



ENVIRONMENT AND CLIMATE CHANGE CANADA'S FINAL SUBMISSION TO THE NUNAVUT IMPACT REVIEW BOARD

RESPECTING THE MARY RIVER PROJECT – PHASE 2 PROPOSAL (08MN053) BY BAFFINLAND IRON MINES CORPORATION

September 23, 2019



Executive Summary

Baffinland Iron Mines Corporation (the Proponent) is proposing an expansion to its existing Mary River Project (the Project), known as the Phase 2 Proposal. The Phase 2 Proposal is located on Baffin Island, Nunavut, and includes an increase in iron ore production along the northern transportation corridor from the currently approved 6.0 million tonnes per year (Mtpa) to 12 Mtpa. To accommodate this increase, the Proponent proposes to construct and operate a 110 km railway from the Mine Site up to the port facilities at Milne Inlet, as well as expand the port facilities to accommodate cape size vessels and expand the mine camp. The Phase 2 Proposal is a tiered approach, where the proposed increase in production to 12 Mtpa via the northern transportation corridor would eventually lead into the development of the southern transportation corridor via Steensby Inlet, which is currently approved for an iron ore production of 18 Mtpa. Once both parts of the Phase 2 Proposal are operational, the total authorized production of the Project will be of 30 Mtpa.

Environment and Climate Change Canada (ECCC) has participated in all phases of the review process for the Phase 2 Proposal thus far, providing information requests (IRs) and technical comments to the Nunavut Impact Review Board (NIRB). ECCC also attended the Technical Meetings held in Iqaluit from April 8 to 10, 2019 and June 17 to 19, 2019. ECCC is continuing its participation through this Final Submission.

The Final Submission summarizes the results of ECCC's technical review of information provided to date, including commitments made by the Proponent throughout the review process, additional information provided by the Proponent after the Technical Meetings, and ongoing discussions with the Proponent throughout the review process.

ECCC is providing the following technical comments pertaining to the Phase 2 Proposal and its potential impacts on air quality, water quality, fuel spills and shipping through the Northwest Passage (NWP). More specifically, ECCC comments and recommendations pertain to the following:

- The submission of all air quality and meteorological monitoring data as part of the annual reports and the comparison of the monitoring data to the Canadian Ambient Air Quality Standards.
- An investigation of NO₂ reduction measures related to power generation and Tier 4 standards for mobile equipment.
- The submission and update of an Air Quality and Noise Abatement Management Plan.
- An investigation on additional mitigation measures to mitigate the black carbon associated with Project-related shipping.
- The submission and subsequent review of the Phase 1 Waste Rock Management Plan (WRMP) to address Acid Rock Drainage and Metal Leaching.
- Fuel spill modelling for Arctic Diesel.
- Clarification on potential shipping through Navy Board Inlet and the Northwest Passage

List of Abbreviations

AAQS	Ambient Air Quality Standards
AMAP	Arctic Monitoring and Assessment Programme
AQNAMP	Air Quality and Noise Abatement Management Plan
ARD	Acid Rock Drainage
BAU	Business-as-usual
CAC	Criteria Air Contaminants
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CEPA	<i>Canadian Environmental Protection Act</i>
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
ERP	Early Revenue Phase
FEIS	Final Environmental Impact Statement
GHG	Greenhouse Gases
g/s	Grams Per Second
HC	Hydrocarbons
IFO	Intermediate Fuel Oil
IMO	International Maritime Organizations
IR	Information Request
LSA	Local Study Area
MBCA	<i>Migratory Birds Convention Act</i>
MDMER	<i>Metal and Diamond Mining Effluent Regulations</i>
ML	Metal Leaching
Mtpa	Million Tonnes Per Year
NIRB	Nunavut Impact Review Board

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NO _x	Nitrogen Oxide
NO ₂	Nitrogen Dioxide
NPRI	National Pollutant Release Inventory
NWP	Northwest Passage
PAG	Potentially Acid Generating
PPB	Parts Per Billion
QIA	Qikiqtani Inuit Association
SARA	<i>Species at Risk Act</i>
SLCF	Short-Lived Climate Forcer
SO ₂	Sulphur Dioxide
TSD	Technical Support Document
TSP	Total Suspended Particulate
t/y	Tonnes Per Year
WRMP	Waste Rock Management Plan

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1.0 Introduction

Baffinland Iron Mines Corporation (the Proponent) is proposing an expansion to its existing Mary River Project (the Project) located on Baffin Island, Nunavut, near the community on Pond Inlet, known as the Phase 2 Proposal. The Phase 2 Proposal consists of an expansion of the Project infrastructure as well as an increase in iron ore production and transportation along the northern transportation corridor. The proposed increase would see the mines production go up from the currently approved 6.0 million tonnes per year (Mtpa) to 12 Mtpa. The Phase 2 Proposal is also a tiered approach, where the proposed increase in production to 12 Mtpa and transportation via the northern transportation corridor would eventually lead to the development of the southern transportation corridor via Steensby Inlet, which is currently approved for an iron ore production of 18 Mtpa. Once both parts of the Phase 2 Proposal are operational, the total authorized production of the mine would be of 30 Mtpa.

To accommodate this increase, the Proponent proposes to construct and operate a 110 km railway from the Mine Site to the port facilities at Milne Inlet via the northern transportation corridor. Further, the increase in production requires an expansion of the port facilities which would include the construction of a second dock with the ability to receive Cape Size vessels. The shipping season would be extended from July 1 to November 15. The mine camp would also need to be expanded in order to accommodate a peak of 1050 workers during the construction period of the Phase 2 Proposal.

The Phase 2 Proposal builds upon the Early Revenue Phase (ERP) and “original” Mary River Project. The Mary River Project was approved in 2012 and consisted of a southern transportation corridor (including a railway) to transport up to 18 Mtpa of iron ore through Steensby Inlet with year-round shipping (the Approved Project). In 2014, the ERP was approved to permit the production of up to 4.2 Mtpa of iron ore that would be transported from the Mine Site via the Tote road and shipped via Milne Inlet. The ERP was approved in October 2018 to temporarily increase the iron ore production to 6.0 Mtpa.

On October 12, 2018, the Nunavut Impact Review Board (NIRB) initiated the technical review of the Final Environmental Impact Statement (FEIS) Addendum for the Phase 2 Proposal. Environment and Climate Change Canada (ECCC) has participated in the review for all phases of the Mary River Project. In regards to the Phase 2 Proposal review, ECCC has participated in the Information Request (IR) Phase via the ECCC IRs provided to the NIRB on November 23, 2018. ECCC participated in the technical review phase via the ECCC Technical Review Submission, provided to NIRB on March 7, 2019. ECCC also attended the Technical Meetings hosted in Iqaluit from April 8 to 10, 2019 and June 17 to 19, 2019. ECCC is providing this Final Submission, taking into account the discussions with the Proponent at and following the Technical Meetings.

A summary of ECCC's mandate and legislation is provided in Section 2.0. ECCC technical comments and recommendations are provided in Section 3.0 and are based on ECCC's technical review of Proponent's information provided to date, including commitments made by the Proponent throughout the review process, additional information provided by the Proponent after the Technical Meetings and ongoing discussions with the Proponent throughout this process.

2.0 Environment and Climate Change Canada's Mandate, Roles and Responsibilities

The mandate of ECCC is determined by the statutes and regulations under the responsibility of the Minister of Environment and Climate Change. ECCC's mandate covers matters such as the preservation and enhancement of the quality of the natural environment (including water, air and soil quality and the coordination of the relevant policies and programs of the Government of Canada), renewable resources (including migratory birds and other non-domestic flora and fauna), meteorology, and the enforcement of rules and regulations. ECCC's specialist advice is provided in the context of the Canadian Environmental Protection Act (CEPA), the pollution prevention provisions of the *Fisheries Act*, the *Species at Risk Act* (SARA), and the *Migratory Birds Convention Act* (MBCA).

ECCC administers the pollution prevention provisions of the *Fisheries Act*, which prohibits the deposit of a deleterious substance into fish-bearing waters. ECCC also participates in the regulation of toxic chemicals and the development and implementation of environmental quality guidelines pursuant to CEPA.

