INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #01**

Date Received

February 28, 2011

Linkage to Other IRs

YKDFN IR #09

Date of this Response

May 31, 2011

Request

Preamble:
The groundwater quality of Giant Mine has been assessed but never compared to guidelines and the DAR therefore does not report on the chemical quality of the groundwater. The DAR states that the groundwater concentrations measured on site are not compared to any guidelines as currently there are no regulatory criteria (guidelines) for groundwater in the Northwest Territories or the rest of Canada. The Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites were released by FCSAP in May 2010 for use on contaminated sites on federal land and should be used for comparison at Giant Mine.

Question:
Please compare the groundwater concentrations measured at Giant Mine to the Federal Interim Groundwater Quality Guidelines and provide the results of the chemical quality of the groundwater currently at the site. These guideline numbers should be used in the future to compare to sampled groundwater as well.

Reference to DAR (relevant DAR Sections)

DAR, s.7.2.4 Groundwater Quality

Reference to the EA Terms of Reference

TOR, s. 3.2.3 Description of the Existing Environment
TOR, s. 3.6 Monitoring, Evaluation and Management

Summary

The Giant Mine Remediation Plan (Remediation Plan) recommends parameters and their detection limits to allow for assessment of changes in the hydrogeochemistry due to remedial works or natural flushing due to groundwater movement over time. The results would be compared to historical data not the Interim Groundwater Guidelines for groundwater entering the receiving environment.

Response

The Interim Groundwater Quality Guidelines for federal contaminated sites as released by Federal Contaminated Sites Action Plan (FCSAP) in May 2010 apply to groundwater entering the receiving environment. The groundwater within the Giant Mine induced hydraulic capture zone reports to a water treatment plant before being discharged into the receiving environment. Currently no groundwater criteria apply to water reporting to the treatment plant.

However, detection limits were recommended in the Remediation Plan to allow for assessment of changes in the hydrogeochemistry due to remedial works or natural flushing due to groundwater movement. over time. These were presented in Table 7.1 of the Remediation Plan (SRK, 2007).

Table 7.1: Proposed Analyte List for Surface and Groundwater Samples

Parameter Name (Units)	Parameter Type	Detection Limit		Preparation Method		Test Method
Alkalinity ($mgCaCO_3$ eq/L)	physical	0.1		none		SM2320:B
Conductivity, Specific (S/cm)	physical	0.4		none		SM2510:B
pH	physical	0.05		none		SM4500-H:B
Solids, Total Dissolved (mg/L)	physical	10		GF/C Filt.		SM2540:C
Solids, Total Suspended (mg/L)	physical	3		GF/C Filt.		SM2540:D
Calcium (mg/L)	major ion	0.1		none		SM4110:B
Cation/Anion Balance (mg/L)	major ion	na		Major Ion Detection		Calculated
Chloride (mg/L)	major ion	0.7		none		SM4110:B
Electroneutrality (mg/L)	major ion	na		Major Ion Detection		Calculated
Magnesium (mg/L)	major ion	0.1		none		SM4110:B
Nitrate as Nitrogen (mg/L)	major ion	0.01		none		SM4110:B
Nitrite as Nitrogen (mg/L)	major ion	0.01		none		SM4110:B
Potassium (mg/L)	major ion	0.1		none		SM4110:B
Sodium (mg/L)	major ion	0.1		none		SM4110:B
Sulphate (mg/L)	major ion	1		none		SM4110:B
Ammonia as N (mg/L)	nutrient	0.005		none		SM4500-NH3:G
Nitrate + Nitrite as Nitrogen (mg/L)	nutrient	0.01		none		SM4110:B
Arsenate (µg/L)	other	5		none		SM3113:B
Arsenite (µg/L)	other	5		none		SM3113:B
Inorganic Carbon, Dissolved (mg/L)	other	0.5		GF/C Filtration		EPA415.1
Organic Carbon, Dissolved (mg/L)	other	0.5		GF/C Filtration		SM5310:B
Metals		**Total**	**Dissolved**	**Total**	**Dissolved**	
Aluminum (mg/L)	metals	0.03	0.0006	Acid Digest	(0.45 µm filt.)	EPA200.8
Antimony (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Arsenic (mg/L)	metals	0.0002	0.0002	Acid Digest	(0.45 µm filt.)	EPA200.8

Barium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Beryllium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Cadmium (mg/L)	metals	0.0001	0.00005	Acid Digest	(0.45 µm filt.)	EPA200.8
Caesium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Chromium (mg/L)	metals	0.0003	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Cobalt (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Copper (mg/L)	metals	0.0003	0.0003	Acid Digest	(0.45 µm filt.)	EPA200.8
Iron (mg/L)	metals	0.05	0.05	Acid Digest	(0.45 µm filt.)	EPA200.8
Lead (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Lithium (mg/L)	metals	0.0003	0.0002	Acid Digest	(0.45 µm filt.)	EPA200.8
Manganese (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Molybdenum (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Nickel (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Rubidium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Selenium (mg/L)	metals	0.001	0.0003	Acid Digest	(0.45 µm filt.)	EPA200.8
Silver (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Strontium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Thallium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Titanium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Uranium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Vanadium (mg/L)	metals	0.0001	0.0001	Acid Digest	(0.45 µm filt.)	EPA200.8
Zinc (mg/L)	metals	0.01	0.0004	Acid Digest	(0.45 µm filt.)	EPA200.8

Reference:

SRK Consulting Inc. 2007. *Giant Mine Remediation Plan*. Prepared for Indian and Northern Affairs Canada.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #03**

Date Received

February 28, 2011

Linkage to Other IRs

Date of this Response

June 17, 2011

Request

Please describe in the DAR the limitations of the land use at the end of the remediation program and what the land use is appropriate for. For example this land use is developed for areas where the primary activity involves the production, manufacture, or construction of goods, and little to no public access to the property is available. There will not be an appropriate level of protection on the remediated site for residential or parkland activities or protection for herbivores from ingestion of soil or contaminated forage.

Reference to DAR (relevant DAR Sections)

S.6.1.2 Summary of Post-Remediation Conditions

Reference to the EA Terms of Reference

S.3.2.4 Development Description

Response

The remediation of the surface land, where soils exceed industrial standards, will be to the GNWT's industrial standard for arsenic in soils and sediments, as set out in the *Environmental Guideline for Contaminated Site Remediation*. Portions of the surface lands already have soil arsenic concentrations below the industrial standards identified in the Guideline. Limitations on future use will be consistent with those set out in the Guideline and soil arsenic concentrations on site following remediation.

Future land use will also be restricted to those activities that will not interfere with or affect remediation efforts on site or any engineered remediation structures (e.g. tailing cap covers, freeze infrastructure, water treatment infrastructure).

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #04**

Date Received:

February 28, 2011

Linkage to Other IRs

Review Board IR #3.6
Review Board IR #8.2
Review Board IR #15.1

Date of this Response:

May 31, 2011

Request

Preamble:
There are currently an estimated 27,000 boreholes such as exploration drillholes on the site, most of which are potential pathways for groundwater movement. As one of the goals of the remediation effort is to minimize the potential for groundwater movement in order to both prevent contaminant movement and maintain frozen conditions in the subsurface, effort should be aimed at sealing the boreholes.

