

To the EA participants:

The Mackenzie Valley Environmental Impact Review Board is pleased to distribute the *Draft Terms of Reference & Draft Work Plan* for EA0809-001, for Indian and Northern Affairs Canada's proposed Giant Mine Remediation Plan. This draft document is being released publicly for an 18 working day review & comment period open to all interested parties.

The deadline for comments is 5pm on Thursday, April 9, 2009. Comments should reference the applicable section and page number of the *Draft Terms of Reference* and can be submitted to me at my email (ttestart@reviewboard.ca) or by fax at (867) 766-7074.

Thank you for your participation in this environmental assessment. Regards,



Tawanis Testart
Environmental Assessment officer

Mackenzie Valley
Review Board



DRAFT
Terms of Reference for the
Environmental Assessment
of the
Department of Indian Affairs & Northern Development's
Giant Mine Remediation Plan
EA0809-001

March, 2009

Mackenzie Valley Environmental Impact Review Board

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Glossary of Acronyms

DAR- developer's assessment report

DFO – Department of Fisheries and Oceans

GNWT – Government of the Northwest Territories

MVRMA – Mackenzie Valley Resource Management Act

NWT – Northwest Territories

SARA – Species at Risk Act

ToR – Terms of Reference and Work Plan

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1 Overview

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

- Section 2– Introduction, including the reasons for environmental assessment referral, as well as the legal context;
- Section 3 – The Scope of Development that is being proposed;
- Section 4 – The Scope of the Assessment, i.e. the issues that will be addressed in the environmental assessment;
- Section 5 – The Terms of Reference (ToR) that will direct the production of a *Developer's Assessment Report* (DAR); and
- Section 6 – Definition of the responsibilities of those involved in the environmental assessment, as well as an overview of the environmental assessment process.

2 Referral to Environmental Assessment

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. That board 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.

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

2.1 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) or by contacting the Review Board office for further information.

The Review Board has developed these *Terms of Reference* 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; and
- Review Board experience in the conduct of environmental assessments.

3 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 clean up the Giant Mine, an abandoned gold mine that houses approximately 237,000 tonnes of arsenic trioxide in underground chambers. Should the 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 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 but is not limited to:
 - 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
- Relocation of a small portion of the Ingraham Trail (Hwy 4)

4 Scope of Assessment

The Scope of Assessment is the determination of 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 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 ToR. 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.

GEOGRAPHIC SCOPE

The Review Board has determined that the 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 launch site. This is consistent with the geographic scope described in the developer's application for a water license (MV2007L8-0031).

While the Review Board has determined that the geographic scope be limited in this way, it is always mindful that for the purpose of assessing potential impacts, such as impacts to rivers or streams for example, 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.

TEMPORAL SCOPE

The method selected by the developer to mitigate the potential impact of arsenic trioxide contamination is to freeze the contaminant *in situ*, 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. As the length of time that must be considered increases, the assumptions made become more speculative. The level of certainty with which these impact predictions are made will necessarily decrease as the temporal scope of the assessment increases.

The developer has predicted that the ground freezing will take approximately 10 years. 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 development is that the arsenic levels in water will be reduced to levels requiring a minimal level of treatment, if any, and that the development will become stable. The Review Board issued Reasons for Decision on the scope of the development and assessment earlier and determined that the 10 years to freezing plus an additional five years for monitoring would be an adequate temporal scope. The Review Board recognizes that the freezing process may not start at the same time for all chambers and that some additional time may be required for the entire site to be stabilized. Therefore, the Review Board asks the developer not to limit their predictions to a 15-year timeframe but to whatever time may be needed to stabilize the mine site and to verify stabilization through monitoring.

The Review Board anticipates that the developer will require renewed water licenses or other authorizations to continue care and maintenance operations at the Giant Mine site beyond the timeframe addressed by this environmental assessment. In the Review Board's opinion such licenses or authorizations should address any changes to the development or the environment in the future rather than this environmental assessment trying to make predictions far into the 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.

5 Terms of Reference

5.1 General Considerations

The developer is to provide the Review Board with the information requested in Section 5.2. When providing this information, the developer must apply the criteria in Section 5.1 to each part of Section 5.2.