ECCC is responsible for protecting and conserving migratory bird populations and individuals under the MBCA. ECCC also administers SARA in cooperation with Fisheries and Oceans Canada (DFO) and the Parks Canada Agency to prevent wildlife species from becoming extirpated or extinct, provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming threatened, endangered or extirpated.

Additional information on ECCC's mandate can be found at: <https://www.canada.ca/en/environment-climate-change/corporate/mandate.html>.

3.0 Environment and Climate Change Canada's Technical Review Comments

This Final Submission summarizes the results of ECCC's technical review of information provided to date, including additional information provided by the Proponent following the Technical Meetings held in Iqaluit from April 8 to 10, 2019 and June 17 to 19, 2019, as well as information provided during and after meetings between ECCC, other federal departments and the Proponent on April 3 (Air Quality), April 4 (Acid Rock Drainage and Metal Leaching [ARD/ML]), June 7 (Air Quality), June 11 (Air quality, water quality, fuel spill modelling, ARD/ML), July 23 (Air Quality) and September 9, 2019 (Air Quality).

Section 3.1 outlines the current status of ECCC's technical comments, identifying technical comments that have been resolved and those that remain outstanding.

3.1 Current Status of ECCC Technical Comments

ECCC's Technical Review Submission was submitted to the NIRB on March 7, 2019. A portion of ECCC's technical issues were addressed in the Proponents Technical Comments Responses submitted to the NIRB on March 25, 2019. Remaining issues were discussed during the Technical Meetings held in April and June, 2019. Following both the Technical Meetings and bilateral discussions, the Proponent made a number of commitments to resolve issues identified by ECCC. Information regarding the Proponent's commitments and/or resolutions was provided to the NIRB by the Proponent on July 4, 2019. Table 1 provides the current status of all technical comments submitted by ECCC during the technical review stage.

Table 1. Current status of all of ECCC's Technical Comments submitted to the NIRB on March 7, 2019.

ECCC No.	Topic	Current Status	Notes
ECCC 3.1	Open-Water and Shoulder Season	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.2	Sea ice Trends and Projected Changes	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.3	Migratory Birds and Avian Species at Risk Effect Assessment and Mitigation Measures	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.4	Calculation of Total Greenhouse Gas Emissions	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.

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ECCC 3.5	Greenhouse Gas Emissions from Marine Diesel Consumption	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.6	Greenhouse Gas Emissions from Ore Carriers, Sealift Vessels and Tankers	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.7	Greenhouse Gas Emissions from Locomotives	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.8	Black Carbon Emitted from Ore Carriers, Sealift Vessels and Tankers	Outstanding	This comment is discussed in detail in Section 3.2.4.
ECCC 3.9	Criteria Air Contaminants from Marine Shipping	Resolved	Resolved after the second Technical Meeting with the additional information that was sent May 1 st . Recommendation for Black Carbon (3.2.4) also applies.
ECCC 3.10	Comparison of Modelled NO ₂ , SO ₂ and Dustfall to Measured Concentrations	Resolved	Resolved with the information provided after both Technical Meetings
ECCC 3.11	Nitrogen Dioxide Concentrations (predictions)	Outstanding	This comment is discussed in detail in Section 3.2.1 and 3.2.2.
ECCC 3.12	Mitigation of Criteria Air Contaminants	Resolved	ECCC has no additional questions on this technical comment. The topic of mitigation is still active in other technical comments such as 3.2.2, 3.2.3, and 3.2.4.
ECCC 3.13	Continuous Particulate Monitoring	Outstanding	This comment is discussed in detail in Section 3.2.3.
ECCC 3.14	Wind Turbines	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.15	Changes in Extreme Precipitation Events	Resolved	Response and information provided by the Proponent in their Responses to ECCC Technical Submission was sufficient.
ECCC 3.16	Sedimentation to Water Bodies along the Transportation Corridor	Resolved	Proponent provided the Tote Monitoring Program in revision 7 of the Roads Management Plan and was considered by ECCC as sufficient
ECCC 3.17	Milne Port Effluent Discharge	Resolved	Proponent provided Milne Inlet Effluent Loadings Memo for review on May 1 st 2019. Memo was considered by ECCC as sufficient.
ECCC 3.18	Marine Water Quality Monitoring	Resolved	Proponent provided 2019 Marine Environment Effect Management Plan study design for review on June 10,

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			2019 as part of the Marine Monitoring Plan. Study design was considered by ECCC as sufficient.
ECCC 3.19	Acid Rock Drainage and Metal Leaching at the Waste Rock Facility	Awaiting Phase 1 Waste Rock Management Plan in December 2019	ECCC is awaiting the submission of the Phase 1 Waste Rock Management Plan which will provide missing information on this issue. Further discussion is provided in Section 3.2.5.
ECCC 3.20	Acid Rock Drainage and Metal Leaching at Rail Line Rock Cuts and Quarries	Awaiting Phase 1 Waste Rock Management Plan in December 2019	ECCC is awaiting the submission of the Phase 1 Waste Rock Management Plan which will provide missing information on this issue. Further discussion is provided in Section 3.2.5.
ECCC 3.21	Site Specific Tactical Response Plans for Bridges	Resolved	ECCC considers this technical comment resolved, but will review the site-specific response plans that will be developed by the Proponent and incorporated into their Spill Contingency Plan prior to railway operations (Railway Emergency Response Plan, May 13 2019).
ECCC 3.22	Arctic Diesel Fuel Spill Modelling	Outstanding	This comment is discussed in detail in Section 3.2.6.

3.2 Outstanding Technical Comments

The technical comments outlined in this section are currently considered outstanding. A detailed discussion of these issues, along with ECCC's recommendation is included below.

3.2.1 ECCC-FC1: Canadian Ambient Air Quality Standards and Reporting of Monitoring Data

Reference(s):

- Baffinland Iron Mines Corporation. 2018. Baffinland Iron Mines 2017 Annual Report to the Nunavut Impact Review Board.
- Baffinland Iron Mines Corporation. 2019. Baffinland Iron Mines 2018 Annual Report to the Nunavut Impact Review Board.
- Baffinland Iron Mines Corporation. 2019. Baffinland Response to Reviewer Comments on the 2018 NIRB Annual Report.
- Baffinland Iron Mines Corporation. 2019. Draft Air Quality and Noise Abatement Management Plan – Revision 7.
- Environment and Climate Change Canada. 2017. Mary River Project – 2016 Annual Monitoring Report, ECCC Comments and Recommendations.
- Environment and Climate Change Canada. 2018. Mary River Project – 2017 Annual Monitoring Report, ECCC Comments and Recommendations.

- Environment and Climate Change Canada. 2019. Mary River Project – 2018 Annual Report, ECCC Comments and Recommendations.

Proponent's Conclusion(s):

In response to ECCC's comments on the 2018 Annual Report, the Proponent stated that they disclose the Project air emissions to the National Pollutant Release Inventory (NPRI). Further, the comment stated:

"Canadian Ambient Air Quality Standards (CAAQS) were developed by the Canadian Council for the Ministers of the Environment (CCME) to manage air emissions and ambient air quality concentrations in a regional airshed; CAAQS are not intended to determine compliance for an industrial facility. CAAQS are best suited as a tool to manage air emissions in regional airsheds that have multiple industrial sources. Regional airsheds typically have sensitive receptors (i.e., vulnerable populations such infants, elderly and those with respiratory ailments), major industrial air emissions and opportunities for achievable emission reductions. These airsheds often have multi-pollutant management needs. Regional airsheds differ based on the unique characteristics of local geography, meteorological conditions, and composition of human activity, including industrial activity" (Page 55).