Question:
Please provide information describing activities aimed at decommissioning and/or sealing existing boreholes or provide an explanation as to why this will not be done.

Reference to DAR (relevant DAR Sections):

S.5.2.6 Boreholes

Reference to the EA Terms of Reference

S.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. . .

Summary

All known boreholes into the arsenic chambers and stopes have been sealed and any new holes in their vicinity will be sealed with grout once the activity in the area is completed. The likelihood that an unidentified borehole passing from the chamber to outside of the freeze wall will remain undetected and unsaturated is low. However, the slow moving water would eventually freeze and seal the borehole and any escaping water will be captured by the minewater collection system and treated.

Response

There are no plans to seal all boreholes in the mine area. There are numerous boreholes across the site for which there are no survey records. It is therefore impossible to guarantee that sealing the known holes will significantly reduce the potential for groundwater movement. Furthermore, the dominant flow paths through the flooded mine are expected to be the mine tunnels themselves, which are much larger and more laterally continuous than the drillholes.

All known boreholes into the arsenic chambers and stopes have been sealed with grout and any new holes in the vicinity will be sealed once all activities in the area are completed. The likelihood that an unidentified borehole passing from the chamber to outside of the freeze wall will remain undetected and unsaturated is low.

The possibility of water escape through such features is further discussed in the response to the Review Board's Information Request #8.2. If a borehole were present, there is a risk of a temporary increase in seepage rates of arsenic saturated water and release of arsenic trioxide sludge during the wetting of the dust. The quantity of seepage would be dependent on the chamber wetting method. Dissolved arsenic present in any seepage would be transported downward into the mine, collected in the mine-water system, and removed by the water treatment plant. As the rate of flow into the borehole would be governed by the dust hydraulic conductivity (measured to be $7x\ 10^{-7}$ m/s), the slow-moving water would freeze quickly and seal the borehole.

The response to Review Board's Information Request #15.1 adds "If unexpected leakage is detected and the frozen shell does not stop the flow, additional measures such as grouting may be reviewed and evaluated as part of the response plan. These cases will be addressed if they are encountered."

The response to the Review Board's Information Request #3.5 discusses the thermal loading from a long-term groundwater flowpath adjacent to a frozen block, and also indicates little or no risk.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #05**

Date Received

February 28, 2011

Linkage to Other IRs

Alternatives North IR #21

Date of this Response

May 31, 2011

Request

Preamble:
Geochemical testing of tailings samples was performed and yielded valuable information about the redox buffering capacity of the backfill. However, tests aimed at simulating mildly reducing conditions were not successful.

Question:
Please provide information on if there has been additional testing and attempts at this testing aimed at simulating mildly reducing conditions.

Reference to DAR:

DAR, s.5.2.2 Other Underground Arsenic Sources

Reference to the EA Terms of Reference

TOR, s. 3.2.3 Description of the Existing Environment

Summary

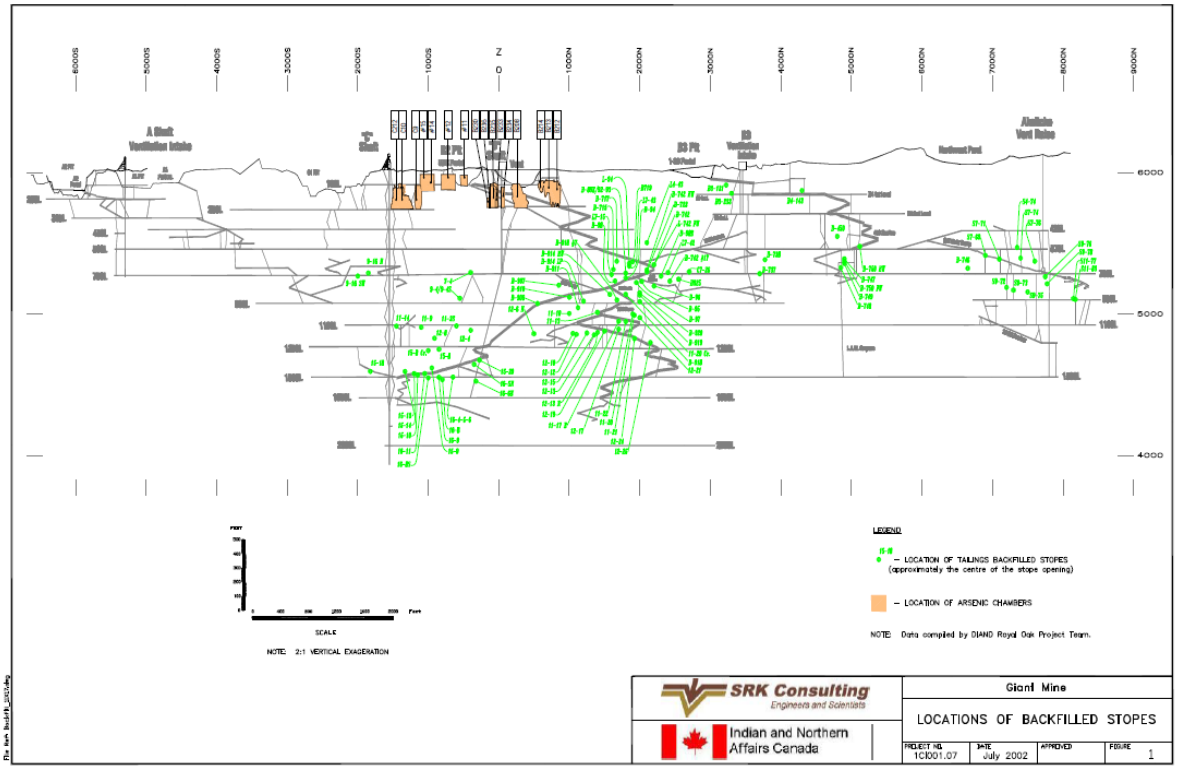
Impact of the backfilled stopes on mine water chemistry during the reflooding of lower levels of the mine was to be monitored using a Multilevel (MP) system installed in the shaft. However, these attempts to test the reducing conditions of the backfill have been unsuccessful.

Response

Impact of the backfilled stopes on mine water chemistry during the reflooding of lower levels of the mine was to be monitored using a Multilevel (MP) system installed in the shaft. The monitoring system was designed upon the assumption that water from the mine would be pumped out via a drill hole based pumping system located just south of the C-Shaft. The flow of mine water past the backfilled stopes and the C-Shaft to the pump inlet(s) would allow for sampling of water that had interacted with the backfilled stopes, as shown in the figure below from SRK, 2002.

However, changes in the mine water pumping system design led to it being located at the Akaitcho Shaft area. Therefore, water sampled by the C-Shaft MP system was not representative of water impacted by interaction with backfilled tailings, but rather more likely to represent water cascading down C-Shaft, or from the southern part of the mine (A-Shaft region).

As a result, the Remediation Plan continues to assume that contact with the backfilled tailings will cause the minewater to be sufficiently high in arsenic that it will need to be managed and treated indefinitely.



