on July 22-23, 2008, both in Yellowknife
- Suggestions from scientific experts contracted by the Review Board to assist in the analysis of the development
- Review Board experience in the conduct of environmental assessments

## 2 Scope

### *2.1 Scope of Development*

Under section 117(1) of the *MVRMA*, the Review Board determined that the scope of development will consist of all the physical works and activities required to remediate Giant Mine, an abandoned gold mine that houses approximately 237,000 tonnes of arsenic trioxide in underground chambers. Should the proposed development be altered by the developer at any point in the environmental assessment, the Review Board may adjust the scope of development. The Review Board also may choose to consider additional works or activities in the scope of development, should information be brought forward that makes such consideration necessary. The development as described below is consistent with the development description found in the Giant Mine Remediation Plan, submitted by the developer to the MVLWB, unless otherwise specified in this document.

The Review Board has determined that the following list of physical works or activities will occur during the remediation process:

- Immobilization of arsenic trioxide through ground freezing (the frozen block method)
- Ongoing treatment of contaminated water to remove arsenic, which includes:
  - Construction of a new water treatment plant
  - Treatment using additives to initiate the precipitation of arsenic from water
  - Storage of treated water and eventual discharge to Great Slave Lake
  - Storage of byproducts of water treatment

- Removal of site infrastructure and materials, such as buildings, waste and contaminated materials
- Capping of tailings areas
- Removal of contaminated soils from mine site and tailings areas
- Rehabilitation of Baker Creek
- Reclamation of open pits, of which some will be filled with site materials, some flooded due to changes in the water course of Baker Creek and some left open and bermed and fenced to prevent access
- Activities related to monitoring
- Relocation of a small portion of the Ingraham Trail (Hwy 4)

## ***2.2 Scope of Assessment***

### **2.2.1 General Scope**

The Scope of Assessment describes which issues and items will be examined in the environmental assessment. The Review Board, after having reviewed the development, having heard party submissions at the scoping hearing and having considered all other information brought forward to date, has determined that it requires more information on the potential biophysical impacts of the proposed development on humans and the environment and on the effectiveness of aspects of the development intended to mitigate or avoid these impacts.

There has been a great deal of information about the development produced and distributed publicly by the developer since it assumed responsibility for the property in 1999. Although this existing information may be included in the DAR, simply referring back to sections of the development description will not satisfy the Review Board's requirements as set out in these Terms of Reference. All information required to satisfy these terms of reference must be included within in the DAR, as the DAR must be a stand-alone document. Where the developer needs to refer to large amounts of technical information, the DAR may provide a summary only and point to other documents for more details.

### **2.2.2 Geographic Scope**

The Review Board has determined that the general geographic scope of the assessment will include Reserve R662T (the Giant Mine), the adjacent town site, a section of shoreline where, historically,

tailings have been released to the north end of Yellowknife Bay of Great Slave Lake and the Cruising Club boat launch site. It also includes the locations of all activities included in the scope of the development (see Section 2.1). This is consistent with the geographic scope described in the developer's application for a water license (MV2007L8-0031).

When assessing potential impacts the Review Board will consider a geographic scope that is appropriate to the valued component being assessed. For example, in the case of the water quality of a stream, the Review Board may choose to include both the source, the stream itself and the outlet of that stream in its assessment of the impact.

### **2.3 Temporal Scope**

The method selected by the developer to mitigate the potential impact of arsenic trioxide contamination is to freeze the contaminant in place, which minimizes but may not ultimately remove the risk of contamination of the surrounding environment. As the contaminant will continue to exist on the site, the risk of potential contamination may exist in perpetuity. To predict impacts in the future, assumptions must be made about future events and conditions. The level of certainty with which these impact predictions are made will necessarily decrease as the temporal scope of the assessment increases.

Although the developer's activities on the site will continue in some form in perpetuity, the Review Board has set a limit on the duration of activities that it can meaningfully assess. The developer's schedule indicates that the freezing process will begin in all chambers within five years of project initiation, and has predicted that the ground freezing will take approximately ten years once begun. Once this happens, the underground arsenic should no longer be a source of contamination and as time progresses the need for water treatment should gradually be reduced. The aim of the proposed development is to reduce arsenic levels in water to levels requiring a minimal level of treatment, remove or manage hazardous materials on the surface, and to prevent the movement of underground arsenic. The Review Board has determined that the fifteen years to freezing plus an additional ten years for monitoring would be an adequate temporal scope. For the purposes of this EA, the development activities are those occurring within 25 years and extending to any further time required to stabilize the site. This assessment will not consider the impacts of activities occurring after that period.