ECCC's Conclusion(s):

ECCC has reviewed and commented on the NIRB annual reports for the existing Project and has reviewed these annual reports to assist in the assessment of future impacts to air quality due to the proposed Phase 2 Project. ECCC requested in its 2016 NIRB annual report comments (June 15, 2017), 2017 NIRB annual report comments (May 18, 2018), technical comments submission (March 7, 2019) and 2018 NIRB annual report comments (June 25, 2019) that the air quality monitoring data be presented in the annual reports along with comparisons of that monitoring data to both the Nunavut Ambient Air Quality Standards (AAQS), as well as the Canadian Ambient Air Quality Standards (CAAQS).

CAAQS are reviewed every five years using the most recent scientific information about the effects of pollutants to ensure they are stringent enough to protect human health and the environment. The CAAQS are not intended to be used as an enforceable standard at the Project perimeter. However, ECCC relies on the comparison with the CAAQS in determining the nature and severity of the project's impact on air quality levels, and the resulting monitoring and mitigation measures that may be required to maintain good air quality levels.

Upon review of the draft Air Quality and Noise Abatement Management Plan (AQNAMP), ECCC notes that the Proponent has agreed to compare to the CAAQS, stating, *"the potential applicability of the 2020 CAAQS to the Project was considered as part of the monitoring framework and it was determined that the 2020 CAAQS would be used for comparison purposes only with the objective to 'keep clean areas clean' with respect to ambient air quality"* (Page 17). ECCC continues to support comparison to the CAAQS and inclusion of that comparison within the annual reports. When reviewing these monitoring results, ECCC notes that these monitoring stations are located on site, not beyond Project boundaries

and the comparison to the CAAQS is for informational purposes only. It is unclear from the draft AQNAMP if the comparison to the CAAQS would appear in the annual reports.

In response to ECCC's comments on the 2018 Annual Report regarding the lack of air quality monitoring data and comparison to the CAAQS, the Proponent stated that they will be publically reporting their emissions to the NPRI. Air quality monitoring data and comparison of concentration data is not related to reporting of emission rates to the NPRI. Monitoring data collected on site are measured as concentrations, usually in units of $\mu\text{g}/\text{m}^3$ or parts per billion (ppb), whereas emissions, which are reported to NPRI are the rate at which a pollutant is emitted from a source, usually in a unit of grams per second (g/s) or tonnes per year (t/y). Emission rates cannot be compared to CAAQS as the CAAQS are concentration standards, not emission rate discharge standards reported to the NPRI.

The Proponent has provided dustfall data in the Terrestrial Annual Report, but did not provide the nitrogen dioxide (NO_2) or sulphur dioxide (SO_2) data in any of its annual reports. In 2018, ECCC made the same request and the NO_2 and SO_2 averages and maximums were emailed to ECCC; however, the data was not presented in the statistical format of the CAAQS, nor was the data compared to the CAAQS for NO_2 or SO_2 . The data was also not submitted as part of the NIRB annual report process.

The results of the monitoring program, specifically all air quality and meteorological data collected on site, should be presented in the NIRB annual reports. The Proponent currently measures NO_2 and SO_2 at two locations, as well as meteorology at six locations (as indicated by the draft AQNAMP). This monitoring is required as part of the Project Term and Conditions #7 to #12 yet only qualitative statements about whether the air quality measurements are above or below the Nunavut AAQS are included in the annual reports. Without the monitoring data, it is not possible to investigate times of the year where concentrations fluctuate, how those concentrations fluctuate with changing meteorology, where mitigations are shown to be effective, or where mitigations might need to be adjusted.

Section 5.2.2 of the draft AQNAMP states that, "*the results of this monitoring are presented in the annual report to the NIRB, as described in Section 6.1*" (Page 36). Section 6.1 states that results of active air quality measurements at the Mine Site and Milne Port will be reported in the annual report. ECCC notes that this data was not included in the annual reports to date. Similarly, Section 6.4 states that meteorological data will be made available to regulatory agencies. ECCC suggests that Section 6.1 be expanded to include at least, but not limited to the following:

- Time series of data.
- Hourly, daily, and annual averages in graphical and/or tabulated form (if applicable to the air quality parameter).
- Comparison to the CAAQS (and relevant statistical forms, if three years is not available, CAAQS can be calculated using one year).
- Comparisons to other years of data.

Section 6.4 should be expanded to include meteorological data reporting to the NIRB annual reports. For example, the following should be included:

- Average wind roses.
- Time series.
- Graph and tables indicating seasonal variability.

The stipulation that all air quality and meteorological data (presented as relevant statistics and time series) should be included in the annual reports and be reflected in the amended Terms and Conditions of the NIRB's Project Certificate following the Phase 2 review.

Further additions to the content of the NIRB annual reports were discussed at the second Technical Meeting. During the second Technical Meeting, the Proponent indicated that they plan to take winter photography so they can visually see how far the dust travels in response to the concern about dust being blown from the stockpiles. ECCC supports this plan and is of the view that these photos would inform the monitoring data as well as the annual reports and therefore should be included in the annual reporting process.

In the most recent draft of the AQNAMP maximum predicted concentrations of particulates are presented in Table 4-2 and Table 4-4 (Pages 28 and 32 respectively). The column titled "*Maximum concentration with the LSA [local study area]*" does not contain the maximum, unless it is greater than or less than the "*Project Standard*". The range and maximum prediction are not presented as in the previous Table 4-1 and Table 4-3 (gaseous predictions). The maximum concentration should be presented in order to effectively indicate the range of particulate concentrations in the LSA. Understanding that this table is in the draft AQNAMP, predicted concentrations should be presented in the annual reports to show the range of predictions as absolute concentrations, not as greater than or less than a Proponent defined Project Standard.

ECCC's Recommendation(s):

ECCC recommends that the NIRB include or amend the Terms and Conditions of Project Certificate No. 005 to require the Proponent to:

- Submit all air quality and meteorological monitoring data as part of the annual reports and compare the monitoring data to the CAAQS, where applicable. The air quality and meteorological monitoring data should be presented to include at least, but not limited to:
 - Time series of data.
 - Hourly, daily, and annual averages in graphical and/or tabulated form (if applicable to the air quality or meteorological parameter).
 - Comparison to the CAAQS (and relevant statistical forms, if three years is not available, CAAQS can be calculated using one year).
 - Wind roses.
 - Graph and tables indicating seasonal variability.
 - Comparisons to other years of data.
- Include any photos taken of dust on snow in the annual reports.
- Present the predicted concentrations in the annual reports as a range of absolute concentrations.

3.2.2 ECCC-FC2: Nitrogen Dioxide, Power Generation, and Mobile Equipment Engine Tier

Reference(s):

- Baffinland Iron Mines Corporation. 2019. Draft Air Quality and Noise Abatement Management Plan – Revision 7.
- Baffinland Iron Mines Corporation. 2019. Technical Comment Responses Phase 2 Proposal – Mary River Project, Response to ECCC 3.11.
- Canada Gazette. Part I, Vol 153, No. 10. Off-road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations. Available at: <http://gazette.gc.ca/rp-pr/p1/2019/2019-03-09/html/reg3-eng.html>.
- Caterpillar. 2010. Tier 4 Interim EPA Emissions Requirements for Diesel Generator Sets. Available at: <http://s7d2.scene7.com/is/content/Caterpillar/LEXE0152-00>.
- Environment and Climate Change Canada. 2018. Environment and Climate Change Canada's Information Requests Regarding Baffinland's Mary River Phase 2 Proposal 08MN053 Submitted to the Nunavut Impact Review Board, IR#5.

Proponent's Conclusion(s):

In response to Technical Comment ECCC 3.11, the Proponent provided updated emission estimates for all equipment and ships, new isopleth maps for NO₂ predictions as compared to the CAAQS with the additional NO₂ sources (generators) and data on the percentage each emission source contributes to the total concentration modelled at specific locations in the modelling domain (source apportionment analysis).

In response, the Proponent indicated the emission estimates for mobile equipment presented in the May 1, 2019 response are at Tier 4. During the second Technical Meeting the Proponent stated that not all equipment will be Tier 4, specifically that existing equipment would not be retrofitted to be Tier 4.

Section 4.1 of the draft AQNAMP states that the highest available tier engines for mobile equipment and power generation will be purchased, where applicable.