References:

SRK Consulting Inc., 2002, *Giant Mine Tailings Backfill.* Prepared for Indian and Northern Affairs Canada. (Giant Mine Arsenic Trioxide Management Alternatives – Final Report, Supporting Document 4b)

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #06**

Date Received:

February 28, 2011

Linkage to Other IRs

Review Board IR #3, #8
YKDFN IR #09

Date of this Response:

May 31, 2011

Request

Preamble:
The proposed frozen block method is aimed at minimizing and eventually eliminating the possible movement of groundwater from the arsenic dust chambers and other storage areas. In section 6.2.8.1, the proponent states that the large number of underground workings is expected to be the primary conduits for any groundwater flow that occurs. The current proposed remediation plan should incorporate long-term secondary mitigation for these possible preferential pathways for groundwater movement. For example, would it be technically feasible to seal off exit pathways (stopes, shafts and other mine workings) below and around the frozen zone to further prevent or minimize groundwater movement within the mine under dewatered and flooded conditions. In other words, even if there was incomplete freezing and contaminated water did escape from the frozen zone; it would not be flowing freely within the workings but would be further confined by features such as adit plugs or backfilled and grouted workings.

Question:
Please describe if there are plans for long-term secondary mitigation for these possible preferential pathways for groundwater movement.

Reference to DAR (relevant DAR Sections)

S.6.2.8.1 Influence of Groundwater

Reference to the EA Terms of Reference

S.3.3 Arsenic Containment

Summary

Bulkheads currently exist outside of all known openings to each arsenic chamber and stope. Prior to freezing, all drifts passing near to each chamber or stope will be plugged, and the plugs will be frozen as part of the "frozen shell" stage.

Mitigation measures include the installation of additional drift plugs, freeze pipes, or thermosyphons.

Response

The statement paraphrased in the preamble from Section 6.2.8.1 of the Developer's Assessment Report (DAR) (the large number of un-plugged underground drifts and other mine voids are expected to be the primary conduit for any flow) refers to areas away from the frozen blocks and not through the blocks. Further details regarding the influence of groundwater and thermal loading from open drifts are discussed in the response to Review Board Information Request #3.

All arsenic chambers are currently secured with bulkheads at all known openings to isolate them from the remainder of the mine. Prior to the initial freeze, all drifts outside each bulkhead will be backfilled with water-tight plugs to provide secondary containment and prevent the free movement of groundwater.

In the unlikely event of incomplete freezing, any leak is more likely to occur through an unidentified borehole, or through a crack that develops in the bedrock or a bulkhead. This scenario is discussed in the response to Review Board Information Request #8, which provides an assessment of the risks if the frozen wall does not seal off completely. Any leaks from the wetting of the dust would be collected by the mine water collection system.

Mitigation measures in the event of a leak from the chambers include the installation of additional drift plugs or the installation of additional freeze pipes or thermosyphons to provide additional cooling. Additional drift plugs could be constructed underground or remotely from surface. It is worth noting that a number of well-proven methods exist for plugging drifts and backfilling voids in underground mining.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #07**

Date Received

February 28, 2011

Linkage to Other IRs

Alternatives North IR #12

Date of this Response

May 31, 2011

Request

Preamble:
An array of survey beacons is in place to monitor movement of a test cover plot of 32 m^2. Cover movement will be a function of the cover materials and the geotechnical characteristics of the underlying tailings and foundation materials (fine grained vs coarse grained, degree of saturation, freeze-thaw cycles). It has been observed at many mine sites in northern environments that the tailings surface can change significantly with time through heaving, frost action, weathering, erosion, etc. Therefore, determining tailings characteristics throughout the impoundments and monitoring movement of the tailings surface over time may provide valuable information about zones of concern and zones of greater movement.

Question:
Please indicate if there is currently and/or will be a surveying program to examine the current rate and patterns of tailings surface movement.

Reference to DAR:

DAR, s.5.5.2.5 Test Tailings Cover Plots

Reference to the EA Terms of Reference

TOR, s. 3.6 Monitoring, Evaluation and Management

Summary

Tailings surfaces will be surveyed as part of final design of the cover system, and probably during and immediately after construction. Particular areas may also require several years of post-construction surveying. But, The Giant Mine Remediation Project (Remediation Project) has no plans for comprehensive and continuing surveys of the covered tailings.

Response

Outside of the test cover areas, there is currently no surveying program to examine rates and patterns of tailings surface movement at Giant Mine.

There are portions of the proposed tailings covers that will warrant several years of post-construction surveying. Portions of the Northwest Pond where drainage swales and channels need to cross soft tailings are an example. However, while it is true that heaving, frost action, weathering and erosion of tailings surfaces have been observed at other northern mines, these processes have not generally created any new risks to the environment or people. Therefore, the Remediation Project has no plan for comprehensive and continuing surveys of the covered tailings surfaces.

There are cases where particular types of tailings surface movement have led to localized problems. At the Beaverlodge Mine in northern Saskatchewan, for example, groundwater and frost action caused radioactive tailings to bubble upwards through a coarse rock cover. The covers proposed for the Giant Mine are designed to prevent that from occurring. But the case is illustrative because the resulting tailings boils were noted in routine inspections. An intensive program of investigation was then focused on the boil areas, allowing appropriate repair measures to be designed and completed. A program of regular comprehensive surface surveys would not have helped and in fact probably would have directed attention away from the real problem.

It is expected that comprehensive surveys will be required for final design of the tailings regrading and covers. Surveys will also be required during tailings cover construction and at completion of the construction. The design and construction surveys will provide a baseline against which future movement could be compared, in the event that such movement does lead to significant risks.

Further information on monitoring is addressed in the response to Alternatives North Information Request #12.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: EC #08**

Date Received

February 28, 2011

Linkage to Other IRs

Date of this Response

June 17, 2011

Request:

Preamble:
The DAR states that underground mine water flow is controlled by climatic conditions and that the Northwest Pond represents the largest input of seepage into the mine.

Question:
Please provide monitoring data from the underground sampling locations to support this statement and to illustrate changes in flow over time.

Reference to DAR (relevant DAR Sections)

S.5.7.1 Underground Mine Water

Reference to the EA Terms of Reference

S.3.2.3 Description of the Existing Environment

Summary

Data collected between 1998 and 2004 indicate a constant seepage of approximately 800 m^3/day from Northwest Pond.

Response

Seepage rates from Northwest Pond to the underground workings were assessed by Golder Associates as part of the tailings management plan for the Giant Mine when operated by Royal Oak Mines. At the time, the seepage losses were estimated to be 698 m^3/day (Golder, 1999). This estimate was based on surveyed water levels taken between January and April 1998, during which time evaporation and

precipitation losses/gains would be zero. The measured tailings and water volume added to the pond was compared to the storage capacity curve for the Northwest Pond and used to determine seepage losses.

This work was updated in 2002 (SRK, 2002). Infiltration to the mine was estimated based on measurements of mine water flow in the ditches during the mid-winter months when frozen ground conditions would prevent infiltration except under large water bodies such as the Northwest Pond. Results of this study estimated a range of 220 to 700 m^3/day seeping in from the pond.

Additional mine water flow data collected between April, 2001 and December, 2004 revised the direct seepage estimate from Northwest Pond to 800 m^3/day. This value correlates well with the two previous estimates of 698 m^3/day and (up to) 700 m^3/day.

References:

Golder Associates Ltd., 1999. *Tailings Management Plan, Giant Mine, Yellowknife, NWT.* Report No. 982-2449 submitted to Royal Oak Mines Inc. January 1999.