Activities beyond this period will be considered in future processes when the developer requires authorizations to continue care and maintenance operations at the Giant Mine site. In the Review Board's opinion such licenses or authorizations should address any changes to the development or the environment in the distant future.

The scope of assessment used in this environmental assessment may be re-examined at any time by the Review Board and altered based on new information deemed to be important to the determination of whether significant adverse impacts on the environment or significant public concern will be likely to occur. If, during the environmental assessment, it becomes apparent that the predictions of time made by the developer in the development are wrong, the Review Board will adjust the temporal scope of assessment accordingly.

### **3 Terms of Reference**

#### ***3.1 Considerations***

The developer shall provide the Review Board with the information requested in section 3.2. When providing this information, the developer must apply the impact prediction criteria in the Review Board's EIA Guidelines. The guidelines are located on the Review Board's website in the [Reference Library](#).

The developer will provide its views on the significance of predicted impacts, including the adverse and desirable effects of the proposed development. These views will be based on residual effects, after considering mitigation measures, and the developer will explicitly describe its methods for determining residual effects.

##### **3.1.1 Incorporation of Traditional Knowledge**

When available, the Review Board gives traditional knowledge equal weight to scientific knowledge in its deliberations. The developer therefore shall make all reasonable effort to incorporate traditional knowledge into its assessment of the proposed project. Traditional knowledge, where applicable, is to be used as a tool to evaluate the specific items required in Section 3.2. The developer is advised to refer to the Review Board's *Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment* when preparing its DAR. The guidelines are located on the Review Board's website in the [Reference Library](#).

##### **3.1.2 Assessing the Impacts of the Environment on the Development**

Consideration should be given to the impact of the environment, such as the impact of extreme weather events or climate change, on the development in each of the sections of 3.2, where applicable. In particular, the developer should clearly set out potential impacts and proposed strategies for mitigation of



impacts of the environment on the development when conditions have stabilized and minimal caretaking is required.

### **3.1.3 Appropriate Media**

The developer should provide information to the Review Board and to participants in a manner that is most useful and understandable to that audience. The use of maps, posters and models is encouraged to help participants fully understand the information being presented by the developer.

The developer should be mindful that not all participants to the environmental assessment have the same level of technical expertise. The DAR should be written at a level that is easily understood in the public domain. When it is necessary to present complex or lengthy documentation to satisfy the requirements of a specific section of the ToR, the developer should make every effort to simplify their response. The DAR should be understandable as a stand-alone document and supporting documents should be included only in appropriate circumstances, such as when lengthy technical information is provided. Supporting documents should be included as appendices and cross referenced to the main body of text.

### **3.1.4 Key Lines of Inquiry**

Key lines of inquiry are the subjects that require the most attention during the environmental assessment and the most rigorous analysis and detail in the DAR. Key lines of inquiry are identified by the Board to ensure a comprehensive, detailed analysis of the issues that resulted in public concern about the proposed development during the scoping phase.

The Key lines of inquiry for this environmental assessment are:

- Any issues related to arsenic trioxide (including its containment for an indefinite period underground and its contamination of the receiving environment)
- Questions related to monitoring and maintenance activities at the Giant Mine after the active freezing stage

## ***3.2 General Information Requirements***

### **3.2.1 Summary**

1. Provide a non-technical summary of the DAR.
2. Provide a concordance table that cross references the items in the ToR with relevant sections of

the DAR.

3. Provide a summary table indicating for each subsequent section (3.2.4 through 3.7) whether scientific knowledge, traditional knowledge, or both, was used in the information collection and analysis.

See Section 4 (Deliverables) for details regarding requirements for translations of plain language summaries.

### **3.2.2 Developer**

Provide the following information:

1. A summary of previous experience of the Project Management Team working on the reclamation of industrial development sites in the NWT or other Northern environments
2. A discussion describing the relationship between the developer and its contractors and subcontractors with details as to how the developer will ensure that the contractors and subcontractors will be responsible for, and honour commitments made by, the developer
3. Any federal, territorial or municipal policy, directives, guidelines, standards or legislated requirements concerning environmental, sustainable development, community engagement or workplace health and safety standards that may have influenced the development design
4. A description of the relationship between the Government of the NWT and the developer as it pertains to the development, including a description of respective duties and obligations of the two organizations
5. A description of project feasibility including financial feasibility. Include discussion of funding certainty for the development and related monitoring

### **3.2.3 Description of the Existing Environment**

The Review Board requires a clear description of the baseline (1999) environmental conditions at the Giant Mine site. The developer should include maps that illustrate any features that may require special attention by the Review Board, such as:

- a. The presence of wild life at risk in the area and any important habitat
- b. Unique landforms, topography, or geology
- c. Heritage resources or areas of high potential heritage resources

- d. Recreational or aesthetic values
- e. Areas that may be used for traditional harvesting of plants or animals or that may have cultural significance

The description should incorporate the entirety of the geographic area for this environmental assessment, as defined in the geographic scope of assessment above. To provide context, it should include at a minimum a description of the following elements, for the purpose of understanding the setting for this development:

1. Site hydrology, including surface water, groundwater and mine water
2. Modifications made to the site hydrology, which should clearly indicate where there are engineered disruptions of natural flow, such as a dams or a bank modifications, and where inputs to the hydrological system come from the mine
3. Information on past and current water quality, quantity and flow regimes, with particular attention to Baker Creek
4. Aquatic organisms (especially fish) and aquatic habitat contained within the geographic area of the environmental assessment
5. Vegetation and plant communities
6. Nature of sediments at the site, meaning the physical and chemical makeup of these sediments, including soils, sediment beds of rivers and lakes, tailings and waste impoundment areas and the shores and nearshore areas of Great Slave Lake (Yellowknife Bay) that have been included in the geographic scope
7. Structural geology: specific consideration shall be given, but not limited, to faults, joint patterns, rock mass quality, ranges of conductivities and macroscopic transmissivity
8. Terrain, bedrock geology, permafrost distribution, ground temperatures, active layer thickness, and seismicity, especially at locations where the developer proposes to freeze arsenic trioxide chambers
9. On site infrastructure, including mine workings, overview of historic and recent boreholes and wells including sealing practices for abandoned boreholes and wells
10. Mine workings on site, including buildings, power lines, roads, fences and gates, and other associated infrastructure, also including:

- a) a description of the mine itself, including pits, underground tunnels, stopes, and vertical shafts; with particular attention paid to the arsenic storage chambers on site
  - b) any equipment or infrastructure currently underground described in general terms, such as power lines or transportation infrastructure such as tracks and earth moving equipment, etc.
- 11. Ambient air quality and climate history
  - 12. Historic and present past land usage, with the identification of traditional land use groups and areas of overlapping land usage
  - 13. Cultural and heritage resources, with the identification of the cultural groups who associate with these resources

### **3.2.4 Development Description**

The developer will provide a description of the development as it is being proposed. This section should not make any predictions or provide mitigative strategies for potential impacts that may arise from the works or activities described here. The use of diagrams, maps and other visual aids is encouraged.

The development description will, at a minimum, include the following elements:

- 1. The proposed physical footprint of the development, including all alterations and additions to the site, existing buildings, roads, fences, mine workings, power lines, water lines, etc.
- 2. Description of the underground chambers and bulkheads currently being used to contain the arsenic trioxide dust, including an assessment of the structural integrity of each and proposed modifications
- 3. Overview of the frozen block method, including a non-technical description of the technology the developer proposes to use (freeze plants and thermosyphons)
- 4. A timeline that sets out the intended freezing sequence for the arsenic chambers and stopes, defines when the arsenic trioxide dust is considered frozen (i.e. safe for the environment), accounts for long term climate changes and differentiates between active and passive freezing
- 5. Demolition plans and locations for buildings and other infrastructure, as well the identification of any structures that may be left intact with reasons provided
- 6. Description of the proposed waste management plan, including waste from building demolition, soil remediation, existing waste materials on site, contaminated mining equipment from underground and the surface and any other source for solid waste

7. Location and ultimate disposition of open pits on the site. If the pits are to be filled, a description of the fill material and potential volumes, and if they are to be left empty, a description of any safety measures that will be installed such as berms or fences, and how these would be monitored and maintained
8. A detailed description of the proposed method(s) and location(s) of tailings disposal and/or containment, including a description of any technologies or materials that may be used, and any temporary or permanent measures to control fugitive dust from tailings disposal areas
9. A detailed description of the proposed water treatment process, include the installation of new infrastructure, the proposed methodology, location and predicted quality of eventual discharge
10. The projected quantity of contaminated water that will be treated and discharged through the water treatment process on an annual basis, broken down by both season and by year
11. The nature of the by-product (sludge) that will be generated through the water treatment process, including chemical makeup, projected quantity, and the proposed method for sludge disposal
12. The proposed Baker Creek remediation activities, including:
  - a. potential re-alignments
  - b. diversion
  - c. channel and habitat enhancements
  - d. options for management of contaminated sediments
  - e. future improvements and contingencies for Baker Creek habitat restoration
13. Estimated power requirements during the active freezing portion of the development, as well as any additional power requirements after the freezing is complete for any other purpose
14. Estimated capital, operating, monitoring and maintenance costs (the latter presented by year for the life of the development)
15. The estimated lifespan of the development broken down into construction, active operations and ongoing maintenance; and monitoring
16. The number of person years of work associated with the development, broken down by life cycle stage
17. The approval process for each development component, including all permits, licenses and authorizations, the regulatory agency in charge of each, and status of the approval process