ECCC's Conclusion(s):

Power Generation

With the inclusion of all NO₂ sources, specifically the additional generators, the NO₂ predictions are now higher than presented in the earlier IRs (IR ECCC5) and above the CAAQS over a slightly larger area than presented in response to IR ECCC 5. Based on the source apportionment analysis provided in the response to Technical Comment ECCC 3.11, the majority of the predicted concentrations can be traced back to the power generation emission sources, at both Milne Port and the Mine Site.

During discussions with the Proponent (Conference Call on April 3, 2019), it is noted that all generators are Tier 2. ECCC has signaled its intent (Canada Gazette, 2019; Part 1, Volume 153) to regulate air pollutant emissions from new stationary diesel engines in the proposed *Off-Road Large Spark-Ignition*

and Compression-Ignition (mobile and stationary) Engine Emission Regulations, which will require Tier 4 emission standards for non-remote and non-backup diesel generators. The proposed regulations will likely include flexibilities for remote locations, like Baffin Island, to use Tier 2 or Tier 3 engines. These flexibilities for remote locations were added to the proposed regulation as Tier 4 engines have not yet been proven to work effectively in cold northern climates. Tier 4 engines also require ultra-low sulfur diesel, which is not always available in remote locations.

As the NO₂ predicted concentrations are high, investigations into NO₂ emission reduction measures that could be applied to power generation in a northern climate may wish to consider all options. The objective of the investigation would be to offset the NO₂ emissions from the generators. Tier 4 generators have been proven to be effective in reducing NO₂ emissions as compared to other tiers and should be investigated as a potential option even in a northern climate.

New Tier 4 stationary diesel generators would emit significantly less air pollutants like nitrogen oxide (NO_x), particulate matter, hydrocarbons (HC) and carbon monoxide. Based on the following information (Caterpillar Inc, 2010), specifically, a 85.3% reduction in NO_x+HC going from Tier 3 to Tier 4 and a 90.8% reduction in NO_x+HC going from Tier 2 to Tier 4. If Tier 4 is not pursued, there are measures to reduce nitrogen oxide (NO_x) emissions, namely using variable speed diesel generators or banks of multiple gensets instead of one large genset as banks of gensets allow for power to be provided in the highest efficiency zone.

Mobile Equipment

ECCC notes that all mobile emission estimates were based on all equipment being Tier 4. However, as discussed at the second Technical Meeting, the existing equipment on site is not Tier 4 and there are no plans for this equipment to be retrofitted to Tier 4. Even though mobile equipment contributes less to the total NO₂ concentrations, committing to transitioning to Tier 4 for all equipment would still be beneficial in reducing NO₂ emissions, including retrofitting current equipment. ECCC supports the Proponents commitment to purchasing the highest available tier engines for new mobile equipment and power generation, where practical (as stated in the draft AQNAMP).

ECCC's Recommendation(s):

ECCC recommends that the Proponent:

- Investigate NO₂ reduction measures that could be applied to power generation that would offset the use of a portion of the emissions from the generators. This information should be provided in a management plan along with a quantitative analysis of the potential emissions offset.
- Commit that all mobile equipment (new and existing) be Tier 4 or better.

3.2.3 ECCC-FC3: Air Quality and Noise Abatement Management Plan

Reference(s):

- Baffinland Iron Mines Corporation. 2019. Draft Air Quality and Noise Abatement Management Plan – Revision 7.
- Baffinland Iron Mines Corporation. 2019. Technical Comment Responses Phase 2 Proposal – Mary River Project, Responses to ECCC 3.10 and 3.13.
- Nunavut Impact Review Board. 2019. 2019 Winter Site Visit Report for the NIRB's Monitoring of Baffinland Iron Mines Corp.'s Mary River Project.

Proponent's Conclusion(s):

In response to ECCC 3.10, the Proponent provided a comparison of measured dustfall from 2013 – 2018 to predictions of both the 30 Mtpa Phase 2 Proposal and at 3.5 Mtpa (average of operations between 2013 and 2018).

In response to ECCC 3.13, the Proponent has committed providing an Air Quality Monitoring Framework that will outline active and continuous particulate monitoring that will be added to the current monitoring on site. A draft of this framework was included in the draft AQNAMP and was submitted to ECCC.

ECCC's Conclusion(s):

The overall analysis presented in ECCC 3.10 shows that the measured annual average dustfall from current operations is higher at some locations than the modelled annual average dustfall for the Phase 2 Proposal. As the Proponent explains, this may be attributed to the difference in the current emission source location compared to where that source is in the Phase 2 mine plan and in conjunction to the dustfall canister location. The Proponent also attributes this difference to the fact that some emission sources were not included in the Phase 2 modelling of dustfall.

ECCC understands there are changes to the mine plan that would reduce the dust in the Phase 2 Proposal; however, those changes are not clearly linked to quantitative reductions in dust. The comparison provided in response to 3.10 demonstrates that there is a need for monitoring and adaptive management.

The goal of air quality management plans is to present an effective method for monitoring and mitigation of air quality pollutants. ECCC has reviewed the draft AQNAMP and has provided comments and suggestions for the Proponent to consider. Inclusion of these comments would lead to a comprehensive air quality monitoring and management strategy that would be more effective at reducing air quality related effects from the Project.

In the most recent draft of the AQNAMP, maximum predicted concentrations of particulates are presented in Table 4-2 and Table 4-4 (Pages 28 and 32 respectively). The column titled "*Maximum concentration with the LSA*" does not contain the maximum, only if it is greater than or less than the "*Project Standard*". The range and maximum prediction are not presented as in the previous Table 4-1 and Table 4-3 (gaseous predictions). The maximum concentration should be presented in order to effectively indicate

the range of particulate concentrations in the LSA and advises that the AQNAMP be updated. Understanding that this table is in the Management Plan, predicted concentrations should be presented in either the AQNAMP or the annual reports to show the range of predictions as absolute concentrations, not as greater than or less than a Proponent defined Project Standard.

Section 4.3 of the draft AQNAMP states that “*Particulate matter emissions will increase at Milne Port, with the addition of rail unloading facilities, an indoor secondary crusher, larger ore stockpiles and the operation of ship loaders at two ore docks*” (Page 26). Section 4 of the draft AQNAMP does not include additional mitigations for the stockpiles. Currently, there are reported issues of dust from stockpiles. This is stated in the NIRB Winter Site Visit Report (August 2019): “*dust emissions from the ore stockpile area posed an environmental risk to marine area around Milne Inlet. Specifically, during ore stockpiling activities it was observed that ore dust was blown across the Milne Inlet surrounding causing widespread dust deposition on sea ice*” (Page 20). This issue was also discussed at the second Technical Meeting and in response the Proponent indicated that they plan to take winter photography to visually identify the dust. ECCC notes that the current draft of the AQNAMP does not include mitigations for the current issue identified by the NIRB and also does not include additional mitigations for the expected larger stockpiles. The Proponent may wish to consider ways to mitigate the emissions from the stockpiles and present these in the AQNAMP for review as well as the methodology of the winter photography and how the photos will be utilized.

Section 5.2.4 of the draft AQNAMP describes the approach taken in the event that there is an exceedance of the trigger levels. ECCC has reviewed these trigger levels and finds them acceptable for the location of the monitoring equipment (on site as opposed to the Project Boundary). However, the Proponent may wish to consider the following adjustments:

- Tables 5-1 and 5-3 (Pages 37 and 41 respectively) indicate that the triggers are based on “*the annual ambient air quality Project standard*” while the Project standards listed in the table are for both 24-hour and annual averaging periods. The management action trigger levels should be defined for both the 24-hour and annual averaging periods. Specifically, under the column heading “*Management Action Trigger Levels and Corrective Actions*” the triggers A) and B) should stipulate both 24-hour and annual averaging periods.
- The frequency at which the data is compared to the triggers is not defined. Since the air quality data analysis and comparison to the defined triggers will also include analysis of meteorological data, details on how the air quality data will be analyzed in conjunction with meteorological data is an important addition to the AQNAMP. It would be beneficial for the frequency at which the data is reviewed to be defined in the AQNAMP, specifically the frequency should allow for timely response for implementation of corrective actions in response to exceedances of triggers.
- ECCC notes that the mitigation listed under the Management Action Triggers in Table 5-3 does not include actions for the stockpiles. As noted above, dust issues and management actions for the stockpiles are being reported and hence would be valuable to include in the table.
- Table 5-2 of Section 5.2.4 provides the dustfall Project standards and proposed management action trigger levels and corrective actions. ECCC notes this table is not complete and will require a review of the trigger levels for dustfall. Further, comments embedded in the table reference the Ekati Diamond Mine dustfall trigger, it is not clear if the Proponent will also be using the same trigger.