SRK Consulting Inc., 2002. *Giant Mine Hydrogeology*. Prepared for Indian and Northern Affairs Canada. (Giant Mine Remediation Plan Supporting Document C1).

SRK Consulting Inc., 2002. *Update to Supporting Document 2.* Prepared for Indian and Northern Affairs Canada. (Giant Mine Remediation Plan Supporting Document C2).

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #09**

Date Received:

February 28, 2011

Linkage to Other IRs:

Date of this Response:

May 31, 2011

Request

Preamble:
There is deep saline groundwater that enters the lower levels of the mine workings.

Question:
Please provide information describing any issues associated with this salinity in terms of water treatment.

Reference to DAR (relevant DAR Sections):

S. 5.7.1.1 Minewater Quality

Reference to the EA Terms of Reference:

S.3.2.3

Summary

Mine water salinity will not affect the proposed treatment process.

Response

Mine water is pumped to the Northwest Pond, and the following table summarizes the concentration of solutes in the pond.

Parameter	Concentration [mg/L]	
	Minimum	Maximum
Dissolved Calcium	155.0	451.0
Total Calcium	156.0	431.0
Dissolved Magnesium	43.0	101.0
Total Magnesium	43.5	99.4
Dissolved Potassium	5.9	15.0
Total Potassium	6.1	15.1
Dissolved Sodium	57.7	195.0
Total Sodium	57.7	195.0
Chloride	115.0	161.0
Sulphate	617.0	617.0

Based on the above data, it is anticipated that the concentration of solutes in the mine water will not affect the proposed process. A slight reduction of the metal salt content should be realized via precipitation during pH adjustment.

Sulphates will increase the scaling potential of the water treatment equipment. This will need to be addressed through proactive operation and maintenance procedures.

It should be noted that the saline properties of the mine water currently does not appear to affect the existing water treatment plant's ability to reduce arsenic levels.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #10**

Date Received:

February 28, 2011

Linkage to Other IRs:

Date of this Response:

May 31, 2011

Request

Preamble:
Treated water from the site is currently discharged to Baker Creek during the open water season. It is proposed that the effluent discharge point be relocated to a diffuser outfall which will be constructed in Yellowknife Bay. It is noted in the DAR that this will change the hydrogeological regime of Baker Creek.

Question:
Please describe any significant negative effects expected from this activity in terms of the reduction in summer flows.

Reference to DAR (relevant DAR Sections):

S.6.1.2 (Summary of Post-Remediation Conditions)

Reference to the EA Terms of Reference

S. 3.5.2 (Fish and Aquatic Habitat)

Summary

The Giant Mine Remediation Project (Remediation Project) is anticipated to result in overall improvements to the environment of Baker Creek. In particular, shifting the treated minewater discharge point from Baker Creek to Great Slave Lake will reduce chemical loadings to the creek. Although this may result in Baker Creek drying up during the summer months, this is not viewed as an adverse effect because flows within the creek will be returned to a more natural condition (both in terms of chemical quality and hydrology). A comprehensive monitoring program will be put in place to verify the performance of the Remediation Project in this regard.

Response

As indicated in Section 8.4.2.3 and Table 8.4.2 of the DAR, the remediation plan will result in a net improvement in hydrological conditions by returning Baker Creek to a more natural condition (i.e., by stopping the current practice of discharging treated minewater to the creek). In addition, while the design of Baker Creek has yet to be finalized, elements of the naturalized creek are anticipated to include channel modifications to create new aquatic habitat, to carry peak flood events and to reduce the potential for water discharges to underground mine workings. These proposed changes are similar to those that were successfully implemented during the rehabilitation of Baker Creek's Reach 4 that occurred in 2006 and 2007.

Potential effects on aquatic habitat and biota of changing hydrology are described in Section 8.7.2.3 of the DAR. The elimination of the volumetric flows associated with the current treated minewater discharge to Baker Creek warrant consideration. This is particularly important during late summer months when, based on current conditions, the discharge of treated minewater often represents the majority of flow within the creek. As indicated in Table 8.7.2 of the DAR, it was concluded that flows associated with the current discharge to the creek are not relevant to Arctic grayling use of the creek as spawning habitat. A similar relationship is expected to apply to other spring spawners such as longnose and white suckers, and northern pike. However, there is a potential that benthic invertebrates, resident fish species (e.g., nine-spine stickleback) and any species spawning late in the summer would be affected during years in which natural flows reduce to low levels following movement of the discharge point. This is not considered to be an adverse Project effect because the creek will be returned to a more natural condition.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #11**

Date Received

February 28, 2011

Linkage to Other IRs

Date of this Response:

May 31, 2011

Request

Please confirm that all samples will be sent to an accredited laboratory.

Reference to DAR (relevant DAR Sections):

S. 14

Response

All samples will be processed in accordance with established industry and regulatory practices. This would include appropriate accreditations of laboratories.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #12**

Date Received:

February 28, 2011

Linkage to Other IRs:

Date of this Response:

May 31, 2011

Request

EC requests that the proponent provide all input and control files used in the ISCST3 model to generate the air quality predictions presented in the DAR. All files should be in a format that can be used directly into the model. Please include all output files in the raw format.

Reference to DAR (relevant DAR Sections):

S.8.6.2 Air Quality

Reference to the EA Terms of Reference:

S. 3.6 Monitoring, Evaluation and Management

Summary

Files provided as requested.

Response

Copies of all input and control files used in the ISCST3 model to generate the air quality predictions presented in the Developer's Assessment Report were provided as separate electronic data files to Environment Canada on May 6, 2011.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #13**

Date Received:

February 28, 2011

Linkage to Other IRs:

Date of this Response:

May 31, 2011

Request

EC requests that the proponent provide a table of all emissions estimates used in the air quality modeling, and emission calculations including emission factors, load factors and any other assumptions used in the emission estimates. Please include the assumptions used to calculate arsenic emissions.

Reference to DAR (relevant DAR Sections):

S.8.6.2 Air Quality

Reference to the EA Terms of Reference

S. 3.6 Monitoring, Evaluation and Management

Summary

Information provided as requested.

Response

All requested information on emissions estimates used in the air quality modeling, and emission calculations including emission factors, load factors and any other assumptions used in the emission estimates has been provided in a separate electronic file.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #14**

Date Received

February 28, 2011

Linkage to Other IRs

Environment Canada IR #12, 13

Date of this Response

June 17, 2011

Request

***Question**:*

1. Environment Canada requests the following:
   a. A map of all of the gridded and discrete receptors including spatial extent and density used in the air quality modeling;
   b. An assessment of the potential air quality impacts from the increased load on the Jackfish Power Plant as a result of the project power demand; and
   c. Total area of exceedance outside the disturbed mine site for each species assessed.

2. *(Supplemental question from Environment Canada)*
   The DAR and the response to Question 1 both evaluated the air quality implications of emissions associated with the incremental power requirements of the Remediation Project (i.e., 3 MW of electricity produced by the Jackfish Power Plant).

   Through direct communications with INAC, Environment Canada subsequently requested that an additional round of dispersion modeling be conducted to evaluate NOx concentrations in the event the Jackfish Power Plant is operated at its total generating capacity (i.e., a total of 27 MW of electricity instead of the incremental 3 MW of demand associated with the Remediation Project).