### 3.2.5 Accidents & Malfunctions

The developer should be able to demonstrate preparedness for a range of possible accidents or malfunctions that could lead to adverse environmental impacts. The developer is required to:

1. Analyze risks for this development, including components, systems, hazards, and failure modes.
2. Assess likelihoods and severity of each risk identified.
3. Describe all emergency response plans that will be in place during the execution of the proposed development, including a description of how the developer plans to communicate consequences and risks to the local population.

(Note: Information requirements regarding potential accidents and malfunctions of the frozen block method are described in Section 3.3 - Arsenic Containment).

### 3.2.6 Public Consultation

The purpose of public consultation is to provide those individuals who may be affected by the development an opportunity to effectively participate in the environmental assessment. Although the developer in this case has held numerous public information sessions and workshops over the many years spent designing the development, one issue identified during the scoping phase of this environmental assessment was a lack of effective public consultation. This may be due to the complexity and volume of information presented by the developer, or the considerable length of time between the last concerted effort on consultation and the referral to environmental assessment. The Review Board needs a thorough understanding of the developer's efforts to consult with the public to consider whether potentially affected individuals have been able to participate in the process.

The following items are required for consideration of public consultation:

1. For each consultation activity, identify dates and locations, participants in consultation activities, methods of consultation and discussion topics. Additionally, identify:
  - a. All public methods used to identify, inform and solicit input from potentially affected parties
  - b. All commitments and agreements made in response to issues raised by the public during these consultations, and how these commitments altered the planning of the proposed the development
  - c. All issues that remain unresolved, and document any further efforts envisioned by the

parties to resolve them

2. Identify any plans, strategies or commitments that the developer is contemplating to ensure that individuals or groups that may be affected by the development will continue to be consulted over the term of this environmental assessment and over the life of the project.
3. Describe the membership and activities of the Giant Mine Community Alliance.
4. Discuss any efforts that the developer will be making to simplify the complex information contained within the development public registry and to more effectively communicate aspects of the development, including any efforts that will specifically address concerns that the developer may have heard from participants in previous consultation activities or during this environmental assessment.
5. Discuss how the developer intends to engage with traditional knowledge holders in order to collect relevant information for the prediction of possible impacts, as well as the development of mitigation methods, adaptive management plans and monitoring program planning.
6. Describe any plans the developer has to continue public consultation and involvement during implementation of the project and afterwards, with particular regard to reporting monitoring results and adaptive management and a description of how public complaints will be addressed and the dispute resolution process.

### **3.2.7 Assessment Boundaries**

When setting spatial and temporal boundaries for the purpose of making impact predictions in the course of this environmental assessment, the developer should use such boundaries that are appropriate to the effect on the valued component being assessed, rather than relying on the general boundaries of the development. This section will provide the developer an opportunity to set out both a rationale for and a description of the spatial and temporal boundaries they have chosen when making impact predictions. This will allow both the Review Board and other parties to then compare the chosen boundaries with the scope of assessment as set by the Review Board and determine their adequacy. The developer should provide a rationale for the boundaries selected.

## ***3.3 Arsenic Containment***

The central issue of the development is the disposition of 237,000 tonnes of arsenic trioxide stored in underground chambers at the Giant Mine. Every party to the assessment brought this issue forward at

the scoping hearing as their main concern. The developer should ensure that its responses are as complete and clearly understandable as possible. The use of alternative visual representations of information, such as diagrams, maps and illustrations, is encouraged.

The description of potential impacts and proposed mitigation for this section should include the following elements at a minimum:

1. A detailed description of how the frozen block method will be done, including:
  - a. A complete timeframe that encompasses the project from the start to the point where stability is reached and the arsenic is completely isolated from the surrounding environment
  - b. With the best available information, a prediction of the amount of active freezing, the amount of passive freezing, power requirements, numbers and general locations of thermosyphons that will be necessary to achieve stability (referring here to a state where active management of the site is no longer necessary)
  - c. An illustration of the stability of the proposed system for a duration of at least 100 years after converting the active freezing system into a passive system
  - d. A description of the intended redundancies and factor of safety, in particular for the passive cooling system
  - e. A description of the monitoring and maintenance requirements of the thermosyphons, the conditions that would require their replacement, and the expected frequency of replacement
  - f. A description of the method of installation of the infrastructure
  - g. A description of the scenario whereby the developer would deem the project complete (that is that the remediation activities have sufficiently reduced or eliminated the arsenic contamination arising from the Giant Mine)
2. A detailed explanation on the saturation procedure of the arsenic trioxide dust before freezing and a demonstration that the frozen dust will be compact and ice saturated, (i.e. no loose cold regions and frozen bridges occur that could jeopardize the stability of the system)
3. A discussion of whether the frozen block method will protect the biophysical environment and the health and well-being of the human residents living nearby to the Giant Mine for as long as the contaminated materials persist at the site



