Environment Canada Environnement Canada

# ENVIRONMENT CANADA'S INTERVENTION

## WITH RESPECT TO

# BAFFINLAND IRON MINES CORPORATION WATER LICENCE APPLICATION

## FOR THE

# MARY RIVER PROJECT

**JUNE 22, 2012**

Canada

## Introduction

Environment Canada (EC) is a science-based Department which works to conserve and protect the environment so that Canadians can live and prosper. Contributing to making sustainable development a reality in Canada's North is a priority for EC. The Department focuses on provision of scientific expertise for incorporation into decisions on developments, such that all parties working together can ensure that there is minimal impact on the natural environment, and that ecosystem integrity is maintained and preserved for future generations. To this end, EC has reviewed the Baffinland Iron Mines Corporation (Baffinland) water licence application and supporting information for the Mary River Project.

EC's submission focuses on issues related to environmental effects on or related to water quality and waste disposal, to the extent it may affect water quality. As directed by the Nunavut Water Board (NWB), EC's submission relates to aspects under the jurisdiction of the NWB and those that fall under EC's mandated responsibilities.

## Mandate, Role and Responsibilities of Environment Canada

The mandate of EC is determined by the statutes, regulations, guidelines, policies, federal, territorial, and international agreements, and related programs that it is assigned by Parliament to administer. The overall objective is to foster harmony between society and the environment for the economic, social and cultural benefit of present and future generations of Canadians. The Department shares this goal with other federal agencies, provinces, territories and First Nations.

The *Department of the Environment Act* provides EC with general responsibility for environmental management and protection. Its obligations extend to and include all such matters over which Parliament has jurisdiction, which are not by law assigned to any other department, board, or agency of the Government of Canada. These include matters related to preservation and enhancement of the quality of the natural environment (e.g. water, air, soil), renewable resources including migratory birds and other non-domestic flora and fauna, water, meteorology, coordination of policies and programs respecting preservation and enhancement of the quality of the natural environment, development of standards and guidelines, promotion of sound environmental practices, and providing advice to federal government agencies. In delivering on these obligations EC has responsibility for specific legislation, regulations, policies, and agreements.

Of particular concern and interest for the current project are the responsibilities conferred on the Department by legislation and standards such as the:

- *Canadian Environmental Protection Act*
- *Fisheries Act* (Sections 36-42)
- *Metal Mining Effluent Regulations*
- Canada-wide Standards for Mercury Emissions
- Canada-wide Standards for Dioxins and Furans

Please see Appendix A for a brief description of the above instruments.

## Background

Baffinland is proposing to construct, operate, and eventually decommission an iron ore mine in the North Baffin Region of Nunavut. During operations Baffinland is proposing to ship 18 million tonnes of ore to European markets per annum using a dedicated fleet of ore carriers operating year round. The Mary River Project consists of an open pit mine; road and rail links as well as two ports and is expected to be in operation for 21 years

During the Nunavut Impact Review Board (NIRB) process EC and Baffinland discussed and resolved many of EC's water related issues. EC would like to commend Baffinland and their consultants on their proactive approach to addressing concerns identified in the NIRB process and in meetings. This intervention presents issues which are still outstanding.

## Technical Comments and Recommendations

In preparing this submission EC reviewed the Mary River Project Type A Water Licence Application and supporting documents submitted by Baffinland in February 2012. Our review focused on areas which fall under the Department's mandated responsibilities, with our comments organized under the following headings:

1. General Comments
2. Water Quality
3. Waste Management
4. Clarifications/Considerations
5. Water licence term
6. Conclusions

Within each category, comments are organized by specific issue, with reference to the appropriate document section, and detailing our concerns and recommendations.

## 1.0 General Comments

EC was pleased with the format of the water licence application materials, finding the documents well laid out and cross-referenced. As outlined in the following technical comments and recommendations our review identified several areas needing further work or clarification. Where possible, we have suggested how conditions in the water licence could address these concerns.

EC's technical comments focus on four main areas: water quality with respect to mine discharges, aquatic effects monitoring, and waste disposal and air emissions insofar as there is the potential to affect water quality.

## 2.0 Water Quality

### *Issue 2.1: Sewage discharge limits*

*Reference:*

- Design Basis – Sewage Treatment Plant, Table 4-4
- Appendix 10D-2, p. 43
- Appendix 10D-3, Table 5-2, p.30-31
- Appendix 10D-12, Table 4-6, p. 26-27
- Water license 2BB-MRY1114

*Proponent's Conclusions:*
The discharge limits presented in the sewage treatment plant design basis, Table 5-2 of Appendix 10D-3 and Table 4-6 of Appendix 10D-12 are inconsistent for $BOD_5$, TSS and faecal coliforms. Specifically, the limits for the design basis are significantly lower for the above parameters compared to the limits presented in Appendices 10D-3 and 10D-12. In addition, in contrast to the existing Type B water license for the Mary River project, the design basis provides a limit for total phosphorus (i.e., < 0.1 mg/L) and both the design basis and Appendix 10D-3 suggest a limit for ammonia (i.e., 2 mg/L). Appendices 10D-2, 10D-3and 10D-12 also provide inconsistent information with respect to how frequently sewage effluent will be monitored to ensure its compliance with regulated parameters. Page 43 of Appendix 10D-2 indicates sewage effluent will be monitored weekly while Page 30 of Appendix 10D-3 and Page 26 of Appendix 10D-12 indicates it will be monitored monthly. Appendix 10D-3 only provides one sampling location for the monitoring of sewage effluent when it is understood two waste water treatment plants will be established at the mine site.

*EC's Conclusion(s):*
EC supports use of the limits for $BOD_5$, TSS and faecal coliforms suggested in the sewage treatment plant design basis and encourages Baffinland to adopt these limits as the maximum authorized average monthly concentrations. EC supports establishing a higher threshold concentration for any grab sample for the above parameters intermediate of the waste water treatment plant design specifications and those provided in the current water license to provide flexibility for system upsets. EC also agrees with establishing a limit for ammonia as proposed and would not disagree with a slightly higher threshold for total phosphorus to be consistent with other operations in the North. Suggested limits are provided in Table 1-1. In addition, EC agrees that sewage sampling on a monthly basis is adequate. Appendix 10D-3 should be revised to include the sampling points for monitoring sewage effluent discharges to Sheardown Lake and Mary River.