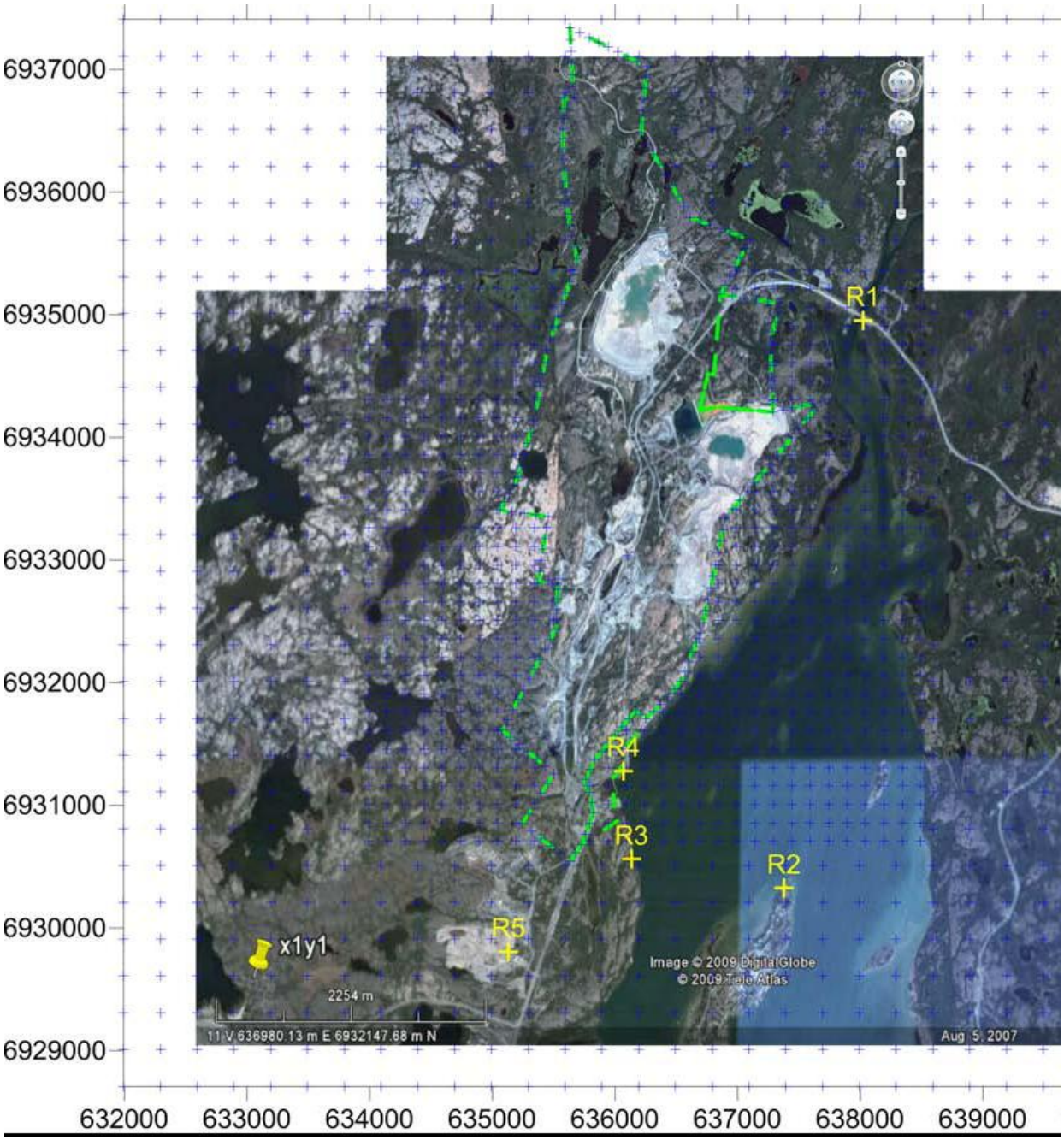
Reference to DAR (relevant DAR Sections)
s.8.6.2 Air Quality

Reference to the EA Terms of Reference
s 3.6 Monitoring, Evaluation and Management

Response 1a

Please refer to Figure 1 below. The gridded modeling locations, which are indicated by a "+" on the figure, were on a 150 m by 150 m spacing interval.

Figure 1 – Map of Gridded and Discrete Receptors Used in Air Quality Modeling (150 m spacing)



Response 1b

As noted in Section 8.6.2.3 of the Developer's Assessment Report (DAR), the assessment of potential air quality impacts from the 3 MW of incremental load on the Jackfish Power Plant as a result of the Giant Mine Remediation Project (Remediation Project) has already been included in the DAR. An example of the calculations used in the assessment is provided below.

Source: Jackfish Power Plant 3MW Diesel Generator Combustion Emissions

The AP-42 Chapter 3.4 - Large Stationary Diesel Engines, Table 3.4-1 outlines emission factors for diesel combustion in internal combustion engines greater than 600 hp. The input capacity of the diesel generator is as follows:

3 MW = 4023 hp
4023 hp

Sample Calculations:

Below is a sample calculation for NOx emissions from the diesel generator

NOx Emission =
$$power(hp)\times\frac{0.024lb}{hp-hr}\times\left(\frac{1hr}{3{,}600\sec}\right)\times\left(\frac{1kg}{2.2lb}\right)\times\left(\frac{1000g}{kg}\right)\times 45\%\,NO/NO_2\ Ratio$$

Emission Rate =
$$4023(hp)\times\frac{0.024lb}{hp-hr}\times\left(\frac{1hr}{3{,}600\sec}\right)\times\left(\frac{1kg}{2.2lb}\right)\times\left(\frac{1000g}{kg}\right)\times 45\% = 5.486\,gNOx/\sec$$

The following table outlines the emission rates for Diesel Generator emissions:

Source ID	Description	Power Rating (hp)	Contaminant	Emission Factor (lb/hp-hr)	Emission Rate (g/s)
DG	Yellow Knife Diesel Generators	4,023	NOx	0.024	5.486
			$PM_{2.5}$	0.0007	0.356
			CO	0.0055	2.794
			SOx	0.00006 *	0.031

Note: * Golder Assumption of 0.0485% sulphur and half is converted to SO2

Response 1c

Total area of exceedance outside the disturbed mine site for each species assessed:

Parameter	Averaging Period	Area of Off-Property Exceedances
Arsenic	24-hr	0.02 km²
Particulate Matter	24-hr	0.13 km²
PM_{10}	24-hr	0.68 km²
$PM_{2.5}$	24-hr	0.93 km²
NO_2	1-hr	0.40 km²
SO_2	1-hr	0.04 km²

Note: Other contaminants and averaging periods not listed were not predicted to have off-site exceedances of applicable criteria.

Response 2 Summary

The current screening level assessment by SENES determined that the Remediation Project would be a relatively small contributor to total nitrogen dioxide concentrations at the receptor locations if the Jackfish Power Plant is simultaneously operated at full capacity. However, consistent with a previous study for the Northwest Territories Power Corporation (NTPC) (Golder 2002), the current assessment also concluded that the operation of the Jackfish Power Plant at full capacity may result in exceedances of the 1-hour NO_2 Ambient Air Quality Criteria under certain meteorological conditions. The conclusions reached in both assessments could be refined by conducting a more detailed assessment of the NTPC facility. Such an assessment is not within the scope of the current Environmental Assessment (EA).