4. A discussion of whether the developer contemplated a reconsideration of the frozen block method should a technological advance or change in the environment make it either necessary or advantageous to do so
5. A discussion whether the developer contemplated assigning resources to make it possible to periodically review the questions posed above (s. 3.3 #5)
6. A description of any opportunity costs for future underground arsenic management and treatment options associated with the proposed development in terms of futures foregone, including *in-situ* and *ex-situ* treatments
7. An assessment of groundwater flows that will be adjacent to the arsenic chambers after the frozen block has been implemented, including a description of expected water quality and quantity, a comparison to current conditions, as well as an estimation of the influence of groundwater flow on the integrity and stability of the frozen block
8. A discussion of the longevity (>30 years) of the proposed cooling system, which will include the following:
  - a. a description of other instances of ground freezing technologies being used to isolate contaminants, a discussion of the challenges involved and of how successful each situation may have been
  - b. identification of other instances of successful long-term application of passive cooling systems
  - c. a discussion of the challenges involved, monitoring systems employed, maintenance efforts required, and why some systems had failed in the past
  - d. contrast the expected duration of the hazard against the expected lifespan of each component of its containment system
9. A prediction of the risks and effects of related to thaw. Include a discussion of the duration, risks and potential impacts if adaptive management required the frozen block to be intentionally thawed, and a discussion of risks and consequences of an accident or malfunction of the frozen block method. What response measures or plans would be in place to mitigate the effects of an accident? How would a failure of the frozen block impact the surrounding environment? This should include:
  - a. A thorough analysis and discussion of diverse scenarios that may lead to partial or

complete failure of the freezing system, and the risks associated with thawing for each scenario, including scenarios caused by external variables (such as prohibitive fuel costs, wildfires, warming of ground water, changes in the surface energy balance from ground water flow regimes influencing the ground surface vegetation, etc.) and internal engineering risks (such as crown pillar deformations, shearing of thermosyphons, stope collapses, etc.)

- b. A description of tolerable thresholds for arsenic trioxide releases for each phase of the development, which may be completed by identifying two or three additional higher threshold levels that correspond to partial failures of the system, each paired with an emergency response and communication plan
  - c. A discussion of any policy or guidelines that would be followed in the case of an accident or malfunction
  - d. Any emergency response plans that have been prepared or would be used in the case of an accident or malfunction of the development
  - e. A discussion of how any information regarding an accident or malfunction or the risk of such an event would be communicated to the local population and how the developer plans to engage with local communities in regards to risk management
10. An account of how climate change predictions and observations affect the risk level in the long-term based on “best estimate” and “high estimate” scenarios, including discussion of risks in light of the current climate predictions as set out in the *Fourth Assessment Report* of the Intergovernmental Panel on Climate Change
11. A description of potential effects of the frozen block on the additional remediation elements, including potential impacts on surface hydrology, tailings ponds consolidation and tailings covers
12. A description of an adaptive management strategy that will use the information gathered during the initial freezing stages and refine the freezing system configuration, incorporating considerations such as freezing performance, site climate, and improved understanding of future climate trends

### ***3.4 Human Environment***

The DAR will examine components of the human environment that might be affected by the

development, regardless of whether the potential impacts are beneficial or adverse.

### **3.4.1 Economy**

The Review Board is required under the Guiding Principles of the MVRMA (section 115) to, among other things, have regard for the economic well-being of the residents and communities of the Mackenzie Valley. Understanding the effects of a development on economic well-being requires analysis of what sorts of effects will occur, how they will be distributed geographically and among populations, and how adverse impacts can be mitigated.

At a minimum, the developer is required to:

1. Provide an updated listing of all employment opportunities by skills category over the life of the development.
2. Discuss the developer's strategies, plans or commitments with respect to maximizing the proportion of direct employees of the development that are NWT residents, aboriginal persons, and local residents.
3. Identify any work that will be contracted out (as opposed to being conducted directly by the developer), the employment involved in those contracts, and the requirements that the developer will impose on contractors to maximize their use of northern and aboriginal contractors.
4. Provide information on any barriers to employment for northern individuals or companies, either as direct employees or as contracted workers.
5. Discuss any socio-economic impacts of the development that are more likely to be experienced by some groups than by others.
6. Identify any effects on local infrastructure and utility costs that may result from the development's demands on these facilities and services.
7. Consider how any aspect of the development may affect present and future land uses in the area, including opportunity costs.