Table 1-1: Suggested sewage discharge limits

| Parameter | Units | Maximum Average Monthly Concentration (mg/L) | | Maximum Concentration of Any Grab Sample (mg/L) | |
|---|---|---|---|---|---|
| | | Mary River/ Sheardown Lake | Milne Inlet/ Steensby Port | Mary River/ Sheardown Lake | Milne Inlet/ Steensby Port |
| $BOD_5$ | mg/L | 10 | 20 | 25 | 50 |
| TSS | mg/L | 10 | 20 | 25 | 50 |
| faecal coliforms | cfu/100 mL | 200 | 200 | 500 | 500 |
| Total-Phosphorus | mg/L | 0.2 | NA | 1 | NA |
| Ammonia (NH3-N) | mg/L | 2 | 2 | 4 | 4 |

***Recommendation EC-2.1:***
EC recommends that:

a. Baffinland establish maximum monthly average concentrations and maximum grab sample concentrations for discharge limits for sewage effluent as per Table 1-1.
b. Sewage effluent sampling be conducted on a monthly basis.
c. Appendices 10D-2, 10D-3 and 10D-12 be updated to reflect the sewage discharge limits and sewage sampling frequency that will be pursued.
d. Appendix 10D-3 be revised to include the sampling locations for monitoring sewage effluent discharges to Sheardown Lake and Mary River.

### *Issue 2.2 Oily water wastewater treatment facility discharge limits*

*Reference:*

- Design Basis – Wastewater Treatment (Oily Water), Table 4-6
- Appendix 10D-3, Table 6-1, p.19, p.32
- Appendix 10D-12, Table 4-7, p. 28

*Proponent's Conclusions:*
Discharge water quality criteria for oily water treatment plants are provided in the design basis for oily water wastewater treatment and Appendices 10D-3 and 10D-12. There are some inconsistencies with the limits provided among the different references. In particular, the discharge limits in Appendix 10D-12 are based on the Guidelines for Industrial Waste Discharges in Nunavut (GIWDN) while the limits provided in the Design Basis and Appendix 10D-3 are the lower values among the MMER Schedule 4 and GIWDN thresholds.

*EC's Conclusion(s):*
Given that the effluent discharging from the oily water wastewater treatment facility does not qualify as mine contact water, EC disagrees with the use of MMER limits for regulating discharges from these facilities. Further, even if these discharges qualified as mine contact water, EC would not support setting the MMER limits as end-of-pipe water quality objectives since these limits provide a minimum national standard and may not be appropriate for more sensitive ecosystems. EC notes that the discharge limits proposed by Baffinland are 1 to 3 orders of magnitude greater than their respective generic CCME water quality guidelines (e.g. Al, As, Cd, Cr, Cu, CN, Fl, Pb, Ag, Zn). As such, EC recommends lowering the discharge limits so they are protective of the receiving aquatic environment. To achieve this, at a minimum, EC recommends the Schedule 4 MMER substance limits be at least one order of magnitude lower than their respective maximum average concentrations established in the regulations. For those substances not covered by the MMER and for which CCME guidelines exist, limits should be no more than 2 orders of magnitude greater than their respective CCME guideline.

EC notes that modeling predictions were not provided in the FEIS for expected concentrations of parameters of concern in treated oily water discharges. It would be helpful if water quality modeling was undertaken for these point sources to determine anticipated concentrations at end-of-pipe and in their respective receiving waters.

***Recommendation EC-2.2:***
EC recommends that Baffinland:

a. Establish discharge limits for treated oily water that are protective of the receiving aquatic environment.
b. Model oily water discharges to determine predicted end-of-pipe and receiving water concentrations for parameters of concern.

### *Issue 2.3: Location of sampling points for sewage and treated oily water discharges*

*Reference:*

- Appendix 10D-3, p. 30-31

*Proponent's Conclusions:*
Sections 9.2 and 9.3 of this Plan describe the location for sampling sewage effluent and treated oily water effluent. The latitude and longitude for the sample points for each effluent type are the same for all 3 sites (Milne, mine and Steensby).

*EC's Conclusion(s):*
EC was under the impression that oily and sewage wastewater would be treated in separate wastewater treatment facilities and thereby have their own discrete discharge points. Since the latitude and longitude for the sampling points are the same for each effluent type at each location, this assumption is being questioned.

***Recommendation EC-2.3:***
EC recommends that Baffinland:

a. Confirm sewage and oily wastewater will be treated in independent wastewater plants.
b. Update the Plan to include the appropriate latitude and longitude for the monitoring locations for each effluent type, including sampling points for the two sewage plants planned for the mine site.

### *Issue 2.4: Mine contact water discharge limits*

*Reference:*

- FEIS, Volume 7, Section 3.0, Tables 7-3.16 to 7-3.22
- Appendix 10D-2, Table 9-2, p. 40
- Appendix 10D-12, Table 4-8, p. 28

*Proponent's Conclusions:*
Appendices 10D-2 and 10D-12 provide the discharge water quality criteria for mine contact water. These limits are a reproduction of the thresholds established for Schedule 4 substances identified in the MMER. Tables 7-3.16 to 7-3.19 of Volume 7 of the FEIS provide tabulated summaries of expected water quality for the west and east waste rock ponds based on kinetic testing of representative rock from the west waste rock pile and east waste rock pile and pit respectively, under average flow and dry conditions. In addition, Tables 7-3.20 and 7-3.21 provide water quality predictions for

runoff from lump and fine ore based on lysimeter monitoring results from the bulk ore stockpile. Finally, Table 7-3.22 provides predicted pit and east pond water quality at mine closure. In all cases, the predicted water quality for each source term did not exceed the maximum average monthly mean for each respective modeled Schedule 4 MMER substance. Specifically, under the average flow scenarios, predicted metal concentrations were 20X to 1000X, 50X to 1250X, 4X to 90X and 6X to 500X less than their respective MMER limit in the west pond, east pond, pit and ore stockpile runoff respectively.

*EC's Conclusion(s):*
In principle, EC does not support setting the MMER thresholds as end-of-pipe water quality criteria since these limits provide a minimum national standard and may not be appropriate for more sensitive ecosystems. Further, given that all mine contact water is predicted to be below MMER Schedule 4 maximum mean monthly concentrations, EC supports the establishment of lower discharge limits for the MMER regulated parameters.

***Recommendation EC-2.4:***
EC recommends that discharge limits for mine contact water from the east pond, west pond, pit and ore stockpiles be established that are commensurate with the predicted water quality for these sources provided in Volume 7 of the FEIS.

***Issue 2.5: Reference site selection***

*Reference:*
- Appendix 10D-14, BIMC correspondence to NIRB, May 15, 2012
- Appendix 10D-12, Table 4-9
- Appendix 10D-13, Appendix 2, Tables 1-4

*Proponent's Conclusions:*
As per a meeting with Baffinland on April 30 and correspondence from Baffinland to NIRB regarding follow-up to commitments made at the Technical Meetings May 1-3, 2012 Baffinland agrees the freshwater reference sites provided in the Metal Mining Effluent Regulations (MMER) Environmental Effects Monitoring (EEM) Study Design Framework and Table 4-9 of Appendix 10D-12 are inadequate and has committed to making progress on reference site selection by early June 2012. Discussions related to reference site selection were limited to the freshwater environment. As noted in the Biophysical Environmental Effects Monitoring Framework, a BACI design has been adopted for all MMER EEM monitoring.