Response 2

As noted in the response to Question 1, the approach used in the DAR was to include Jackfish Power Plant emissions associated with the 3 MW of incremental load requirement for the Remediation Project. The assumption was that diesel generator emissions associated with other electrical production requirements from the Jackfish Power Plant would be included in existing background concentrations, which were added to model predicted contaminant concentrations. Background contaminant concentrations were developed from the air quality monitoring station located adjacent to École Sir John Franklin High School (ÉSJFHS) in central Yellowknife, which is closer to the Jackfish Power Plant than the Giant Mine Site.

During the Information Request (IR) process, Environment Canada requested that additional air dispersion modelling be performed based on the assumption that the Jackfish Power Plant is operating at its maximum rated capacity of 27 MW, not just the incremental 3 MW power requirements for the freeze plant. The supplemental Environment Canada request provides an example for NO_x emission rates, which is the primary contaminant of concern from the combustion of diesel fuel. The current IR response therefore focuses on determining NO_x emissions under a scenario in which the Jackfish Plant is operating at full capacity.

Estimating NO_2 Emissions From Diesel Generators

NO_x is a combination of NO_2 and NO, however, ambient air quality criteria are based on NO_2 concentrations. When discharged into the atmosphere, NO will oxidize with available ozone (O_3) under certain meteorological conditions to form NO_2 (and O_2). When carrying out air dispersion modelling to estimate ground level NO_2 concentrations resulting from diesel generator NO_x emissions, it is important to consider the ratio of NO_2 in total NO_x emissions. There are two common methods for estimating ground level NO_2 concentrations: (1) applying a NO_2 / NO_x ratio to modelled NO_x concentrations based on NO_2 and NO monitoring data; and, (2) allowing an air dispersion model that includes chemical

conversion to calculate NO_2 concentrations based on monitored ozone concentrations available for the conversion of NO to NO_2. The first approach was used in the DAR, based on NO_2 and NO monitoring data from the ÉSJFHS monitoring station, resulting in a NO_2/NO_x ratio of 45%. In general, the second method is considered to be the most realistic (if sufficient data for modelling parameters are available), while the first method is more conservative because the assumption is that NO emitted from the diesel generator stack will react quickly to form NO_2 in ratios typically measured at the monitoring site.

Previous Studies of Diesel Generator Emissions From the Jackfish Power Plant

A separate study was completed by Golder Associates for the NTPC to determine potential health risks related to atmospheric emissions from their facilities, including the Jackfish Power Plant (Air Quality and Health Assessment for NTPC Generating Stations, Golder Associates, December 2002). This report was provided to SENES by NTPC during the preparation of the DAR to be used to develop diesel generator stack details at the Jackfish Power Plant, which are required for air dispersion modelling. In the Air Quality and Health Assessment completed for NTPC, the CALPUFF air dispersion model was used to estimate ground level NO_2 concentrations resulting from the Jackfish Power Plant based on monitored ozone concentrations. The report concluded that 1-hr exceedances of NO_2 criteria may be expected and that further assessment would be required to obtain a more accurate estimate of NO_x emissions and model predicted NO_2 concentrations resulting from Jackfish Power Plant operations. The maximum predicted 1-hour ground level NO_2 concentrations from the Jackfish Power Plant was 1,922 $\mu g/m^3$.

Assessment of Total Emissions from Diesel Generators at the Jackfish Power Plant

In response to the supplemental request from Environment Canada, SENES conducted a screening level modelling of NO_x emissions from the Jackfish Power Plant for three different scenarios:

Scenario 1. Worst case Giant Mine remediation activities with 3 MW of incremental power for the freeze plant (as presented in the DAR);

Scenario 2. Maximum operations of the Jackfish Power Plant minus 3 MW incremental power for the freeze plant (i.e., 27 MW maximum operations minus 3 MW incremental power = 24 MW). This scenario is intended to represent "maximum baseline" conditions for scenario 3; and,

Scenario 3. Worst case Giant Mine remediation activities and maximum operations of the Jackfish Power Plant (i.e., 27 MW, which would include the 3 MW consumed by the freeze plant).

A comparison of model results for scenarios 1 and 2 with the results for scenario 3 was used to differentiate between the impacts resulting from Giant Mine remediation activities versus the impacts resulting from maximum operations at the Jackfish Power Plant.

Model results are presented in the tables below for six (6) receptor locations: the five (5) sensitive receptors identified in the DAR and ÉSJFHS, which is the location of the Environment Canada monitoring station used to develop background concentrations for NO_2.

TABLE 1
MODEL PREDICTED 1-HOUR NO_2 CONCENTRATIONS

Receptor	Scenario 1.	Scenario 2.	Scenario 3.
	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
R1 - Yellowknife River Park	98	742	834
R2 - N'Dilo Residential Receptor	127	499	560
R3 - Back Bay Residential Receptor	150	1157	1301
R4 - Boat Launch Recreational Receptor	194	1135	1276
R5 - Municipal Landfill Receptor	220	1714	1928
R6 - Sir John Franklin High School	156	1206	1357
NAAQO	**400**		
Background	**6**		

Note: NAAQO – National Ambient Air Quality Objective (NWT does not have an Air Quality Standard for NO_2; therefore, national objectives are used.)
Background concentration for NO_2 from the DAR; estimated as median 2005/2006 values from the Sir John Franklin High School.

TABLE 2
MODEL PREDICTED 24-HOUR NO_2 CONCENTRATIONS

Receptor	Scenario 1.	Scenario 2.	Scenario 3.
	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
R1 - Yellowknife River Park	14	71	79
R2 - N'Dilo Residential Receptor	15	65	72
R3 - Back Bay Residential Receptor	16	85	95
R4 - Boat Launch Recreational Receptor	29	156	179
R5 - Municipal Landfill Receptor	29	193	217
R6 - Sir John Franklin High School	44	313	351
NAAQO	**200**		
Background	**6**		

Note: NAAQO – National Ambient Air Quality Objective (NWT does not have an Air Quality Standard for NO_2; therefore, national objectives are used.)
Background concentration for NO_2 from the DAR; estimated as median 2005/2006 values from the Sir John Franklin High School.

The results presented in Tables 1 and 2 indicate that the primary source of ground level nitrogen dioxide concentrations at the receptor locations is anticipated to be the Jackfish Power Plant (assuming it is operating at full capacity). Table 1 also predicts that exceedances of the 1-hour NO_2 Ambient Air Quality Criteria (AAQC) may occur. However, it should be noted that the results presented in Tables 1 and 2 are considered conservative based on SENES' assumption that NO emitted from the diesel generator stack will react quickly to form NO_2 in ratios measured at the ÉSJFHS monitoring site (NO_2/NO_x ratio of 45%). It should also be noted that SENES model predicted 1-hour NO_2 concentrations in the vicinity of the Jackfish Power Plant (approximately 2,680 $\mu g/m^3$) are comparable to those predicted by Golder Associates in their December 2002 assessment.