- Table 5-2 of Section 5.2.4 only uses dustfall data collected every 30 days as the basis of triggers for dustfall impacts. As Total Suspended Particulate (TSP) will be monitored on the Project boundary, the Proponent may wish to include TSP data in the dustfall triggers analysis. TSP data will be collected at a shorter time scale than the dustfall data and can signal an early warning as to if there is a high dust event. Typically, if there is high TSP it will be translated to elevated dustfall. TSP data also helps to determine which days of the 30 day dustfall sample might have caused the elevated dustfall and can therefore assist in determination of the potential source that caused the increased dustfall.

Section 5.2.4 also discusses the particulate monitoring that would be conducted off-site where there is no power. ECCC agrees with the proposed plan to monitor particulates at the Project boundary during the months of April to October when there is enough sunlight to charge the solar panels needed for those instruments. Comments embedded into the draft AQNAMP suggest that the solar powered samplers will be located upwind and downwind at both Milne Port and Mine Site. The draft AQNAMP does not provide the wind roses from the onsite meteorological stations and maps as to where these potential monitoring locations are. The draft AQNAMP would be more comprehensive if this information along with discussion on the chosen site locations be included as well as discussion of how emissions from the stockpiles would be captured by these monitoring stations.

ECCC's Recommendation(s):

ECCC recommends that the NIRB amend the Terms and Condition #7 of Project Certificate No. 005 to require the Proponent to:

- Complete the AQNAMP in consultation with ECCC and other interested interveners.
- Monitor PM_{2.5} and TSP using continuous monitors at:
 - The sites that already monitor NO₂ and SO₂ at both Milne Port and the Mine Site.
 - New locations on or close to the Project Boundary at both the Milne Port and Mine Site that include sites that are close to locations of passive dustfall monitoring and in locations that have predicted and passively measured high dustfall; and site placement also consider prevailing wind direction.

ECCC recommends that the Proponent update the AQNAMP with the following:

- Present the predicted concentrations in the AQNAMP as a range of absolute concentrations.
- Investigate ways to mitigate the emissions from the stockpiles and present these in the AQNAMP for review.
- Include management actions for the stockpiles in Section 4 of the AQNAMP as well as Table 5-2, and Table 5-3.
- Define the management action trigger levels for both the 24-hour and annual averaging periods for all species (Table 5-1, Table 5-2, and Table 5-3).
- Define the frequency at which air quality and meteorological data is reviewed that allows for timely response for implementation of corrective actions in response to exceedances of triggers.
- Include details on how the air quality data and meteorological data will be analyzed together during the investigation of exceedance of trigger levels and necessary management actions.

- Confirm the trigger levels for dustfall and include corrective actions associated with collected dustfall data.
- Include 24-hour and annual Total Suspended Particulate data in the dustfall management action trigger levels and describe how it will be used as a tool for determining potential causes of elevated dustfall.
- Include the wind roses from onsite meteorological stations, maps showing where these potential monitoring stations are located, discussion on the rationale for the site locations, and discussion on how emissions from the stockpiles would be captured by these monitoring stations.

3.2.4 ECCC-FC4: Black Carbon Emissions

Reference(s):

- AMAP Assessment. 2015. Black carbon and ozone as Arctic climate forcers. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. vii + 116 pp.
- Baffinland Iron Mines Corporation. 2019. Draft Air Quality and Noise Abatement Management Plan – Revision 7.
- Baffinland Iron Mines Corporation. 2019. Technical Comment Responses Phase 2 Proposal – Mary River Project, Response to ECCC 3.08.
- Baffinland Iron Mines Corporation. 2019. Technical Memo – Black Carbon Emissions for the Phase 2 Project (August 22, 2019).
- Bond, T. C., Doherty, S.J., Fahey, D.W., Forster, P.M., Berntsen, T., DeAngelo, B.J., Flanner, M.G., Ghan, S., Karcher, B., Koch, D., Kinne, S., Kondo, Y., Quinn, P.K., Sarofim, M.C., Schultz, M.G., Schulz, M., Venkataraman, C., Zhang, H., Zhang, S., Bellouin, N., Guttikunda, S.K., Hopke, P.K., Jacobson, M.Z., Kaiser, J.W., Klimon, Z., Lohmann, U., Schwarz, J.P., Shindell, D., Storelvmo, T., Warren, S.G., and Zender, C. 2013. Bounding the role of black carbon in the climate system: A scientific assessment, *J. Geophys. Res. Atmos.*, 118, 5380–5552, doi:10.1002/jgrd.50171.
- Flanner, M.G., C.S. Zender, J.T. Randerson and P.J. Rasch. 2007. Present day climate forcing and response from black carbon in snow. *Journal of Geophysical Research: Atmospheres*, 112:D11202, doi:10.1029/2006JD008003.
- Gong, W., Beagley, S. R., Cousineau, S., Sassi, M., Munoz-Alpizar, R., Ménard, S., Racine, J., Zhang, J., Chen, J., Morrison, H., Sharma, S., Huang, L., Bellavance, P., Ly, J., Izdebski, P., Lyons, L., and Holt, R. 2018. Assessing the impact of shipping emissions on air pollution in the Canadian Arctic and northern regions: current and future modelled scenarios, *Atmos. Chem. Phys.*, 18, 16653-16687, <https://doi.org/10.5194/acp-18-16653-2018>, 2018.
- Lack, 2017 – An Update to Investigation of appropriate control measures (abatement technologies) to reduce Black Carbon emissions from international shipping (BLG17/INF.7), submitted by Canada to the IMO's Pollution Prevention and Response Subcommittee – 5th meeting, document number PPR 5-INF.7.
- Sand, M., T. K. Berntsen, Ø. Seland, and J. E. Kristjánsson. 2013. Arctic surface temperature change to emissions of black carbon within Arctic or midlatitudes, *J. Geophys. Res. Atmos.*, 118, 7788–7798, doi:10.1002/jgrd.50613.

Proponent's Conclusion(s):

In response to Technical Comment ECCC 3.08, the Proponent provided a memorandum outlining the black carbon emission estimates associated with shipping from the Project. During the second Technical Meeting, the Proponent stated that there was an error in the emission estimates and new estimates would be provided. The Proponent provided new black carbon estimates and a conference call was held between the Proponent and ECCC on July 23, 2019 to discuss the updated emissions. As a result of that call the Proponent will be updating the emissions again using different assumptions.

On August 22, 2019 the Proponent submitted updated black carbon estimates using the agreed upon fraction of 0.5 black carbon to PM_{2.5}. The Proponent estimated the black carbon emissions for the maximum shipping scenario of 30 Mtpa of iron ore, occurring from 2025 to 2035. The results of the calculation showed that the total black carbon emissions for the maximum shipping scenario are 65.2 t/y. The Proponent concluded that the “*estimated total of black carbon emissions after maximum shipping is reached would increase the 2017 Canadian North black carbon by 11%*” (Page 6). The August 22, 2019 memo also lists the Proponent's proposed mitigations for black carbon emissions. These are:

- Use of shipping route evaluation criteria to design the shortest, most efficient route feasible while also considering safety and other environmental impacts (e.g., avoidance of whales/sensitive marine life).
- Reduce power demand while idling by turning off equipment.
- Reduce power demand while stationary by anchoring over drifting, considering it is safe to do so.
- Equipment is maintained in good working order. Crews monitor and maintain equipment as part of their existing daily tasks.
- Shipping contractors have the necessary training programs for their employees on optimal equipment use methods, such as proper driving/piloting techniques to reduce fuel consumption and required maintenance activities.
- Compliance with the International Marine Organization's 2011 Guidelines for the Control and Management of Ships' Biofouling, reducing potential drag on a vessel while in transit.
- Ships being used by the Proponent will comply with all applicable shipping regulations, including those established to reduce emissions. As of January 1, 2020 the International Maritime Organizations (IMO) Global Sulphur Cap 2020, vessels will no longer be able to use fuels with greater than .5% Sulphur without scrubbers.