*EC's Conclusion(s):*
As per EC IR 28a and IR 32b issued for the FEIS, EC did not support the proposed freshwater reference sites provided in the MMER EEM study design framework since all three sites (F0-05, L1-06 and G0-03) were within the zone of influence of mining activities. Apart from indicating the marine reference site would be in Steensby Port, the framework lacked details on the location of this site. Since the marine environment was not discussed at the above meeting or technical meetings, EC submits that a similar effort should be undertaken to locate an appropriate reference site for Steensby Port.

Reference site selection is crucial to supporting the BACI study design Baffinland has committed to follow for detecting project-related changes in invertebrate and fish communities and water quality at the mine site and Steensby Port resulting from construction and operation activities. Delaying reference site selection and sampling jeopardizes Baffinland's plans to follow a BACI study design. If reference sites are not sampled this upcoming field season, Baffinland will miss the opportunity of obtaining comparable temporal baseline data at its exposure and reference sites pre-impact and the study will be reduced to a control-exposure study design.

***Recommendation EC-2.5:***
EC recommends that:

a. Baffinland select defensible reference sites for the freshwater and marine environments at its earliest opportunity and undertake a comprehensive sampling program at these sites in 2012.
b. When selecting reference sites, Baffinland consider the proximity of project infrastructure along with total suspended particulate (TSP) contour plots provided in Appendix 5C-5 of Volume 5 to ensure sites are not within the mine's zone of influence.

***Issue 2.6: Statistical Design***

*Reference:*

- Appendix 10D-13, Appendix 1, Tables 1, 5; Appendix 3, Tables 4, 5

*Proponent's Conclusions:*
During the April 30, 2012 meeting, Baffinland agreed that the Biophysical Environmental Effects Monitoring Study Design Framework provided limited statistical design details (e.g. sample sizes, power of test, levels for alpha and beta, early warning indicators) related to monitoring and detecting project-related impacts to water and sediment quality in the marine and freshwater environments.

*EC's Conclusions:*
As per EC IR-29 issued for the FEIS, the appropriate time for consideration of statistical design details for monitoring programs intended to detect project-related changes is the environmental assessment. In particular, given the availability of baseline data and known thresholds for many parameters related to water and sediment quality (i.e. CCME guidelines), Baffinland has adequate information to undertake a power analysis to determine adequate sample sizes for detecting change and ascertaining the power of the test to detect change for parameters of concern.

If attention is not paid to the statistical design of the water and sediment quality monitoring programs, sampling programs can be misguided and be wasteful of resources. Knowing the power of the statistical test that will be used to detect change is critical information for determining the effectiveness of the sampling program. If the statistical test used to analyze monitoring data has low power, then very little can be inferred from the monitoring results.

***Recommendation EC-2.6:***
EC recommends that Baffinland provide more statistical details regarding its water and sediment monitoring programs before construction gets underway with the objective of

ensuring these programs are adequate to detect project-related changes. For more guidance regarding study design, EC recommends Baffinland consult INAC (2009). EC would be pleased to review the plans and the proposed sample sizes, based on results of power analysis, once available. In particular:

a. As per EEM guidance (EC 2012, EC 2004) EC recommends the same probability level be assigned to alpha and beta so the chance of rejecting the null hypothesis when it's true (i.e., false positives) is equivalent to accepting the null hypothesis when it's false (i.e., false negative).
b. EC also recommends Baffinland commit to using one-tailed hypothesis testing for water and sediment quality analyses since one-sided tests are appropriate in this case and increase the power of the test.

*Literature Cited:*

Environment Canada. 2012. Metal mining technical guidance for environmental effects monitoring, National Environmental Effects Monitoring Office. Gatineau, Quebec.

Environment Canada. 2004. Pulp and Paper EEM guidance document. May 2004. National Environmental Effects Monitoring Office. Gatineau, Quebec.

Indian and Northern Affairs. 2009. Recommended Procedures for Developing Detailed Designs for Aquatic Effects Monitoring Programs, AEMP Technical Guidance Document Volume 4. June 2009. Indian and Northern Affairs Canada, Yellowknife, Northwest Territories.

### *Issue 2.7: Quarry setback from water courses along railway*

*Reference:*

- FEIS, Volume 7, Section 3.4.2.1, SQSW-5, p. 131-133

*Proponent's Conclusion:*

The FEIS concludes that the residual effect on water and sediment quality in the five freshwater aquatic local study areas (LSAs) from runoff originating from quarries and borrow sources will not be significant. This conclusion is supported by Baffinland's commitment to strive to avoid quarry sites that have the potential for acid rock drainage or metal leaching (ARD/ML). In addition, should reactive materials be encountered in any quarry/borrow source, the magnitude assessment asserts that the relative insensitivity to acidic input of lakes and streams throughout the project area will negate any concern related to ARD/ML originating from quarries. To mitigate impacts from runoff related to quarries, as per the Quarry and Borrow Sources Management Plan, Baffinland commits to observing a 31 m setback from water bodies for all quarries and will consider a 100 m setback for sensitive areas.

*EC's Conclusions:*

EC agrees with the assessment's conclusions regarding quarries and water/sediment quality effects, provided Baffinland implements all its stated mitigation measures. However, EC disagrees with the generalization related to all streams and lakes in the five LSAs being relatively insensitive to acidic inputs. Specifically, as per Table 7-3.5, EC notes that two of the river systems (e.g. Cockburn area and Rowley River) along the railway alignment are sensitive to acidic inputs.

If Baffinland is not able to keep its commitment related to avoidance of reactive quarries, given their sensitivity to acidity, water bodies along the railway alignment will be more

susceptible to ARD/ML should other mitigation measures fail to contain runoff from quarries.

***Recommendation EC-2.7:***
Given the acid sensitivity of the some of the river systems along the railway, EC recommends Baffinland consider the lakes/streams in this LSA as sensitive environments and institute a minimum setback of 100 m from the high water mark for quarries accessed along the railway that have ARD/ML potential.

### *Issue 2.8: Sediment sampling*

*Reference:*

- Volume 7, Section 3.4.4.2, p. 175

*Proponent's Conclusions:*
The FEIS indicates Baffinland is committed to monitoring sediment quality in streams and lakes, the latter in accordance with guidance from EC for sampling of Arctic lakes with low deposition rates.