Determination of Significance

The developer must provide its views on the significance of impacts, using the following criteria:

Direction The main focus of the impact review is to assess whether the development is likely to cause significant adverse impacts on the environment or be cause for significant public concern. The developer is also encouraged to report anticipated positive changes.

Magnitude Magnitude refers to the degree of change that may be caused, e.g. amount of water diverted. Where possible magnitude should be reported in absolute and in relative terms.

Likelihood Likelihood refers to the probability of the impact occurring.

Geographical Extent Geographical extent refers to the area affected. In using this criterion “locational intensities” must be considered as well, i.e. where an impact may affect various areas to differing degrees, separate analysis may be required. For example, downstream effects may be separated into several geographic areas of high, medium, low magnitude, rather than reporting an average impact on a large area.

Duration Both the duration of individual events (e.g. waste water discharges) and the overall time frame during which the impact may occur (e.g. during construction, operation, and closure) must be considered. In addition, the length of time effects will last must be reported and considered.

Frequency The frequency of impacts and events causing impacts must be considered, as well as the length of time between occurrences.

Reversibility The reversibility of any impacts must be considered not only in terms of whether the impact is reversible at all but also in terms of how much time will be required for the affected environmental component to recover. In terms of the human environment the manageability of impacts may be considered rather than their actual reversibility. Where appropriate the evaluation must also identify the existing social resources that may be diverted due to the proposed development to facilitate maintenance of acceptable conditions.

Ecological Context Ecological context refers to the type of the impact as well as the nature of the affected environmental component. For example, the mortality of a hundred caribou might be considered significant, while the mortality of a thousand mosquitoes might not, although all other criteria such as frequency, geographic extent and even magnitude may appear to indicate otherwise. Generally an impact on a highly valued component may trigger significance at relatively low magnitude, duration, and likelihood.

Incorporation of Traditional Knowledge

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 4.2 (see A-4 below). 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 at <http://www.reviewboard.ca/HTML/MVGuides/MVdocs.asp>.

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 5.2, 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 it has reached a point of stability and there is minimal caretaking occurring.

Utilization of 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 when 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.

Key Lines of Inquiry

Key Lines of Inquiry are subjects of concern 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, either its containment for an indefinite period underground or its contamination of the receiving environment; and
- Questions related to monitoring and maintenance activities at the Giant Mine after the active freezing stage.

5.2 Specific Requirements

A Summary

- 1) Provide English, French, Dogrib and Chipewyan plain language, non-technical summaries of the DAR;
- 2) Provide an audio translation of the plain language summary in the Dogrib and Chipewyan languages; and
- 3) Provide a concordance table that cross references the items in the ToR with relevant sections of the DAR.
- 4) Provide a summary table indicating for each subsequent section (C through L) whether scientific knowledge, traditional knowledge, or both, was used in the information collection and analysis.

B Developer

Provide the following information:

- a. 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;
- b. 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;
- c. Any federal policy, directives or terms of reference concerning environmental, sustainable development, community engagement and/or workplace health and safety standards that may have influenced the development and
- d. A clear description of the relationship between the Government of the NWT (GNWT) and the developer as it pertains to the development, including a description of respective duties and obligations of the two organizations.

C Description of the Existing Environment

The Review Board requires a clear description of the baseline environmental conditions at the Giant Mine site. This should include a description of past mining activities, other industrial activities, and any other contemporary/past land use activity at the site. The developer should provide maps to illustrate the locations of buildings, landforms, underground features, water bodies and other features. On these maps, it should be

clearly indicated if there are any features that may require special attention by the Review Board, such as:

- a. The presence of SARA-listed species 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/aesthetic values; or
- 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. It should include at a minimum a description of the following elements:

- 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) Historic and current information on 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) The mine workings on site, including buildings, power lines, roads, fences and gates, and other associated infrastructure. The description of the mine should include the mine itself, including pits, underground tunnels, stopes, and vertical shafts; with particular attention paid to the arsenic storage chambers on site. Any equipment or infrastructure currently underground should be described in general terms, such as power lines, 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; and
- 13) Cultural and heritage resources, with the identification of the cultural groups who associate with these resources.