### **3.4.2 Human Health & Safety**

Protecting the health and well-being of the human population of Yellowknife, Ndilo and Dettah is essential. During scoping, many participants raised concerns about potential adverse impacts to human health and safety linked to exposure to arsenic trioxide. Both real and perceived risks to human health and safety can have a significant impact on the populations that live in proximity to the Giant Mine site. The

environmental assessment must make a full consideration of impacts to all aspects of how local residents live and interact with their environment.

Consideration shall be given, but not limited, to:

1. Identification of all potential pathways for contaminant exposure for local residents
2. An assessment of all risk to human health and impacts to quality of life related to exposure to arsenic trioxide, with consideration to chronic exposure as well as to short-term high level exposure that might result from a catastrophic malfunction of the development

### **3.4.3 Cultural Impacts**

When the development is completed, the current Giant Mine site will be greatly altered from its current condition. At present, the area is hazardous, contaminated and filled with industrial waste but it is reasonable that recreational and cultural use of the area will increase as these hazards are removed. The Review Board is interested in the ways in which the development may affect human activities and culture as it occurs at the Giant Mine, both as the plan is being implemented and after the development has reached a stage of stability.

When predicting impacts to human culture that might occur, consideration must be given to the following elements, at a minimum:

1. How the implementation of the proposed development may affect land use at the Giant Mine site, with special consideration for traditional harvesting and other cultural land uses
2. The type and nature of land uses (giving special consideration to traditional harvesting and other traditional activities of local aboriginal communities) that would be possible when the site is fully remediated (meaning the envisioned end point of active management) and how the permanent infrastructure and landforms contemplated by the development may affect these future activities (for example, if the site is more heavily used for recreation in the future, how will the open pits left on site affect local residents?)

## ***3.5 Biophysical Environment***

An environmental assessment must make a thorough examination of potential impacts to biophysical components, and provide mitigative measures for potential impacts that may arise from the activities. This must include an assessment of the likelihood and potential severity of any accidents or malfunctions over the lifespan of a project.

### 3.5.1 Water

The Review Board has identified water as a key valued component for this environmental assessment. The contaminated water at the Giant Mine must be treated before discharge to the environment to ensure the health and safety of the ecosystem and the local residents who depend on that ecosystem.

While conducting an impact assessment based on identified valued components, specific consideration shall be given to the following:

1. A listing of all applicable water resource permits, licenses, and authorizations that will be required from federal and territorial regulatory authorities, as well as all water quality requirements that may be mandatory or have been committed to previously by the developer
2. A prediction of how a malfunction of the frozen block might affect contaminant levels in water both at the Giant Mine site and in the surrounding area, including Back Bay, Yellowknife Bay and Great Slave Lake. A timeline should be included
3. An examination of the potential effects of the proposed development on water quality, quantity and temperature throughout the potentially impacted area. Assessments of water quality should make use of applicable standards and guidelines. This analysis shall include, but not be limited to:
  - a. A prediction of water quality, with special attention on arsenic levels, and how these levels may change through the lifespan of the project, the assessment of which should cover both inflows to the treatment process from i) mine water and ii) contaminated surface runoff and outflows from the treatment plant to the environment
  - b. A prediction of water quantity in local water bodies, such as Baker Creek, including a description of peak and minimum flows, seasonal variations and water balance patterns and how these may change due to water treatment activities and other activities on site that may affect surface drainage patterns to other water bodies (such as realignment or diversion of Baker Creek or drainage channels)
  - c. A prediction of water quality and quantity in new water bodies that may form in abandoned, unfilled open pits, highlighting potential sources of contamination that might have an effect on these water bodies
4. Where permafrost exists at the Giant Mine, an analysis of potential impacts to the permafrost and its active layer from remediation activities;
5. An analysis of the effect of all remediation activities on ice formation, with particular attention to

the impact of active freezing activities on normal seasonal freeze and thaw cycles in nearby water bodies

6. An analysis of the short and long term effects of changes in surface water bodies and ground water flow on the frozen block and vice versa

### **3.5.2 Fish and Aquatic Habitat**

Potential effects to fish and fish habitat were identified as issues of concern during the Review Board's scoping exercise. Public concern focused on the development's potential to contribute to the contamination of local fish stocks and aquatic habitat, including concerns about health impacts on traditional harvesters and other harvesters of fish.