*EC's Conclusions:*
EC previously recommended Baffinland sample the top 1-2 cm of sediments instead of the top 5 cm as originally proposed to take into account the extremely low sedimentation rates in Arctic streams and lakes. EC is concerned that sampling the top 5 cm of sediments may impede Baffinland's ability to detect project-related impacts on sediment quality because it may mask changes occurring at the surface of the sediments.

EC has not published a protocol that documents how to sample the top 1-2 cm of lake/stream sediments, but this is commonly done by consulting companies working in the North.

***Recommendation EC-2.8:***
EC is pleased Baffinland plans to sample the top 1-2 cm of sediments as recommended. EC notes that other northern mines have successfully sampled the top 1 cm of sediments and recommends that Baffinland liaise with the consultants who have had success at sampling the top 1 cm of sediments in Arctic lakes/streams. EC would be available to discuss a proposed protocol.

### *Issue 2.9: Use of dust suppressants*

*Reference:*

- Appendix 10D-3, p. 21

*Proponent's Conclusions:*
As described in section 6.2.2 of this Plan, Baffinland plans to use DL-10 and calcium chloride as dust suppressants on roads at the mine and Steensby sites in accordance with the Government of Nunavut's *Environmental Guideline for Dust Suppression*. This Guideline endorses the use of Bunker C, calcium chloride and DL 10.

*EC's Conclusions:*

While EC acknowledges that Baffinland intends to meet the Government of Nunavut's *Environmental Guideline for Dust Suppression* EC understands other commercially available dust suppressant products may pose less risk to the environment than calcium chloride or DL10.

***Recommendation EC-2.9:***
EC recommends Baffinland consider all commercially available dust suppressants and select the product that poses the lowest risk to the environment, particularly when the material is to be applied close to water bodies. If Baffinland ultimately decides to use DL-10 or calcium chloride, EC recommends that a buffer zone of 30 m be maintained around water bodies intersecting or adjacent to the tote road or railway access road, and that application rates be maintained such that product does not migrate from the roadway.

### *Issue 2.10: Criteria for treated landfarm soil to permit its use outside the landfarm*

*Reference:*
- Appendix 10D-2, p. 18, 20, 27

*Proponent's Conclusions:*
Several sections of this Plan (e.g., 6.1.1, 6.3.2, 6.5.3) indicate treated soil from the landfarm that meets appropriate criteria will be used as landfill cover material or for other acceptable purposes.

*EC's Conclusions:*
The criteria the treated soil must meet to allow its use as landfill cover or in other applications are not specified in this Plan. In addition, the Plan does not state the number of samples that will be taken per volume of soil to confirm its acceptability for use outside the landfarm.

***Recommendation EC-2.10:***
EC requests Baffinland specify the criteria that will be used to determine if treated soil from the landfarm is suitable for use as landfill cover material or other purposes. For clarity, these criteria along with the number of soil samples taken per volume of soil to verify its compliance with criteria should be included in the next iteration of this Plan.

### *Issue 2.11: Toxicity testing of emulsion plan residue*

*Reference:*
- Appendix 10D-3, p. 21

*Proponent's Conclusions:*
Section 6.2.2 of this Plan indicates "the emulsion plant shall be supplied with its own wastewater treatment plant which utilizes an evaporation system to evaporate the water leaving solid residue and oil. This residue will be tested for toxicity and if necessary taken off-site for disposal in a licensed facility otherwise the waste will be land filled."

*EC's Conclusions:*

Given the presence of nitrogenous compounds in the production of explosives, EC supports toxicity testing of the emulsion plant residue to ensure it doesn't pose a risk to the environment if disposed of in the landfill. EC could not find any details in the Plan regarding what toxicity testing will be conducted, nor the frequency of toxicity testing and what conditions would need to be met to allow emulsion residue to be disposed at the landfill site.

***Recommendation EC-2.11:***
EC requests that Baffinland provide details on how toxicity will be tested, the frequency of toxicity testing and what will constitute a pass/fail for the toxicity test. Also, if the residue is determined to be toxic, EC requests a description of levels at which offsite disposal would be used, or alternatively, how it would be encapsulated in the landfill and suggests an evaluation of landfarm disposal be considered.

### ***Issue 2.12: Method detection limits for metals in seawater***

*Reference:*
- Volume 8

*Proponent's Conclusions:*
The method detection limits (MDL) for Cr (VI), Cr (III), As and Cd in marine water quality baseline collections were all above their respective CCME guidelines.

*EC Conclusions:*
Given that the MDL for the above metals exceed their respective CCME guidelines, analyses for these metals are not informative as comparisons cannot be made with CCME thresholds.

***Recommendation EC-2.12:***
EC recommends Baffinland seek out analytical labs that can achieve MDL lower than the CCME guidelines for Cr (VI), Cr (III), As and Cd so meaningful comparisons can be made between monitoring results and CCME thresholds.

## 3.0 Waste Management

### *Issue 3.1: Commitment to recycling practices*

*Reference:*
- Appendix 10D-4, Section 4.4.3, p. 19; Annex 4, Appendix A, p. 17

*Proponent's Conclusions:*
As per Section 4.4.3, this Plan makes many commitments related to recycling of mine-related waste. Specifically, Baffinland anticipates its contractors will carry out their own salvage of economically worthwhile recyclables, particularly ferrous metals and copper, where a ready market exists. In addition, the Plan anticipates a lot of polyethylene film waste will be generated from unpacking of equipment. Opportunities for recycling of this material will be explored and, if practical, the film will be baled and shipped for reuse. The Plan also indicates a recycling program will be instituted as personnel are expected

to place waste into appropriate recycling bins which will be clearly marked to indicate what is recyclable and what is not. Lastly, Section 2 of the Landfarm Operation Manual (Annex 4 of Appendix 10D-4) identifies steel and pallets as materials that can be recycled or reused.

*EC's Conclusions:*
EC is encouraged by the number of recycling practices being considered by Baffinland as presented in the Waste Management Plan.

***Recommendation EC-3.1:***
EC recommends Baffinland clarify what commitments will be made with respect to recycling practices and ensure these commitments are accurately captured in the next revision of this Plan.

### *Issue 3.2: Use of modified burn barrels*

*Reference:*
- Appendix 10D-4, p. 24

*Proponent's Conclusions:*
As per Section 4.5.3, the Plan states that modified burn barrels will be employed to burn, among other things, food waste and food packaging. As stated in this section, "unburned materials from modified burn barrels used to burn paper, paperboard packing, untreated wood, food waste, food packaging and natural fibre textiles is suitable for burial in a designated pit or municipal landfill."