D 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/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;
- 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;
- 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 amount of contaminated water that will be treated 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) 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;
- 13) Estimated capital and operating and maintenance costs (the latter presented by year for the life of the development);
- 14) The estimated lifespan of the development broken down into construction, active operations and ongoing maintenance; and monitoring; and
- 15) The number of person years of work associated with the development, broken down by life cycle stage.

E Accidents & Malfunctions

By definition, accidents cannot be anticipated with reasonable certainty, however the effect of accidents or malfunctions must be planned for. The developer should be able to demonstrate a preparedness for a range of possible accidents or malfunctions that could lead to adverse environmental impacts that might occur during the execution of their proposed development.

Please 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.

F Public Consultation

The purpose of public consultation is to provide those individuals who may be impacted 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 developing 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 perhaps due to 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 impacted 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; and
 - 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 who may be impacted by the development will continue to be consulted with 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 of 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; and

- 5) A discussion as to how the developer intends to engage with traditional knowledge holders in order to collect relevant information for the establishment of baseline conditions, the prediction of possible impacts, as well as the development of mitigation methods, adaptive management plans and monitoring program planning.

G 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 valued component being assessed, rather than relying on the boundaries used in 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 establishment of boundaries.

H Human Environment

Assessment of the human environment (social, economic and cultural impact assessment – also called “socio-economic impact assessment”) is an important part of any environmental assessment in the Mackenzie Valley, in relation to the identification of both potential significant adverse impacts on the environment and significant public concern. 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.

H-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.

Specific consideration shall be given, but not limited, to:

- 1) Providing an updated listing of all employment opportunities by skills category over the life of the development;

- 2) Discussing 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 employment that will be contracted to outside companies, and any requirements that the developer will pass on to contractors to maximize their use of northern and aboriginal contractors; and
- 4) Provide information on any barriers to employment for northern individuals or companies, either as direct employees or as contracted workers.

H-2 Human Health & Safety:

Protecting the health and well-being of the human population residing in 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 we live and how we interact with our environment.

Consideration shall be given, but not limited, to:

- 1) Identification of all potential pathways for contaminant exposure for local residents; and
- 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 abrupt, high level exposure that might result from a catastrophic malfunction of the development.

H-3 Cultural Impacts:

When the development is fully implemented, 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 use of the area will increase as these hazards are removed. The Review Board is interested in the ways in which the development may impact 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) Describe how the implementation of the development may potentially impact land use at the Giant

Mine site, with special consideration for traditional harvesting and other land uses; and

- 2) The developer should make a prediction about the type and nature of land uses 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 impact 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 impact local residents? Special consideration should be given to traditional harvesting and other traditional activities of local aboriginal communities.

I Biophysical Environment

An environmental assessment must make a complete examination of potential impacts to biophysical components, including an assessment of the likelihood and potential severity of any accidents or malfunctions over the lifespan of a project.

I-1 Water Resources

The Review Board has identified water resources 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 both the ecosystem and the local residents who depend on that ecosystem. This treatment will be necessary until such time as levels of arsenic contained within the water are reduced to what the developer has determined to be acceptable levels.

While conducting an impact assessment based on identified valued components, specific consideration shall be given to, but not be limited 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 impact contaminant levels in water resources both at the Giant Mine site and also in the surrounding area, including Great Slave Lake. A timeline should be included for such an event;
- 3) An examination of the potential effects of the 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 water quality should cover both inflows to the treatment process from (i) mine water and (ii) contaminated surface runoff and outflows from the treatment process 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;
 - c. A prediction of water quality and quantity in new water bodies that may form in abandoned, unfilled open pits. The developer should highlight 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 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; and
 - 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.

1-2 Fish and Aquatic Habitat

Potential effects to aquatic animals (fish) and their 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 & other harvesters of fish.