The conservative nature of this NO to NO_2 conversion assumption can also be demonstrated based on a comparison of the model predicted NO_2 concentrations at Sir John Franklin High School with monitoring results at the same location. Monitoring results at the ÉSJFHS monitoring station from 2005 and 2006 indicate a maximum 1-hour NO_2 concentration of 103 $\mu g/m^3$ (55 ppb) (data is available from: http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html), compared to the model predicted

maximum concentration of 1,206 µg/m^3 (based on 24 MW power production from the Jackfish Power Plant). This order of magnitude difference can be primarily attributed to two factors:

1. The conservative assumption for the conversion of NO to NO_2 outlined above; and,
2. The Jackfish Power Plant does not typically operate at full capacity, whereas modelling for Scenario 2 is based on the assumption that 24 MW of power are generated continuously 365 days of the year 24 hours/day to ensure that the worst case operating scenario corresponds with the worst case meteorological conditions. The Jackfish Power Plant likely did not operate at 24 MW power production during the worst case 1-hour meteorological conditions in 2005 and 2006.

The conclusions reached in the current evaluation, as well as the previous study for the NTPC, could be refined by conducting a more detailed assessment of the NTPC facility. Such an assessment is not within the scope of the current EA.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: EC #15**

Date Received:

28 February, 2011

Linkage to Other IRs:

YKDFN IR #11
YKDFN IR #12

Date of this Draft:

May 31, 2011

Request

Preamble:
Chapter 14 outlines the Environmental Monitoring and Evaluation Framework (EMEF) and a Long-term Environmental Monitoring Program to meet the Terms of Reference established for the Giant Mine Remediation Project EA. The owner or operator of a mine is required to conduct environmental effects monitoring studies as a condition governing authority to deposit under the Metal Mining Effluent Regulations (MMER). No mention is made of environmental monitoring requirements under the MMER in Chapter 14.

Question:
Please provide information on effluent, water quality and biological monitoring that will be conducted to meet the requirements specified in the MMER of the Fisheries Act for environmental effects monitoring studies, and how the federal monitoring requirements fit into the EMEF and Long-term Environmental Monitoring Program.

Reference to DAR (relevant DAR Sections):

s. 14 Environmental Monitoring and Evaluation Framework and Long-Term Environmental Monitoring

Reference to the EA Terms of Reference:

s. 3.6 Monitoring, Evaluation and Management

Summary

The effluent and water quality monitoring will occur as required under part 1 of the Metal Mining Effluent Regulations (MMER).

As much as possible the Giant Mine Remediation Project Team (Project Team) intends to harmonize the MMER requirements with the water licencing requirements (e.g. one report).

This will also be part of the long term environmental monitoring program to be developed under the Environmental Monitoring and Evaluation Framework (EMEF) and the Environmental Monitoring System (EMS) as described in Chapter 14 of the Developer's Assessment Report (DAR).

The Project Team is committed to involving stakeholders and the public in the design and implementation of the monitoring program.

Response

The effluent and water quality monitoring will occur as required under part 1 of the MMER. If the concentration of effluent in the exposure area is greater than 1% in the area located within 250 m of the final discharge point, a study on fish populations and benthic invertebrates will be conducted.

As much as possible the Project Team intends to harmonize the MMER requirements with the water licencing requirements (e.g. one report). This will also be part of the long term environmental monitoring program to be developed under the Environmental Monitoring and Evaluation Framework (EMEF) and the Environmental Monitoring System (EMS) as described in Chapter 14 of the Developer's Assessment Report (DAR). The Project Team is committed to establishing an EMEF which can monitor and evaluate environmental protection and regulatory responsibilities throughout the remediation of Giant Mine. The Giant Mine Remediation Project will use the EMEF to establish the blueprint for how environmental protection and regulatory responsibilities will be monitored and evaluated throughout the stages of remediation.

The EMS is intended to include all of the monitoring programs that will be established in response to Review Board recommendations, relevant regulatory requirements from the Mackenzie Valley Land and Water Board and other regulators, and input from potentially affected parties. The details of the individual monitoring programs will not be fully developed and finalized until the final project design is completed and the project moves to the regulatory stage. As this information becomes available it will be shared through the means and mechanisms described in the DAR (e.g. DAR Chapter 13).

The Project Team is committed to involving stakeholders and the public in the design and implementation of the monitoring program. It will be done in a manner that is transparent and fair and meets the other principles listed in the response to Review Board IR #27 including credible, adaptive and inclusive. The Project Team will certainly involve Environment Canada in the future discussion on the EMS.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #16**

Date Received:

February 28, 2011

Linkage to Other IRs:

Alternatives North IR #14
Review Board IR #24

Date of this Response:

May 31, 2011

Request:

Preamble:
Year-round discharge of treated effluent into Yellowknife Bay is proposed, and three potential discharge locations have been identified. The DAR states that "Further investigation of alternative diffuser locations…is still required".

Two factors that need to be included in further studies are the effects of the diffuser under varying ice thicknesses and sediment disturbance due to turbulence associated with the diffuser. Ice thickness would be a factor in reducing the dilution at trapping depth, and it did not appear that this was taken into account. With respect to the sediment disturbance, we note that two of the locations (1 and 3) are within the area that was contaminated by historic tailings, with arsenic concentrations greater than 1000 mg/kg, and Location 2 appears to be outside the submerged historic tailings.

Question:
Please outline what factors will be considered in the investigation, and how they will be weighted in the decision-making process. How will the proponent ensure that there will not be issues with varying ice thickness, and mobilization of contaminants through disturbance of existing sediments? What is the timeline for finalizing the diffuser location and design?

Reference to DAR (relevant DAR Sections):

S. 6.8.6 Outfall and Diffuser

Reference to the EA Terms of Reference:

S.3.2.3.6
S.3.2.4.9

Summary

Effluent mixing in Yellowknife Bay will be modeled for several scenarios encompassing the characteristics of the effluent and ambient waters, and will include ice thickness as a factor reducing mixing depth. Effects of the effluent on ice thickness and bottom sediment will be addressed.

Response

Effluent mixing in Yellowknife Bay will be dependent on the characteristics of the effluent (density, chemistry, discharge velocity, volume of discharge) and ambient waters (depth, current velocity, density, chemistry). These characteristics are considered in the mixing model used for the project (CORMIX). Observed site conditions will be utilized to develop several scenarios to describe and bracket the range of possible depths and current velocities in Yellowknife Bay. The CORMIX model will be implemented for these scenarios to predict effluent dilution in the near field. Several diffuser configurations will be tested. The diffuser configuration selected for design will be one that meets the required water quality criteria within the mixing zone under all design scenarios, while minimizing the size of the mixing zone.

Other considerations for the design of the diffuser are as follows:

- Guidelines and strategies on effluent quality criteria proposed in the Water and Effluent Quality Management Policy by the Mackenzie Valley Land and Water Board (MVLWB 2011);
- A conservative ice thickness, obtained from observations in the Bay (*i.e.,* 1.5 m), will be considered for at least one of the design scenarios developed for the site to determine the performance of the diffuser under the reduced mixing depths (due to ice) during the winter;
- Preliminary thermal modelling using CORMIX will be conducted to determine the effects of the discharge on ice thickness. It is expected that the effects on ice thickness will be minimal primarily due to the low temperature of the effluent during the winter months; and
- The diffuser exit ports will be located above the bottom of the bay (1 to 1.5 m above) to minimize sediment entrainment.

A draft of the preliminary diffuser design is expected in the fall of 2011. Analyses will be conducted during the detailed design stage to confirm the optimum diffuser port geometry (*i.e.,* number of ports, diameter, port angle and height above the bottom of the bay) that meets water quality guidelines and minimizes impacts on the ice cover and bottom sediments.