*EC's Conclusions:*
It is important to minimize what is released to the atmosphere during incineration because it will ultimately be deposited on the ground and in water bodies. A recent study commissioned by EC (EC 2011) tested the efficiency of the modified burn barrel endorsed by the GN's *Environmental Guideline for Burning and Incineration of Solid Waste*. The study results suggest that dioxins and furans emitted from burning food waste and rubbish in a modified burn barrel were approximately 10X greater than the applicable Canada-Wide Standards. Therefore, EC does not support the use of modified burn barrels for the disposal of food packaging and food waste.

***Recommendation EC-3.2:***
Based on the recent study noted above EC recommends that Baffinland dispose of food waste and food packaging using an incinerator that meets applicable Canada Wide Standards for Dioxins and Furans and the Canada Wide Standards for Mercury.

*Literature Cited*:
Environment Canada, 2011. Characterization of Semi-volatile and Volatile Organic Compounds released from the Reduction of Food Waste using a Modified Burn Barrel. Report ERMS 2011-02. Emissions Research & Measurement Section, Air Quality Research Division, September 2011.

### *Issue 3.3: Storage capacity for sewage at temporary railway camps*

*Reference:*

- Appendix 10D-3, p. 16-17

*Proponent's Conclusions:*
Sections 5.4.4 and 5.4.5 of the Plan indicate that sewage will be stored at the Mid-rail, Ravn River and Cockburn North sites for much of the first year before roads are constructed. In addition, the sewage storage capacity will be sized for one-week storage at the Cockburn South rail camp.

*EC's Conclusions:*
EC could not locate the capacity of the sewage storage containers at each of the rail camps in this Plan. EC does not agree that a one-week storage capacity at Cockburn South rail camp is sufficient given that inclement weather could lead to extended road closures and prevent access for sewage removal. EC is concerned that situations preventing timely pumpout of the sewage could result in emergency discharges of untreated wastewater to the environment.

***Recommendation EC-3.3:***
EC recommends Baffinland consider increasing the capacity of sewage storage at Cockburn South camp to accommodate more than 1 week of storage. In addition, EC recommends the next iteration of the Plan be updated to include the sewage storage capacity of each of the temporary camps so reviewers can determine whether the capacity is adequate.

***Issue 3.4: Use of bacteria in landfarm to expedite biodegradation***

*Reference:*

- Appendix 10D-4, p.28

*Proponent's Conclusions:*
Section 4.8 of this Plan indicates special bacteria may be introduced to ameliorate biodegradation of hydrocarbon-contaminated soil in the landfarm.

*EC's Conclusions:*
EC was not able to locate any details regarding the special bacteria that might be used to expedite biodegradation in the landfarm in this Plan. EC anticipates that the bacteria may be a product of biotechnology and subject to the *New Substances Notification Regulations (Organisms)*.

***Recommendation EC-3.4:***
EC recommends Baffinland consult the *New Substances Notification Regulations (Organisms)* before importing or using bacteria in landfarming applications. If the bacteria are not listed on Canada's Domestic Substance List, Baffinland may need to notify the Government of Canada about the bactieria before it can be imported or used at the Mary River Project site.

***Issue 3.5: Use of soil from bladder farm in landfarm construction***

*Reference:*

- Appendix 10D-4, Annex 5

*Proponent's Conclusions:*
Section 3.2 of Annex 5 (Landfarm Management Plan) indicates the less-impacted materials from the bladder farm may be re-used as a protective layer in the newly constructed landfarm facility. Further, Section 4.2 lists the chemical criteria that soil must meet before being disposed of at the landfarm,

*EC's Conclusions:*
EC could not locate any information in the Plan which indicated the frequency of sampling or number of samples taken per volume of soil to confirm its compliance with landfarm chemical criteria.

***Recommendation EC-3.5:***
EC recommends the frequency of analysis and the number of samples taken per volume of soil to ensure compliance with landfarm chemical criteria be provided in the next revision of this Plan.

### *Issue 3.6: Landfilling of sewage sludge*

*Reference:*
- Appendix 10D-4, p. 10

*Proponent's Conclusions:*
Table 4.1 of this Plan indicates that, in addition to incineration, one of the disposal methods suggested for biological sludge is landfilling.

*EC's Conclusions:*
Landfilling of biological sludge is an appropriate method for final disposal. However, EC notes that Appendix 10D-3 does not make reference to landfilling as a possible disposal alternative for dewatered sludge.

***Recommendation EC-3.6:***
EC recommends Baffinland clarify if landfilling will be used as a disposal method for dewatered sludge and, if so, to update Appendix 10D-3 accordingly.

### *Issue 3.7: Verification that incinerator bottom ash meets landfill disposal criteria*

*Reference:*
- Appendix 10D-4, p. 24

*Proponent's Conclusions:*
Section 4.5.3 of this Plan indicates that a Toxicity Characteristic Leaching Procedure (TCLP) analysis will be employed to verify bottom ash from the incinerator is suitable for landfill disposal.

*EC's Conclusions:*
EC could not locate in the Plan how frequently the TCLP analysis will be undertaken to confirm ash is suitable for landfill disposal.

***Recommendation EC-3.7:***
EC recommends Baffinland clarify how frequently the TCLP analysis will be conducted on bottom ash. Specifically, EC requests Baffinland specify whether a set of samples will be taken and tested for every burn cycle or if subsamples will be taken per specified quantity of accumulated ash. This information should be conveyed in the next revision of this Plan.

***Issue 3.8: Analytes tested in contact water from Milne Inlet landfarm***

*Reference:*

- Appendix 10D-4, Annex 5

*Proponent's Conclusions:*
This Plan indicates a landfarm will be constructed at Milne Inlet to treat the Milne Inlet fuel bladder farm soil that is contaminated with 8000 L of Jet A fuel. According to Section 3.1, Jet A fuel is anticipated to require treatment for F2 and F3 fractions. Section 7.2 indicates contact water from the Milne Inlet landfarm will be tested for F1 and F2 hydrocarbons.

*EC's Conclusions:*
It is unclear why contact water from the Milne Inlet landfarm will not be tested for the F3 fraction. If section 3.1 is accurate the soil at the Milne Landfarm may be contaminated with F2 and F3 fraction hydrocarbons therefore any water that comes in contact with that soil should be tested for both fractions.

***Recommendation EC-3.8:***
EC recommends that Baffinland test and if necessary treat Milne landfarm contact water for the F3 fraction and update Annex 5 accordingly.

***Issue 3.9: Uncertainty in runoff and streamflow estimates at the Baffinland Mine and associated works***

*Reference:*

- EIS Volume 7 Freshwater Environment Appendix 7 Regional Hydrology
- Spence, C. and A. Burke, 2008. "Estimates of Canadian Arctic Archipelago Runoff from Observed Hydrometric Data", Journal of Hydrology 362: 247-259.