While conducting an impact assessment on fish, aquatic organisms and habitat for both, specific consideration shall be given, but not be limited, to:

- 1) The identification of any fish-bearing water bodies within the geographic scope including local lakes, Baker Creek and Yellowknife Bay (Great Slave Lake);
- 2) The potential effects of the development operations on the site's aquatic organisms and habitat;
- 3) 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;

- 4) The potential impacts to fish and fish habitat in Baker Creek resulting from the development, including the realignment/reconstruction of portions of the watercourse. Specifically, construction activities that could affect surface drainage patterns and the hydrology of Baker Creek. Further, any activities that could lead to the introduction of sediment (including contaminated sediments) into Baker Creek;
- 5) The potential impacts to fish and fish habitat from the ongoing offshore migration of fine tailings associated with historical tailings released into north Yellowknife Bay. The re-distribution of fine tailings deposited in the area could result in degradation to adjacent fish habitat and a reduction in benthic invertebrates;
- 6) 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/flow of Baker Creek which could lead to the potential for seasonal drying of portions of the creek, thereby reducing fish habitat; and
 - 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.
- 7) The potential impacts to fish and fish habitat in Baker Creek due to block freezing of Arsenic Trioxide dust in underground mine chambers. Particularly any ice-damming in sections of Baker Creek that may result form active freezing and could lead to in extensions to the time period when the creek is frozen thereby reducing habitat utilization and access to spawning habitat for fish.

I-3 Vegetation

Vegetation is very important to the general ecosystem health of the area. Animals and humans that consume 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 consume local vegetation such as rabbits or waterfowl, are also likely being harvested by local residents. It is important that vegetation be protected.

While conducting an impact assessment on vegetation, specific consideration shall be given, but not limited, 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 vegetation 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) Local plant life’s vulnerability to invasive species, and the likelihood that invasive species will be introduced;
- 7) A list of all mitigation required and committed to, to avoid significant impacts from the activities described above; and
- 8) A conceptual plan for the adaptive management of effects on vegetation, including any monitoring programs, as well as reporting to regulators and potentially-impacted communities.

I-4 Wildlife and Wildlife Habitat

While conducting an impact assessment based on wildlife valued components, specific consideration shall be given, but not limited, to:

- 1) The rationale and methodology for the selection of species as valued components, but the mandatory inclusion of the following species in the developer’s consideration:
 - a. (*SARA*-species) - Peregrine falcon;
 - b. Black bear;
 - c. Moose; and
 - 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, but not be limited to:

- a. Potential direct effects to habitat with a quantification of that effect for each valued component;
 - b. Potential indirect effects to habitat with a quantification of that loss/gain for each valued component;
 - c. Historic, current and expected wildlife use of potentially-contaminated water sources, and an assessment of the effects predicted from such activity;
 - d. Potential effects of contaminated fugitive dust on wildlife habitat;
 - e. Potential effects of altered water quality or quantity on health and distribution of animals, considering both steady long term exposure and abrupt higher level exposure resulting from a major malfunction of the development; and
 - f. Disruption, blockage, impediment and sensory disturbance, of daily or seasonal wildlife movements (e.g., migration, home ranges) due to the development activities or results;
- 3) The potential effects of the development operations on rare, threatened or endangered species including
- The *Species at Risk Act*-listed species noted above; and
 - consideration to species listed by the *Committee on the Status of Endangered Wildlife in Canada* and the *General Status Ranks of Wild Species in the NWT*; and
- 4) A conceptual wildlife management plan, including furbearers, migratory birds, waterfowl, large ruminants and large carnivores, in regards to ongoing monitoring of contaminant levels present in the ecosystem.

J 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. It is understood that the current layout will suffice in the near term but as we better understand future climates and the effectiveness of the freezing system, it may be possible that adaptations to the proposed the development may be needed at some point in the future.

The developer should treat this section as the most important section of the DAR, and as such ensure that their 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 the mechanics and methodology of the frozen block method, 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 and numbers of thermosyphons that will be necessary to achieve stability (stability being 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/factor of safety, in particular for the passive cooling system; and
 - e. A description of the method of installation of the infrastructure; and
 - f. Describe the scenario whereby the developer would deem the project complete, that is that the remediation activities have met the expectations of the developer in terms of reducing or eliminating the arsenic contamination arising from the Giant Mine.
- 2) A description of an adaptive management strategy that will use the data gathered during the initial freezing stages and refine the freezing system configuration based on performance monitoring, site climate, and improved understanding of future climate trends;
- 3) 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;
- 4) Will the frozen block method 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?
- 5) Has 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? Has the developer contemplated assigning resources to make it possible to periodically review

these questions?