Mackenzie Valley Land and Water Board (MVLWB). 2011. Water and Effluent Quality Management Policy. MVLWB, Yellowknife.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #17**

Date Received:

February 28, 2011

Linkage to Other IRs

YKDFN #11, 12
Alternatives North IR #14

Date of this Response:

May 31, 2011

Request

Preamble: The DAR notes that regulatory compliance for arsenic will be to the Metal Mining Effluent Regulations (MMER) concentrations, with maximum monthly mean values of 0.5 mg/L and maximum grab concentration of 1.0 mg/L. The DAR states that the longterm average discharge concentration of 0.2 mg/L is achievable. The 2005 Senes report states that with the treatment option of oxidation and direct precipitation with iron, a well operated plant could meet an average discharge level of about 0.1 mg/L arsenic. Discharge effects predictions have been based on an annual average of 0.2 mg/L arsenic, and 0.4 mg/L maximum monthly average concentration.

The DAR does not propose ammonia be monitored in the effluent, however increasing the water levels in the mine workings may result in an initial increase in ammonia. Water quality and toxicity testing results may be affected by this.

Question: What discharge limits does the proponent anticipate meeting for the currently regulated list of parameters? The MMER provide minimum national standards, and represent discharge levels that have not been evaluated in this assessment and that would not be deemed desirable for year-round discharge to Yellowknife Bay.

Will effluent be non-toxic at end of pipe, given the TDS, arsenic, and ammonia? Please provide an assessment of the potential for increases in ammonia to compromise water quality results and affect predictions.

Reference to DAR (relevant DAR Sections):

DAR, s. 6.8.6 Outfall and Diffuser
DAR, Figure 6.8.2
SENES Report August 2005 Water Treatment Update – Giant Mine Remediation Plan, p 5
DAR, Table 14.2.6

Reference to the EA Terms of Reference

s. 3.2.4. Development Description

Summary

The expected effluent quality from the new Water Treatment Plant (WTP) is provided in the response to Alternatives North IR #14. The Mackenzie Valley Land and Water Board (MVLWB) will ultimately decide on the effluent quality criteria in a future water licence for the WTP.

The analyses completed by SENES in 2006 included an upper bound scenario that modeled a 30% increase in arsenic loading from all sources, which is equivalent to a discharge of 0.52 mg/L from the WTP. The upper bound scenario resulted in an increase of only 0.0002 mg/L in arsenic levels in North Yellowknife Bay.

Acute toxicity testing will be carried out on effluent from the new WTP. Since the new WTP is expected to produce better quality effluent than the current plant and the current effluent is non-toxic at the end of pipe, the same is expected from the new WTP.

Ammonia has not been an issue in mine water or surface water at site over the past 10 years. There is no expectation for this to change. The management of ammonia will be part of the Environmental Management System in order to minimize loading to the mine water.

Response:

It is the Project Team's intention to design a Water Treatment Plant (WTP) that will produce a higher quality effluent (i.e. lower concentrations of contaminants) than the minimum national standard listed in the Metal Mining Effluent Regulations (MMER). A detailed listing of the expected effluent quality has been provided in the response to Alternatives North IR #14, question 1. Ultimately, the Mackenzie Valley Land and Water Board (MVLWB) will establish effluent quality criteria within its water license granted to the Project Team for discharge from the Giant Mine WTP. The water quality objectives to be met at the edge of the mixing zone consist of drinking water quality criteria and Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment (CCME)) criteria for the protection of freshwater aquatic life, or being within 10% of ambient water concentrations (i.e., when ambient concentrations of a given substance is above drinking water and CCME criteria). These criteria incorporate arsenic.

Environment Canada correctly noted that the DAR did not explicitly include a risk assessment of effluent discharge at an arsenic concentration of 0.5 mg/L. However, the analyses completed by SENES in 2006 for a mean effluent discharge of 0.4 mg/L arsenic also assessed the effects of a range of arsenic loads with an "upper bound" increase in the total arsenic load of 30% on all sources, including the treated effluent load. This would be equivalent to an effluent discharge of 0.52 mg/L arsenic. The range in the arsenic loads incorporated in the assessment is documented in Table 4.1-1 of the SENES 2006 report. The results of the assessment, which are summarized in Table 6.1-1 of the SENES 2006 report, showed that the arsenic level in North Yellowknife Bay increased by only 0.0002 mg/L (i.e., from 0.0014 mg/L at a discharge of 0.4 mg/L to 0.0016 mg/L for a 30% increase in the loads from all sources). On this basis, there is no need to redo the Risk Assessment for an effluent discharge of 0.5 mg/L arsenic.

Page 14-27 of the DAR indicates that acute toxicity testing on rainbow trout and Daphnia magna will be conducted monthly for the first year of operating the WTP and quarterly thereafter. The effluent from the existing treatment plant is non-toxic at the end of pipe and the new WTP is expected to produce even better quality effluent. Therefore the effluent from the new WTP is expected to be non-toxic.

Of the water samples collected since 2000 from underground and surface sources (over 1400 samples) only one sample exceeded the value for ammonia set in the former water license. The average of these site-wide samples is roughly an order of magnitude less than the water license value (0.9 mg/L total ammonia-N versus 12 mg/L total ammonia-N, respectively). The past source of ammonia at the site, and the reason it was included as a parameter on the former water license, was the use of explosives underground. Since INAC became custodian of the mine, there has been very limited and sporadic use of explosives (e.g. adding a new access ramp in 2007, adding a new drift for the FOS in 2009). It is expected that future levels of ammonia will be similar to the levels seen over the past ten years, even during implementation of the freeze program when additional drifts may be required around the arsenic chambers. The management of ammonia will be part of the Environmental Management System in order to minimize loading to the mine water. This will be achieved through good 'housekeeping' practices on site. Ammonia compounds as part of the freeze program coolant systems are contained in closed-loop systems on surface and are not circulated underground, and thus have a very low risk of entering the environment.

INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Environment Canada #02**

Date Received

February 28, 2011

Linkage to Other IRs

Review Board IR #9
City of Yellowknife IR #2

Date of this Response:

May 31, 2011

Request

Please provide a vegetation monitoring plan for the tailings' covers or a revised design plan for the covers that has a greater vegetation support layer depth so that the cover does not have the potential to be compromised by vegetation growth.

Reference to DAR (relevant DAR Sections):

DAR, s.6.6.6 Tailings Covers

Response:

Section 6.6.6 of the DAR, Tailings Covers, of the Developer's Assessment Report explains the two-layer cover concept proposed for the Giant Mine. The upper layer will act as a clean surface for runoff, support vegetation, reduce infiltration, and support future uses of the area. The bottom layer will act as a robust physical barrier to prevent human or animal contact with tailings in the event that the overlying layer is damaged, minimize upwards wicking of arsenic from the tailings, and restrict the penetration of roots into the tailings. The depths of each layer will be determined through further design, and may vary across the site based on material availability, construction difficulty, associated costs and final land use.

The final design of the tailings covers has not been completed pending further consultations with traditional knowledge holders and the public. Further information on design considerations of the tailings covers, including vegetation management, is included in the response to City of Yellowknife IR #2.