In the impact assessment on fish, aquatic organisms and habitat, specific consideration shall be given, but not be limited, to:

1. An description of fish and fish habitat present, and the various life stages that the proposed development may affect
2. A description of potential impacts to fish and fish habitat, including predicted habitat losses or gains from the proposed development
3. Site-specific mitigation measures proposed to reduce the predicted impacts to fish or fish habitat from the construction, operation or decommissioning of any development components
4. The production of a plan to offset residual impacts (such as a No Net Loss Plan and habitat creation)
5. The potential downstream effects of arsenic contamination on aquatic organisms and their habitat considering both chronic exposure and also a scenario of a catastrophic failure leading to an abrupt and high level exposure
6. The potential impacts to fish and fish habitat in Baker Creek resulting from the development, including:
  - a. the realignment or reconstruction of portions of the watercourse (specifically, construction activities that could affect surface drainage patterns and the hydrology of Baker Creek)
  - b. any activities that could lead to the introduction of sediment (including contaminated sediments) into Baker Creek
7. The potential impacts to fish and fish habitat from any effects of the development on offshore

migration or redistribution of existing tailings in north Yellowknife Bay

8. The potential impacts to fish and fish habitat associated with operation of the new water treatment plant, and proposed discharge of treated effluent into Yellowknife Bay (Great Slave Lake), including:
  - a. The reduction of overall discharge or flow of Baker Creek which could lead to the potential for seasonal drying of portions of the creek, thereby reducing fish habitat
  - b. The construction of the new discharge pipe and the discharge zone within Yellowknife Bay which could lead to the potential degradation of fish habitat
9. The potential impacts to fish and fish habitat in Baker Creek due to block freezing of arsenic trioxide dust in underground mine chambers, including discussions of any ice-damming in sections of Baker Creek that may result from active freezing and could lead to extensions to the time period when the creek is frozen thereby reducing habitat utilization and access to spawning habitat for fish.

### **3.5.3 Vegetation**

Vegetation is very important to the general ecosystemic health of the area. Animals and humans that eat local vegetation should be protected from contamination. Due to the project's proximity to the community of Yellowknife, it is reasonable to assume that local berries and other plants are being or will be harvested by residents of Yellowknife, Ndilo and Dettah in the future when the site no longer exhibits the characteristics of an industrial area. Animals that eat local vegetation such as rabbits or waterfowl might be harvested by local residents.

Specific consideration shall be given to:

1. An overview of areas that will be revegetated, which should include a description of existing vegetation at those locations, a description of what seed mix or reclamation methods might be used and associated timelines
2. Identification of any rare or "at risk" species
3. The potential effects of the development on vegetation, with special attention to culturally significant species – as identified through traditional or community knowledge
4. The potential effects of fugitive dust on vegetation and pathways for contamination of country food by ingestion of contaminated vegetation

5. The potential effects of contaminated water on vegetation
6. The vulnerability of local plant communities to invasive species, and the likelihood that invasive species will be introduced by the proposed development
7. A list of all mitigation required and committed to, to avoid significant impacts from the activities described above
8. A conceptual plan for the adaptive management of effects on vegetation, including any monitoring programs, as well as reporting to regulators and potentially-affected communities

#### **3.5.4 Wildlife and Wildlife Habitat**

While conducting an assessment on potential impacts on wildlife valued components, specific consideration shall be given to:

1. The rationale and methodology for the selection of species as valued components. Include species selected by the developer, and the following species (identified during issue scoping):
  - a. Peregrine falcon (*anatum* subspecies)
  - b. Black bear
  - c. Moose
  - d. Other fur-bearing mammals that frequent the area

Analysis of each species shall include mapping the known distribution of each species, their likely and preferred range in the area, their habitat usage intensity broken down seasonally, migration corridors and any particularly important habitat sites.

2. The effects that each the development component may have on wildlife and wildlife habitat valued components, which shall include:
  - a. A description and quantification of all potential direct and indirect effects on habitat for each valued component
  - b. Historic, current and expected wildlife use of potentially-contaminated water sources, and an assessment of the effects predicted from such activity
  - c. Potential effects of contaminated fugitive dust on wildlife habitat
  - d. Potential effects of altered water quality or quantity on health and distribution of animals, considering both steady long term exposure and short term higher level exposure resulting



from a major malfunction of the development

- e. Disturbance of wildlife, including blockages to movements, loss of effective habitat from disruption, and sensory disturbances from sources such as noise due to the development activities or results
3. The potential effects of the development operations on rare, threatened or endangered species including Peregrine falcon (*anatum* subspecies) and species listed by the Committee on the Status of Endangered Wildlife in Canada, including plans for monitoring species listed as “at risk” or “may be at risk” in the NWT *General Status Ranks*
4. A conceptual wildlife management plan, including furbearers, migratory birds, waterfowl, hoofed mammals and large carnivores, in regards to ongoing monitoring of contaminant levels present in the ecosystem