Additionally, Section 4.3.5 of the draft AQNAMP states that “*Baffinland will investigate and implement mitigation to reduce CAC [Criteria Air Contaminants] emissions from large vessels, including use of alternative fuels and higher emission standards, but there is a limited ability to control the types of vessels and fuels used in shipping to and from the site*” (Page 33).

ECCC's Conclusion(s):

Black carbon, as a short-lived climate forcer (SLCF), contributes to warming in the atmosphere due to increased absorption of radiation, and also contributes to Arctic warming due to ice-albedo effect and may accelerate snow and ice melting (Bond *et al.*, 2013; Flanner *et al.*, 2007). A report prepared by Arctic Council's Arctic Monitoring and Assessment Program (AMAP) concluded that a mass of black carbon emitted within the Arctic is likely to warm the Arctic several times more than the same mass of black

carbon emitted outside the Arctic (AMAP, 2015). A study found that black carbon emitted within the Arctic has an almost five times larger Arctic surface temperature response (per unit of emitted mass) compared to emissions at mid-latitudes (Sand *et al.*, 2013). A recent study by ECCC's scientists has shown that marine shipping emissions have a local to regional impact on black carbon at current (2010) levels and this impact would increase significantly under a 2030 business-as-usual (BAU) projection for shipping in the region (e.g., black carbon deposition to ice/snow roughly doubles in the 2030 BAU scenario from 2010 levels). In particular, the study found that, in the 2030 BAU scenario, contribution to the black carbon loading from shipping could represent up to 15% locally over Baffin Bay, and that contribution to the black carbon deposition from shipping could exceed 30% locally over the east coast of Baffin Island (Gong *et al.*, 2010).

Black carbon emissions from ships burning the 0.5% Sulphur fuel, to be mandated globally in 2020, is expected to result in equivalent black carbon emissions as current higher-Sulphur heavy fuel oil. While overall particulate matter emissions would be lower with the 0.5% S fuel, this is due to reduction in sulphate particles and not black carbon. Therefore, the ratio of black carbon to total particulate mass is expected to be much higher with the 0.5% S fuel when compared to current Heavy Fuel Oil with higher Sulphur levels. This is an important consideration when calculating the black carbon emissions from the Project. ECCC has reviewed the August 22, 2019 memo on black carbon and concurs with the assumptions, methodology, and total emission estimates that arrive at a total black carbon emission of 65.3 tonnes.

In the most recent memo on black carbon, the Proponent has provided a comparison to the 2017 Canadian North black carbon emissions which shows that during the peak shipping period, the Proponent vessels increase the black carbon emissions in the Canadian North by 11%. The Proponent had previously stated that shipping related black carbon emissions are a small percentage of the total Canadian black carbon emissions. ECCC had advised that comparing project-related black carbon to Canada's total emissions is not useful or appropriate. Unlike greenhouse gas (GHG) emissions – which act globally to influence climate – black carbon emissions that occur within the Arctic have a much greater impact in the Arctic than emissions occurring at southern latitudes. A more relevant comparison is project-related black carbon emissions as a proportion of anthropogenic black carbon emissions in Nunavut, or the Canadian Arctic.

While the Proponent has listed potential mitigations in the most recent memo on black carbon, these mitigations may not be sufficient in reducing the Project's contribution to Canadian Arctic black carbon. Further investigation of additional, effective mitigation measures should be provided by the Proponent to reduce black carbon emissions from shipping. A possible mitigation measure is the use of distillate fuels. As stated by Canada in a report to the IMO, "*new studies provide more certainty that a switch from residual fuel to distillate fuel reduces BC emissions by at least 33%. Low sulphur fuel blends will likely not lead to BC reductions*" (Lack, 2017).

ECCC's Recommendation(s):

Given the sensitive nature of the Arctic, ECCC recommends the Proponent investigate additional mitigation measures to mitigate the black carbon associated with Project-related shipping.

3.2.5 ECCC-FC5: Acid Rock Drainage and Metal Leaching at the Waste Rock Pile, Quarries and Rail Line Rock Cuts

Reference(s):

- Baffinland Iron Mines Corporation. 2019. Technical Comment Responses Phase 2 Proposal – Mary River Project, Responses to 3.19 and 3.20.
- Environment and Climate Change Canada. 2019. Environment and Climate Change Canada's Technical Submission to the Nunavut Impact Review Board Respecting Mary River Project – Phase 2 Proposal by Baffinland Iron Mines Corporation, ECCC 3.19 and ECCC 3.20.
- Baffinland Iron Mines Corporation. 2019. Memo: Outstanding questions related to ECCC 3.19, May 1, 2019.
- Baffinland Iron Mines Corporation. 2019. Memo: Statement on Waste Rock and ARD, July 3, 2019.

Proponent's Conclusion(s):

On March 7, 2019, ECCC submitted two technical comments to the NIRB regarding concerns and questions on Acid Rock Drainage (ARD)/Metal Leaching (ML) rock mitigation and management as part of ECCC's Technical Review Submission (ECCC 3.19 and ECCC 3.20). ECCC 3.19 provided recommendations regarding the waste rock pile, whilst ECCC 3.20 provided recommendations regarding quarries and rail line rock cuts. On March 25, 2019 the Proponent provided the following in response to ECCC's technical comments 3.19 and 3.20:

“...management strategies are continually updated to mitigate observed issues and evaluate the effectiveness of the management practices. Baffinland continues to investigate the source of the observed ARD at the WRF, and has retained expert engineering support to evaluate the effectiveness of the current management strategy and update the thermal model.

The waste rock management plan continues to be updated on an as-needed basis, with an interim update scheduled for 31 March 2019 and a full update of the management plan in December 2019 following the collection and assessment of monitoring data to be completed in 2019. Baffinland continues to evaluate how waste rock is characterized and to monitor the geochemical data from blast hole data for waste rock characterization. Information will continue to be provided to CIRNAC [Crown-Indigenous Relations and Northern Affairs Canada], ECCC, QIA [Qikiqtani Inuit Association] as required under the terms and conditions of the existing Type A Water Licence and through MDMER [Metal and Diamond Mining Effluent Regulations] reporting” (Page 54).

In response to concerns raised by ECCC and CIRNAC, the Proponent issued two technical memos (May 1 and May 14, 2019) providing a description of work underway, commitments to provide an updated Waste Rock Management Plan (WRMP) by Dec. 31, 2019 and an explanation of the proposed mitigation and management for the Phase 2 Proposal developments. These concerns were further discussed with the Proponent and CIRNAC during the June 18-19 Technical Meetings.

In the May 1 2019 technical memo, (as well as during discussions at the June 18-19, 2019 Technical Meetings) further clarification was provided by the Proponent on 2019 geochemical investigations being

undertaken in order to determine soluble sulphate contents within the waste rock and potential impacts to seepage water quality. The Proponent stated that this geochemical testing program will provide the information needed to inform management responses which will be provided in an updated WRMP that will be available by December 31, 2019. More specifically, the geochemical testing program will provide insight on the need to re-assess the 0.2% total Sulphur content cut-off used to classify rock as Potentially Acid Generating (PAG) or non-PAG. The results of this investigation would allow the Proponent to better understand the cause of ARD/ML at their Waste Rock Pile and better inform mitigation measures to be used to manage ARD/ML and seepage issues.