*Proponent Conclusions:*
Baffinland has used standard engineering design protocols, methods and standards, and best practices in estimating runoff and streamflow for the project. The project hydrologist recognizes there is high uncertainty in the estimates due to the paucity of regional data and the short duration of the local monitoring program. Baffinland has incorporated appropriate and accepted methods of conservatism (ie safety factors) into the estimates.

*EC's Conclusions:*
EC agrees that Baffinland has applied the regional and local monitoring data to the best of their ability and used accepted standard methods. However, the regional climate and

hydrometric network they have to work with is very sparse which results in a difficult to quantify but likely high uncertainty. EC research during the International Polar Year implies the errors in mean annual runoff could be as high as 150%. Uncertainty in flood estimates is at least as large. Using generally accepted standards may not address this level of uncertainty.

Flood estimates are important considerations in project infrastructure design, uncertainty in those estimates can result in over or under engineering of project components which can lead to unnecessary environmental impacts and risks. For example uncertainty in estimates of streamflow in receiving waters introduces uncertainty in conclusions of the assessment regarding impacts resulting from effluent discharge into those receiving waters. It should also be noted that Baffinland's conclusions of impacts are accurate only as long as the proposed water management systems operate within design specifications. Uncertainty in estimates of streamflow at the design stage introduces the risk of underdesign in engineered works which increases risk of unintended discharge of effluent, which introduces more uncertainty in the conclusions of assessment of impacts.

***Recommendation EC-3.9:***
EC recommends that both Baffinland and NIRB recognize and consider the implications of the uncertainty in the runoff and streamflow estimates used in project design. EC notes that while Baffinland has done an admirable job with the tools and data available, the noted uncertainty makes it difficult to define the risk of either underdesign or overdesign of engineering works on site (i.e. wastewater collection ponds, railroad stream crossings, etc.) and the uncertainty will vary depending on the catchment.

### *Issue 3.10: Air Quality and Noise Abatement Management Plan*

*Reference:*

- FEIS Volume 5, Section 2.6.3.3, Appendix C5-4, Appendix 5C-5 Part IV
- FEIS Volume 10 Appendix 10D-1 Air Quality and Noise Abatement Management Plan
- FEIS Volume 10 Appendix 10D-11 Terrestrial Environmental Effects Framework
- Response to EC IR-18b, IR round 2
- Volume 5, Section 2.0, Page 32, Table 5-2.5.
- Design Basis – Environmental Design Basis, Table 6-3 & Section 6.1.1

*Proponent's Conclusions:*
Baffinland has provided a draft of the Air Quality and Noise Abatement Management Plan (AQNAMP) which includes a monitoring plan and mitigation strategies. The monitoring plan includes active total suspended particulate (TSP) monitoring, passive sampling for $SO_2$, $NO_2$, $O_3$, and dustfall monitoring at the mine site and the Steensby Port.

*EC's Conclusions:*
The AQNAMP does not include monitoring for fugitive dust from the transport of ore from the Mary River mine site to the Steensby Port. In the interest of monitoring and ultimately minimizing the amount of fugitive dust deposited on the ground and into waterbodies as a result of the transport of iron ore EC recommends dust fall sampling along the railway corridor.

In the AQNAMP the dustfall threshold for application of corrective actions is set as an annual level of 4.6 g/$m^2$/yr. This threshold should have a shorter time period so that corrective action, if required, can be implemented in a timely fashion. The objective of this threshold should be clearly defined and the appropriateness of the threshold investigated.

Marine shipping at the Steensby Port is the largest source of $SO_2$ emissions for this project. $SO_2$ emissions should be monitored and minimized to prevent deposition related impacts to land and water. Baffinland has committed to using 0.1% fuel sulphur content in support ships, 0.0005% fuel sulphur content in auxiliary generators on ore carriers while "hoteling", and 1.5% fuel sulphur content in ore carrier ships while in transit until 2020 at which point Baffinland will use fuel with a sulphur content no greater than 0.5% or at a level consistent with global standards. Air quality modeling predictions indicate that there is potential for exceedances of the 1-hour ambient standard for $SO_2$. The current fuel sulphur content standard of 3.5% for large ships in Canadian northern waters is 2.3 times higher than what Baffinland assumed in its air quality modeling. In its response to EC IR 18b, Baffinland states that using 3.5% fuel sulphur content in the ore carrier ships would increase the predicted $SO_2$ ambient concentrations by 230% and increase the exceedances of ambient standards at Steensby Port. Baffinland is proposing to use passive samplers to measure $SO_2$ ambient concentrations. Passive samplers are used to collect long term integrated data typical over a 30-day period. Therefore data from passive samplers cannot be compared to short-term 1-hour ambient standards. Baffinland should use continuous ambient $SO_2$ monitoring at the Steensby Port to assure that emissions from ships do not result in exceedances of ambient standards.

EC notes that Alberta has released updated air quality objectives for $NO_2$ and $SO_2$ that are now more stringent than those selected by Baffinland in the FEIS (Vol 5, Table 5.2.5). Given that Baffinland has selected the most stringent Canadian ambient air quality criteria as the threshold for each contaminant indicator, the revision to Alberta's air quality objectives for $SO_2$ and $NO_2$ would result in a decrease of some the threshold values.

| ***Revised Alberta Air Quality Objectives*** | | |
|---|---|---|
| **$SO_2$** | **Original objective** | **New Objective** |
| 24-hour average | 150 ug/$m^3$ | 125 ug/$m^3$ |
| 30-day average | | 30 ug/$m^3$ |
| Annual average | 30 ug/$m^3$ | 20 ug/$m^3$ |
| **$NO_2$** | | |
| 1-hour average | 400 ug/$m^3$ | 300 ug/$m^3$ |
| Annual average | 60 ug/$m^3$ | 45 ug/$m^3$ |
| Note: Alberta has eliminated the 24-hr average for NO2 | | |

***Recommendation EC-3.10:***
EC recommends that Baffinland:

a. Develop the Air Quality and Noise Abatement Management Plan in consultation with EC and that the monitoring plan include dustfall monitoring along the railway corridor, and continuous ambient monitoring of $SO_2$ at the Steensby Port;

b. Adopt the Alberta objectives as threshold values where appropriate; and
c. Provide an annual report on the volume and sulphur content of fuel consumed.

***Issue 3.11: Incineration Management Plan***

*Reference:*

- FEIS Volume 10 Appendix 10D-4: Waste Management Plan for Construction, Operation, and Closure.
- Design Basis – Incinerator, Pages 1-7
- Design Basis – Solid Waste Management Operational Standards, Pages

*Proponent's Conclusions:*
Baffinland is proposing to have permanent incinerators at the Mine Site and Steensby Port, and incinerators at temporary construction camps: Milne Port; Ravn River; Mid Rail; North Cockburn; and South Cockburn. The types of waste to be incinerated include: camp waste; food waste; maintenance / workshop wastes; dewatered sewage sludge, waste oils and waste fuels.