- 6) Identify other instances of ground freezing technologies being used to isolate contaminants and provide a discussion of the challenges involved and how successful each situation may have been;
- 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/stability of the frozen block;
- 8) A discussion on potential thaw into the frozen block and its sustainability considering different scenarios, such as wild fires, developments (e.g. new infrastructures), warming of ground water, or changes in ground water flow regimes that may also influence the ground surface vegetation, hence the surface energy balance;
- 9) Demonstrate the longevity (>30 years) of the proposed cooling system by identifying other instances of successful long-term application of passive cooling systems, discuss the challenges involved, monitoring systems employed, maintenance efforts required, and why some systems had failed in the past;
- 10) Predict the risks and effects 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 discussion of any policy or guidelines that would be followed in the case of an accident or malfunction;
 - b. Present any emergency response plans that have been prepared or would be used in the case of an accident or malfunction of the development;
 - c. 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; and
 - d. A discussion of scenarios of partial failure of the active and/or passive freezing system addressing the time dependent risks associated with partial thawing of the frozen block;
- 11) How do climate change predictions / observations affect the risk level in the long-term based on “best estimate” and “high estimate” scenarios?
- 12) Identify potential effects of the frozen block on the additional remediation elements, in particular,

but not exclusive, on surface hydrology, tailings ponds consolidation and tailings covers.

K Environmental Monitoring

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. It was important to parties and to the Review Board that the developer fully answer questions related to the continuing monitoring of arsenic levels in water and sediments at the site and to the anticipated responses should these monitoring activities produce results that vary from the developers expectations. Please provide:

- 1) A detailed description of the monitoring program proposed by the developer, including at a minimum a description of:
 - a. Monitoring standards and requirements for water quality, ground temperature, ecological effects and sediment contamination;
 - b. A description of any technology used in the implementation of the monitoring activities;
 - c. A schedule of anticipated activities to implement the monitoring program;
 - d. A schedule of probable review of the efficacy of the proposed monitoring program and technologies used and a reevaluation of the goals and benchmarks of the monitoring program;
 - e. A description of efforts to engage with local communities in the development and implementation of monitoring activities;
 - f. The anticipated lifespan of active monitoring activities; and
 - g. 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; and
- 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.

L 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.

While it is beyond the scope of this environmental assessment to consider the impact of mining activities that were not the responsibility of this developer, the developer will be required to provide information on the issues presented in this section. 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) An analysis of the valued components to be considered in the cumulative effects assessment;
- 2) Consideration of all historic, present and future human activities at the Giant Mine site that may affect the same valued components as the development, or impact the implementation of the development. This should include
 - a. A discussion of what human activities were considered and a rationale for not including those that were discarded; and
 - b. A rationale for inclusion of those that were chosen for consideration.
- 3) Consideration of how any aspect of the development may impact present and future land uses in the area;
- 4) Identification and rationale for the geographic and temporal scale that will be applied to the cumulative effects assessment of the valued components under consideration, in recognition of the minimum geographic parameters set above;
- 5) Discussion of the approach and methodologies used to identify and assess cumulative effects. This shall include the provision of explicit documentation of the assumptions, models and information sources used, as well as information limitations and associated levels of uncertainty; and
- 6) A plan for the monitoring of cumulative effects and the adaptive management of the development's contribution to regional cumulative effects.

6 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:

- 10 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 not to exceed 5 MB in size and ideally with individual files being less than 3 MB in size (using only low resolution images);
- a concordance table that clearly cross-references the *Terms of Reference* with the impact statement as part of the DAR;
- 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 GNWT spatial data warehouse specifications;
- a non-technical summary of the DAR in English, Tlicho, Chipewyan, and French; and
- 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 when the developer is unclear about any of the requirements of this *Terms of Reference* document, and to seek clarification in writing.