In the May 14, 2019 technical memo, the Proponent provided clarification regarding the need to reassess their PAG/Non-PAG rock characterization protocol in order to avoid ARD/ML in future quarries and rail line rock cuts. The Proponent also provided clarification regarding mitigation measures that can be implemented if PAG rock is identified at quarries and rail line rock cuts. The Proponent mentions that, where possible, PAG rock would be avoided and would not be developed or exposed. In the event that PAG rock cannot be avoided, the Proponent will employ the following mitigations measures, *“diverting of runoff and seepage from exposed PAG rock cuts; re-sloping and covering PAG face with crushed carbon rich rock; and design of engineered covers such as shotcrete cover of exposed PAG rock cuts”* (Page 2). Further, surface water runoff from quarries will be monitored and should be able to inform if the mitigation measures are effective and if they are shown to be ineffective the Proponent states that possible treatment methods will be evaluated to manage the issue.

ECCC's Conclusion(s):

ARD/ML at the Waste Rock Pile

ECCC's technical comment regarding ARD/ML issues at the waste rock pile (ECCC 3.19) discussed ongoing issues already occurring with current operations at the mine site and how these issues could be managed for the Phase 2 Proposal expansion, which will add additional waste rock to the pile. These issues relate to determining the cause of ARD/ML and managing seepage from the waste rock pile. Recommendations were made by ECCC regarding the use of more conservative rock characterization protocols, management of the waste rock pile and the necessity for detailed and specific mitigation measures.

In the May 1 2019, technical memo the Proponent provided clarification on the waste rock pile liner and testing of the liner after construction, which addressed ECCC's concern with the liner. The Proponent also committed to providing a summary of lessons learned in their Phase 1 WRMP.

The 2019 field season is critical for the Proponent to fully investigate the cause of ARD/ML at their waste rock pile. As such, ECCC is unable to provide a full technical review of ARD/ML issues at the Waste Rock Pile at this time and will be unable to do so until the Phase 1 WRMP is submitted by the Proponent for review by interested parties. ECCC expects that the updated Phase 1 WRMP will provide insight on the cause of ARD/ML as well as inform key management responses (including mitigation measures and adaptive management measures) that will limit potential impacts on the receiving environment. The importance of the management measures presented in the Phase 1 WRMP will be significant as ore production is expected to increase significantly during the Phase 2 Proposal and the additional waste rock could increase potential impacts to the environment. As such, the Phase 1 WRMP will provide insight

on a number of uncertainties that exist at the current waste rock pile and its review by interested parties must be undertaken prior to authorizing an increase in ore production.

ARD/ML at Quarries and Rail Line Rock Cuts

The Proponent has provided examples of mitigation measures that should be able to manage potential impacts related to ARD/ML at the quarries and rock cuts. However, the results from the geochemical investigations in the Phase 1 WRMP should also inform the adequacy of waste rock characterization by the 0.2% total sulphur content cut-off at the quarries and rail line rock cuts. This will ensure that this cut-off will allow the Proponent to adequately manage potential impacts from ARD/ML at the quarries and rock cuts.

ECCC's Recommendation(s):

ECCC recommends that

- The NIRB include a new Term and Condition as part of Project Certificate No. 005 that requires the Proponent to Submit the Phase 1 WRMP for review by interested parties.
- The Proponent consider the results of the Phase 1 WRMP in re-evaluating the 0.2 % Sulphur cut-off for quarries and rock cuts.

3.2.6 ECCC-FC6: Arctic Diesel Fuel Spill Modelling

Reference(s):

- Baffinland Iron Mines Corporation. 2019. Technical Comment Responses Phase 2 Proposal – Mary River Project.
- Environment and Climate Change Canada. 2019. Environment and Climate Change Canada's Technical Submission to the Nunavut Impact Review Board Respecting Mary River Project – Phase 2 Proposal by Baffinland Iron Mines Corporation, ECCC 3.22.

Proponent's Conclusion(s):

In their responses to ECCC's technical comments, dated March 25 2019, the Proponent stated that they conducted four weathering simulations considering both Intermediate Fuel Oil (IFO) and Arctic Diesel representing both open water season (July) and shoulder season (October). The Proponent presented four figures (Figures 1 to 4) from these simulations in their response to ECCC's technical comments. According to the Proponent, "*...Arctic diesel in the shoulder season conditions is expected to disperse much more quickly than in open water*", whilst "*IFO shows little loss in either scenario*" (Page 56).

The Proponent states that it is difficult to characterize fuel and ice interactions because these processes occur at a small scale, and that resolutions for sea ice models are in the 10 to 100 km range. Therefore interactions with snow and ice were not included in their fuel spill model presented in Technical Support Document (TSD) 19 and a remodelling to include Arctic Diesel would not characterize their behaviour in ice and snow conditions. It is however noted that the general discussion provided for weathering of IFO

during break-up and freeze-up can be applied to diesel and thus that the “*overall conclusions from the TSD 19 would be expected to be applicable to Arctic diesel for spills in the shoulder season relative to the open water season*” (Page 56).

ECCC's Conclusion(s):

IFO and Arctic diesel have significantly different physical and chemical properties. As a consequence, they would have notably different fate and behaviour if a spill event were to occur under identical environmental conditions. This is demonstrated in the four weathering simulations provided by the Proponent in their response (Figures 1 to 4).

In Figure 1, the % Evaporation Loss curves for the diesel vs IFO shoulder season present observable differences in slope in the initial 20 hours and only approach 20% and 17% Evaporative Loss respectively after 120 hours.

Figure 2, Water column (Dispersion) loss for all four seasons and Figure 3, Water column (Dispersion) loss for all IFO scenarios, display notable differences in the amount of diesel or IFO dispersed or entrained in the water column during the initial 20 hours. The figures show diesel plateauing at 80% (Figure 2) and IFO fuel at <0.002% after 120 hours (5 days). Figure 4, fuel remaining for all four scenarios, displays notable differences in the amount of diesel versus IFO fuel remaining during the initial 20 hours. After 120 hours 83% of the IFO fuel will remain for the shoulder season scenario while only trace amounts of diesel will remain after the same 120 hour period. In summary, the figures appear to demonstrate that during the shoulder season there exists the potential that the fate and behaviour of IFO and Arctic diesel are significantly different.

Although the trajectories of the spills with the two fuels might be similar, it is believed that their weathering patterns will be different, which in turn could lead to different response strategies for both fuels. Modelling of Arctic diesel is thus advisable in order to adequately determine the best response strategy for this fuel in the event of a spill.

ECCC's Recommendation(s):

ECCC continues to recommend that the Proponent conduct Arctic diesel fuel spill modelling for all scenarios in order to account for the differences in the fate and behaviour with IFO and adequately determine the best response strategy for Arctic Diesel.

3.2.7 ECCC-FC7: Shipping in the Northwest Passage

Reference(s):

- Baffinland Iron Mines Corporation. 2019. Technical Memo – Black Carbon Emissions for the Phase 2 Project (August 22, 2019).
- Baffinland Mines Iron Corporation. 2019. Mary River Project: Environmental Review of Shipping through the Northwest Passage.

- Fisheries and Oceans Canada. 2019. Technical Review Comments – Baffinland Iron Mines Corporation Mary River “Phase 2 Development” Project Proposal.

Proponent's Conclusion(s):

In response to Fisheries and Oceans Canada's Technical Comment 3.1.4, the Proponent provided the report, *Environmental Review of Shipping through the Northwest Passage*. This report provided information of alternate shipping routes going through Navy Board Inlet and the Northwest Passage (NWP). This report is titled an environmental review, but Section 3.0 (Methods) states that “*this report is not an environmental assessment, and does not present conclusions as to the significance of residual environmental effects*” (Page 9).

The report describes the existing environment along potential shipping routes with a brief description of project interactions (Section 5.0 and 6.0). Section 2.3 states that a number of plans would require revisions for this change in shipping route including the Environmental Protection Plan, Shipping and Marine Wildlife Management Plan, Ballast Water Management Plan, Emergency Response Plan and Spill at Sea Response Plan. No information is provided regarding fuel spill modelling along the proposed shipping routes through the NWP.