Baffinland has proposed using the ECO 2TN 1P incinerators at each of the camps. The incinerators will be equipped with continuous emission monitors that measure temperature and other combustion emissions. The monitoring does not include dioxins and furans sampling.

Operational data and maintenance records will be retained and made available to inspectors and other regulatory officials upon request.

*EC's Conclusions:*
Incineration can be an environmentally sound method of disposing of camp waste. However, if appropriate incineration technologies and operating practices are not used, there is potential for the formation and release of contaminants to the environment. An environmental fate modeling study conducted by Webster and Mackay (2007) found that emissions from an incinerator capable of meeting the Canada-wide Standards (CWS) for Dioxins and Furans operated properly are unlikely to cause adverse environmental impacts. On the other hand, the study found that poor incineration could lead adverse impacts on soil, water, lake sediments, fish and wildlife. Wilson et al. (2011) linked elevated levels of dioxins and furans measured in lakebed sediments at a northern mine to the incineration of camp waste.

To minimize the release of contaminants and thereby minimize the risk of potential environmental impacts, EC recommends that Baffinland develop and implement an incineration management plan that is consistent with the advice provided in the *Technical Document for Batch Waste Incineration*.

The continuous monitoring proposed by Baffinland will provide information on the combustion efficiency of the incinerators. In addition the continuous monitoring, stack emission testing should be completed to assure that the incinerator can achieve the Canadian Council of Ministers of the Environment (CCME) Canada-wide Standards (CWS) for Dioxins and Furans and the CWS for Mercury emissions. The stack tests should be completed using typical waste streams from the development including

dewatered sewage sludge. The stack tests should occur prior to commissioning the incinerators and the results of the stack tests should be provided to the Board.

***Recommendation EC-3.11:***
EC recommends that Baffinland:

a. Develop and implement an incineration management plan in consultation with EC incorporating the advice provided in the EC Technical Document for Batch Waste Incineration. Annual reports summarizing incineration activities and operational data should be submitted to the Board; and
b. Complete stack emission testing for all incinerators to ensure compliance with the CWS for Dioxins and Furans and the CWS for Mercury. The stack tests should be completed using typical project waste streams including dewatered sewage sludge.

*Literature Cited:*

Canadian Council of Minsters to the Environment (CCME). Canada –wide Standards for Dioxins and Furans. 2001, Available at: http://www.ccme.ca/assets/pdf/d_and_f_standard_e.pdf

Canadian Council of Minsters to the Environment (CCME). Canada –wide Standards for Mercury Emissions. 2000. Available at: http://www.ccme.ca/assets/pdf/mercury_emis_std_e1.pdf

Environment Canada, Technical Document for Batch Waste Incineration, prepared by A. J. Chandler & Associates Ltd. for Environment Canada, 2010. Available at: http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=5F6E5596-1

Webster, E., and D. Mackay. Modelling the Environmental Fate of Dioxins and Furans Released to the Atmosphere During Incineration. Canadian Environmental Modelling Centre Report No. 200701, 2007. Available at: http://www.trentu.ca/academic/aminss/envmodel/CEMC200701.pdf

Wilson, A., D. Fox, G. Poole, and R. Bujold. Linking Incineration to Dioxins and Furans in Lakebed Sediments. Journal of Integrated Environmental Assessment and Management, Volume 7, Issue 2, pp. 302, 2011.

## 4.0 Clarifications/Considerations

***Issue 4.1: Ore crushing facilities and conveyer system for Milne Port trucking operation***

*Reference:*

- Appendix 10D-2, Table 6.2

Table 6.2 of the Appendix 10D-2 lists the facilities at the mine site. The following facility is identified: ore crushing facilities and conveyor systems for the Milne Port trucking operation.

***Clarification EC 4.1:***
EC seeks clarification on whether this facility is still part of the mine site plan.

***Issue 4.2: Hydroelectric site***
*Reference:*

- Appendix 10D-2, Figure 5.3

Figure 5.3 of Appendix 10D-2 contains a label for a ‘proposed hydroelectric site’.

***Clarification EC-4.2:***
EC seeks clarification on whether Baffinland is investigating the development of hydroelectric power in the local study area.

***Issue 4.3: Waste Rock Management***
*Reference:*

- Vol 3, Appendix 3B, Attach 4 -Mary River Mine Site docs - Waste Rock Design Criteria - Sections 3.3 and 3.6.
- Vol 3, Appendix 3B, Attach 5 - Waste Rock Management Plan Table 3-1

*Proponent's Conclusions:*
In Section 3 of the Waste Rock Design Criteria Baffinland presents several alternatives for waste rock placement. Baffinland selected Scenario #2 which entails the "Placement of the waste rock in a single stockpile with segregation of the PAG and non-PAG material. The PAG material would be encapsulated within the confines of the non-PAG material" with the migration of permafrost into the core of the pile preventing water penetration and leaching.

*EC's Conclusions:*
While the logic behind the selection of the preferred option is clear it is unclear if this approach would successfully prevent the release of acid rock drainage if the core of the pile does not remain frozen. Table 3-1 of the Preliminary Schedule of Waste Rock Production suggests that there will be at the least 3:1 of non-PAG to PAG rock however this is a preliminary estimate. If the ratio of PAG to non-PAG rock is lower than 3:1 there may be insufficient non-PAG rock available to prevent the release of acid rock drainage on the long term. The blending of PAG and non PAG in the core of the pile prior to encapsulation in non PAG rock might reduce the risk of ARD if the core does not remain frozen.

***Clarification EC-4.3:***
EC requests that Baffinland clarify if consideration was given to "blending" the non-PAG & PAG waste rock prior to encapsulation and the justification used to reject it.

***Issue 4.4: Waste Rock Management***
*Reference*

- **Vol 10, Sec 7.2.4.1;**
- **Vol 3, App 3B, Attachment 5 - Waste Rock Management Plan**

Proponent's Conclusions:
Baffinland states that "The majority of the waste rock will be placed while the ground is frozen allowing the level of permafrost to rise in elevation by conduction. It expected that a permanently frozen impermeable core will form in the waste rock storage area within the first few years after placement. The technical memorandum on the development of permafrost in waste rock stockpiles is included in Annex 2."

*EC Conclusions:*

It appears that Baffinland has assumed that climate change will not affect the penetration of permafrost into the waste rock pile. While drainage ditches are in place to collect runoff for treatment it is unclear what mitigations are in place to prevent the release of ARD/ML if the core does not freeze as predicted.