### ***3.6 Monitoring, Evaluation and Management***

The continued surveillance of the environment at and around the Giant Mine site was a source of interest for participants throughout the scoping phase of the environmental assessment. To address this concern the developer shall provide:

1. A detailed description of the monitoring program proposed by the developer, including at a minimum a description of:
  - a. A framework for effects monitoring, evaluation and management for all stages of the development
  - b. Monitoring standards, methodologies and requirements for water quality, ground temperature, ecological effects and sediment contamination, and the effectiveness of mitigation and compensation measures
  - c. Criteria for evaluating monitoring results, including triggers and thresholds for actions
  - d. Internal management systems to ensure that results are properly assessed
  - e. Plans for responding to unacceptable monitoring results through project management actions, and confidence in the adequacy of the management options available
  - f. A description of any technology used in the implementation of the monitoring activities, and monitoring locations, frequency and duration

- g. A schedule of anticipated activities to implement the monitoring program
  - h. Plans to periodically review of the efficacy of the proposed monitoring program and technologies used and a reevaluation of the goals and benchmarks of the monitoring program
  - i. Plans to engage with local communities in the development, implementation and review of monitoring activities
  - j. The anticipated lifespan of active monitoring activities
  - k. Anticipated redundancies in the monitoring program
2. An assessment of the ability of the monitoring program to adequately detect and identify small arsenic trioxide leakages from the frozen block
  3. An assessment of the ability of the monitoring program to adequately protect human health and safety and the integrity of the local ecosystem, with consideration given to the potential impact of a catastrophic malfunction

### ***3.7 Cumulative Effects***

The scoping sessions identified concerns relating to other mining activities and historical deposition of tailings and other contaminants due to mining activity in the Yellowknife area.

Existing contamination on the site is not within the scope of the development being assessed. However, to understand the cumulative effects of the proposed development, it is necessary to consider how its effects will combine with all other past, present and reasonably foreseeable future activities that will affect the same valued components, including the effects of past mining. This should include consideration of beneficial impacts and adverse impacts. In addressing this section, the developer is encouraged to refer to Appendix H of the Review Board's *Environmental Impact Assessment Guidelines*. The incorporation of Traditional Knowledge is recommended alongside scientific analysis.

The following items are required for consideration of cumulative effects:

1. Identify the valued components to be considered in the cumulative effects assessment.
2. Describe all past, present and future human activities that may affect the same valued components as the development, or affect the implementation of the development. Provide a rationale for the choice of those activities.

3. Identify and provide a rationale for the geographic and temporal scale that will be applied to the cumulative effects assessment of the valued components under consideration.
4. Predict the cumulative effects of the human activities selected (in 2, above) on the valued components identified (in 1, above), including:
  - a) A description of the predicted condition of the site following the development relative to baseline (1999) and natural background conditions
  - b) A discussion of the approach and methodologies used to identify and assess cumulative effects
  - c) Provide explicit documentation of the assumptions, models and information sources used, as well as information limitations and associated levels of uncertainty
5. Provide a plan for the monitoring of cumulative effects and the adaptive management of the development's contribution to regional cumulative effects.

## 4 Deliverables

The developer is expected to submit the DAR to the Review Board office for a conformity analysis. Once in conformity Review Board staff will provide direction to the developer for distribution of materials to parties. The DAR submission to the Review Board should include:

- ten copies of the DAR in hardcopy (although once the DAR is determined to be in conformity with these *Terms of Reference*, copies will be required for all parties)
- the DAR in digital format with individual files ideally not exceeding 5 MB in size
- a commitments table listing all mitigation measures the developer commits to employ as part of the DAR
- associated maps (not including engineering drawings) as shape files in accordance with Government of the Northwest Territories spatial data warehouse specifications
- a plain language non-technical summary of the DAR in English, Tlicho, Chipewyan, and French
- an audio translation of the plain language summary in the Dogrib and Chipewyan languages
- any supporting materials such as videos or animations that might enhance the understanding of the Review Board and the parties.

While preparing the DAR, the developer is encouraged to continue consulting with all parties to the environmental assessment. The developer is also encouraged to contact the Review Board office if unclear about any of the requirements of this *Terms of Reference* document, and to seek clarification in writing.