The report describes potential project shipping routes and current shipping activity in the NWP, yet does not provide an estimate nor a quantification on the number or range of transits the Proponent intends to send through this proposed route. Table 14, states that “*though the Northwest Passage route distance will likely be longer in total length to market destinations, only a fraction of total ships will be redirected to this route, and it is therefore predicted that the route through the Northwest Passage will not substantively change the total GHG [greenhouse gas] emissions estimates for the Project*” (Page 83). Similarly, Table 14 states that there will be no “*potential substantive interaction*” (Page 83) of the Project with air quality and Section 6.1 states an estimated amount of black carbon for the Project at 15.6 tonnes per year.

ECCC's Conclusion(s):

The purpose of the Proponent's *Environmental Review Report* for shipping through the NWP is unclear as the report states that it is not intended to present conclusions on the significance of residual environmental effects. It is unclear to ECCC if the Proponent is intending to ship through Navy Board Inlet and the NWP, or if this report simply presents the potential for an alternative route through the NWP that would require a more in depth evaluation. If the purpose of this report was to assess the environmental effects of the Project's shipping in the NWP, information on the number of transits and preferred routes would be beneficial.

ECCC notes that information is missing from the Proponents report in order to evaluate potential impacts to migratory birds and key marine habitat sites along the proposed shipping routes. Marine birds congregate in large concentrations throughout most of the year and are therefore more sensitive to site-specific threats, (e.g., oil spills) than other more dispersed species. There is no discussion of the effects of a potential spill on marine birds, or any other wildlife species. At a minimum, a spill trajectory assessment in Navy Board Inlet should be completed, similar to what was conducted for Milne Inlet and Steensby Inlet. A similar assessment relative to key marine habitat sites that are most likely to interact

with Project shipping along the NWP is also advisable depending on the magnitude of the proposed shipping activity.

ECCC also notes that information is missing regarding air quality effects. Table 14 states that there will be no “*potential substantive interaction*” of the Project with regards to air quality (Page 83). Without quantification of GHG and CAC emissions for all potential shipping routes in Canadian waters, the determination of potential impacts to air quality and climate cannot be made. In order to determine the potential impacts to air quality and climate, at minimum, the following should be completed:

- Quantification of total black carbon emissions for all proposed shipping routes within Canadian waters. This calculation should be updated to use a black carbon to PM_{2.5} ratio of 0.5 and a 0.5% Sulphur fuel content assumption. The black carbon totals should be compared to the total black carbon emissions in the Canadian arctic as opposed to all of Canada.
- Quantification of total CAC (NO₂, SO₂, PM₁₀, and PM_{2.5}) emissions for all proposed shipping routes within Canadian waters.
- Quantification of total GHG emissions for all proposed shipping routes within Canadian waters.
- A comparison of all emission totals for each proposed shipping route.

ECCC's Recommendation(s):

ECCC recommends that the Proponent:

- Identify whether they intend to use the alternative shipping through Navy Board Inlet and/or the Northwest Passage and if so, under which circumstances.
- Conduct an environmental assessment prior to using alternative shipping, including an evaluation of potential effects of shipping on migratory birds, the aquatic environment and the atmospheric environment.

4.0 Summary of Recommendations

4.1 ECCC- FC1: Canadian Ambient Air Quality Standards and Reporting of Annual Monitoring Data

ECCC recommends that the NIRB include or amend the Terms and Conditions of Project Certificate No. 005 to require the Proponent to:

- Submit all air quality and meteorological monitoring data as part of the annual reports and compare the monitoring data to the CAAQS, where applicable. The air quality and meteorological monitoring data should be presented to include at least, but not limited to:
 - Time series of data.
 - Hourly, daily, and annual averages in graphical and/or tabulated form (if applicable to the air quality or meteorological parameter).
 - Comparison to the CAAQS (and relevant statistical forms, if three years is not available, CAAQS can be calculated using one year).
 - Wind roses.
 - Graph and tables indicating seasonal variability.
 - Comparisons to other years of data.
- Include any photos taken of dust on snow in the annual reports.
- Present the predicted concentrations in the annual reports as a range of absolute concentrations.

4.2 ECCC- FC2: Nitrogen Dioxide, Power Generation, and Mobile Equipment Engine Tier

ECCC recommends that the Proponent:

- Investigate NO₂ reduction measures that could be applied to power generation that would offset the use of a portion of the emissions from the generators. This information should be provided in a management plan along with a quantitative analysis of the potential emissions offset.
- Commit that all mobile equipment (new and existing) be Tier 4 or better.

4.3 ECCC- FC3: Air Quality and Noise Abatement Management Plan

ECCC recommends that the NIRB amend the Terms and Condition #7 of Project Certificate No. 005 to require the Proponent to:

- Complete the AQNAMP in consultation with ECCC and other interested interveners.
- Monitor PM_{2.5} and TSP using continuous monitors at:
 - The sites that already monitor NO₂ and SO₂ at both Milne Port and the Mine Site.
 - New locations on or close to the Project Boundary at both the Milne Port and Mine Site that include sites that are close to locations of passive dustfall monitoring and in locations

that have predicted and passively measured high dustfall; and site placement also consider prevailing wind direction.

ECCC recommends that the Proponent update the AQNAMP with the following:

- Present the predicted concentrations in the AQNAMP as a range of absolute concentrations.
- Investigate ways to mitigate the emissions from the stockpiles and present these in the AQNAMP for review.
- Include management actions for the stockpiles in Section 4 of the AQNAMP as well as Table 5-2, and Table 5-3.
- Define the management action trigger levels for both the 24-hour and annual averaging periods for all species (Table 5-1, Table 5-2, and Table 5-3).
- Define the frequency at which air quality and meteorological data is reviewed that allows for timely response for implementation of corrective actions in response to exceedances of triggers.
- Include details on how the air quality data and meteorological data will be analyzed together during the investigation of exceedance of trigger levels and necessary management actions.
- Confirm the trigger levels for dustfall and include corrective actions associated with collected dustfall data.
- Include 24-hour and annual Total Suspended Particulate data in the dustfall management action trigger levels and describe how it will be used as a tool for determining potential causes of elevated dustfall.
- Include the wind roses from onsite meteorological stations, maps showing where these potential monitoring stations are located, discussion on the rationale for the site locations, and discussion on how emissions from the stockpiles would be captured by these monitoring stations.

4.4 ECCC- FC4: Black Carbon Emissions

Given the sensitive nature of the Arctic, ECCC recommends the Proponent investigate additional mitigation measures to mitigate the black carbon associated with Project-related shipping.

4.5 ECCC- FC5: Acid Rock Drainage and Metal Leaching at the Waste Rock Pile, Quarries and Rail Line Rock Cuts

ECCC recommends that

- The NIRB include a new Term and Condition as part of Project Certificate No. 005 that requires the Proponent to Submit the Phase 1 WRMP for review by interested parties.
- The Proponent consider the results of the Phase 1 WRMP in re-evaluating the 0.2 % Sulphur cut-off for quarries and rock cuts.

4.6 ECCC- FC6: Arctic Diesel Fuel Spill Modelling

ECCC continues to recommend that the Proponent conduct Arctic diesel fuel spill modelling for all scenarios in order to account for the differences in the fate and behaviour with IFO and adequately determine the best response strategy for Arctic Diesel.

4.7 ECCC-FC7: Shipping in the Northwest Passage

ECCC recommends that the Proponent:

- Identify whether they intend to use the alternative shipping through Navy Board Inlet and/or the Northwest Passage and if so, under which circumstances.

Conduct an environmental assessment prior to using alternative shipping, including an evaluation of potential effects of shipping on migratory birds, the aquatic environment and the atmospheric environment.

5.0 Acknowledgements

ECCC would like to thank the NIRB for this opportunity to provide input to the review process for the Mary River Project – Phase 2 Proposal (08MN053) and looks forward to continuing its participation in this process.

ECCC's technical review comments and recommendations are not to be interpreted as any type of acknowledgement, compliance, permission, approval, authorization, or release of liability related to any requirements to comply with federal or territorial statutes and regulations.