***Clarification EC-4.4***
EC requests that Baffinland clarify what mitigations could be put in place to prevent the release of ARD/ML if the permafrost in the PAG rock core thaws.

## 5.0 Water License Term

*Reference:*

- Type A Water License Application

*Proponent's Conclusions:*
Baffinland is seeking a 25 year term for their Type A Water License.

*EC's Conclusions:*
Given the current northern regimes, a license term of 25 years is extraordinary. EC supports a shorter license term to allow for modifications to the license once the mine is operating and monitoring data is available to verify the environmental assessment predictions and the suitability of license conditions. Most northern mines are operating with a water license term of no more than 10 years. Given a (minimum) mine life of 21 years and 4-year construction phase, EC supports a license term of 10 to 12 years.

***Recommendation:***
EC recommends a shorter term for the water license in the range of 10 to 12 years.

## 6.0 Conclusion

EC would like to thank the NWB for the opportunity to comment on the Mary River Project water licence application, and we hope that these technical comments and recommendations are useful to the Board in their decision-making process. We look forward to working with the Board and Baffinland throughout the Water Licence Process.

## APPENDIX A: RELEVANT LEGISLATION, POLICIES AND GUIDELINES

### *Department of the Environment Act*

The *Department of the Environment Act (DOE Act)* provides EC with general responsibility for environmental management and protection. Itss obligations extend to and include all matters over which Parliament has jurisdiction, and have not by law been assigned to any other department, board, or agency of the Government of Canada as related to:

- Preservation and enhancement of the quality of the natural environment (e.g. water, air, soil)
- Renewable resources including migratory birds and other non-domestic flora and fauna
- Water
- Meteorology
- Coordination of policies and programs respecting preservation and enhancement of the quality of the natural environment.

The *DOE Act* states that EC has a mandated responsibility to advise heads of federal departments, boards and agencies on matters pertaining to the preservation and enhancement of the quality of the natural environment. As such, this mandate is extremely broad.

### *Canadian Environmental Protection Act, 1999*

Proclaimed on March 31, 2000, the new *Canadian Environmental Protection Act, 1999* (CEPA 1999, referred to hereinafter as *CEPA*) is an Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development. *CEPA* shifts the focus away from managing pollution after it has been created to preventing pollution. The Act provides the federal government with new tools to protect the environment and human health, establishes strict deadlines for controlling certain toxic substances, and requires the virtual elimination of toxic substances which are bioaccumulative, persistent and result primarily from human activity.

For substances that are declared “toxic” under *CEPA* and are added to the List of Toxic substance in Schedule 1 of the Act, instruments will be proposed to establish preventive or control actions for managing the substance and thereby reduce or eliminate its release into the environment. These tools may be used to control any aspect of the substance’s life cycle, from the design and development stage to its manufacture, use, storage, transport and ultimate disposal.

Examples of preventive and control instruments include:

- Regulations;
- Pollution prevention plans;
- Environmental emergency plans;
- Environmental codes of practice;
- Environmental release guidelines; and
- Pre-notification and assessment of new substances (chemicals, biochemicals, polymers, biopolymers, and animate products of biotechnology).

Authority to require emergency plans for toxic or other hazardous substances is provided in Part 8 of *CEPA*. Environmental emergency plans for such a substance(s) must cover prevention, preparedness, response and recovery.

***Fisheries Act – Pollution Prevention Provisions***

The Minister of Fisheries and Oceans is legally responsible to Parliament for administration and enforcement of all sections of the *Fisheries Act*. However, under a Prime Ministerial Instruction (1978) and a Memorandum of Understanding (1985), EC administers and enforces those aspects of the Act dealing with the prevention and control of pollutants affecting fish. In this context, EC works to:

- Advance pollution prevention technologies;
- Promote the development of preventative solution; and
- Work with the provinces, territories, industry, other government departments and the public on issues relating to the pollution provisions of the *Fisheries Act.*

The main pollution prevention provision is found in subsection 36(3) of the Act, and is commonly referred to as the "general prohibition". This subsection prohibits the deposit, into fish-bearing waters, of substances that are deleterious to fish. The legal definition of "deleterious substance" provided in subsection 34(1) of the Act, in conjunction with court rulings, provides a very broad interpretation of deleterious and includes any substance with a potentially harmful chemical, physical or biological effect on fish or fish habitat. One measure of a deleterious substance (such as a liquid discharge) is acute lethality as measure by the standard 96 hour fish bioassay test.

Pertinent regulations under the Fisheries Act include the Metal Mining Effluent Regulations (MMER's). The MMER's were registered and became national law on June 6, 2002. The regulations apply to all metal mines in Canada. The MMER's take a three tiered approach to monitoring, including end of pipe physical/chemical quality, end of pipe biological quality (through biological testing of lethality), and downstream environmental effect monitoring. The MMER's also have a requirement for comprehensive Environmental Effects Monitoring (EEM). An EEM program is a scientific assessment to evaluate the effects of mine effluent on the aquatic environment, specifically fish, fish habitat and the use of fisheries resources as defined in the Fisheries Act. An "effect" is defined in the MMER's as a statistically significant difference between fish or benthic invertebrate community measurements taken from exposure and reference areas (or along a gradient of effluent exposure). EC staff are available to assist in the development of EEM programs and to answer questions relating to the MMER's.

***Canada-wide Standards for Mercury Emissions***

Mercury is a naturally occurring substance, which is transformed through biological processes to methyl mercury, a persistent substance which bioaccumulates in the food chain and is particularly toxic to humans and wildlife. Mercury levels originate from a combination of naturally-occurring mercury and anthropogenically emitted mercury. Levels in any one region reflect variable combinations of local, regional and even global sources. Approximately sixty percent of the mercury entering the ecosystem is from anthropogenic sources.

Recognizing the hazard posed by anthropogenically emitted mercury entering the food chain, the CCME ministers agreed in June 2000 to the Canada-wide Standards (CWS) for Mercury Emissions. The CWS set limits for mercury emissions from several sectors, including incinerators.

***Canada-wide Standards for Dioxins and Furans***

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, are toxic, persistent, bioaccumulative, and result predominantly from human activity. Due to their extraordinary environmental persistence and capacity to accumulate in biological tissues, dioxins and furans are slated for virtual elimination under CEPA, the federal Toxic Substances Management Policy (TSMP) and the CCME Policy for the Management of Toxic Substances.

Recognizing the hazard posed by dioxins and furans entering the environment, the CCME ministers agreed, in May 2001, to the Canada-wide Standards (CWS) for Dioxins and Furans. These standards set limits for dioxin and furan emissions from several sectors including incinerators.