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ECCC File: 6100 000 011/004
NWB File: 2AM-MRY1325

June 20, 2022

via email at: licensing@nwb-oen.ca

Richard Dwyer
Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0

Dear Richard Dwyer:

RE: 2AM-MRY1325 – Baffinland Iron Mines Corporation – Mary River Project – 2021 Annual Report

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Nunavut Water Board (NWB) regarding the above-mentioned annual report.

ECCC is providing technical, science-based information and knowledge based on our mandate pursuant to the *Canadian Environmental Protection Act* and the pollution prevention provisions of the *Fisheries Act*. These comments are intended to inform the assessment of this project's potential effects in the receiving environment and on valued ecosystem components. Any comments received from ECCC in this context does not relieve the proponent of its obligations to respect all applicable federal legislation.

The following comments are provided:

1. **ECCC Comments from 2020 Annual Report Review**

Reference(s)

- 2021 QIA-NWB Annual Report Appendix E.14 2021 Responses

Comment

The response table for comments on the 2020 Annual Report includes responses from Baffinland, with many having the assigned due date of "March 31, 2022 (2021 Annual Report submission)". It would be useful for all the comments linked to the 2021 Annual Report to include explicit references to where the information can be found. ECCC comments have been substantially addressed in the 2021 Annual Report for Intervenor Comments 2, 3, 4, 6, and 7. Comments 5 and 8 are partially addressed, and follow-up recommendations are made below.

Comment 1 is included in separate comments below (ECCC# 4 and 5).

a) Comment 5 deals with the Reclamation Research Studies Pit Lake Literature Review, which does not appear to have been included in the 2021 Annual Report as noted in the table (the 2021 Reclamation appendix is focused on revegetation.) The ECCC comment was as follows:

Provide a discussion of final pit depth and geotechnical investigations required to evaluate groundwater inflows which may inform data collection activities outlined in the Reclamation Research Studies Pit Lake Literature Review.

In the response table, Baffinland provided the currently anticipated maximum pit depth (160 m) and noted that, "As the open pit is advanced, the potential for groundwater inflows will be monitored and additional geotechnical and/or hydrogeological investigations will be proposed as necessary."

b) Comment 8 recommended the following to be included in subsequent annual reports:

Continue monitoring, investigating and updating the thermal assessment of the WRF and identifying other possible hot spots in the WRF.

The response from Baffinland referenced thermal monitoring and noted that continued monitoring and management will be required to ensure the proposed closure scenario remains valid. There were no updates to the Interim Closure and Reclamation Plan for the 2021 Annual Report, and details of thermal monitoring and results do not appear to have been included in the 2021 Annual Report. Section 9.6.4 Thermal Monitoring Program states that 8 thermistors were installed in 2018-2019, but no data is provided. Information on identification of hot spots is not mentioned.

ECCC Recommendation(s)

a) ECCC recommends that Baffinland identify the conditions which will trigger geotechnical and/or hydrogeological investigations.
b) ECCC recommends subsequent annual reports include a section explicitly reporting thermal investigation results and any updates to the waste rock management approach for closure.

2. Groundwater Well Installation

Reference(s)

- 2021 QIA-NWB Annual Report Appendix E.12 2021 Groundwater Monitoring Report
    - Section 2.2 Groundwater Monitoring and Sampling at Landfill Facility

Comment

In 2020, Baffinland's consultant recommended the installation of permanent 2" diameter monitoring wells, to improve data collection repeatability and to conduct hydraulic conductivity tests. Logistical obstacles prevented the planned installation in 2021, and the Groundwater Monitoring Report notes that installation will be "considered" in 2022.

ECCC Recommendation(s)

ECCC recommends Baffinland confirm whether installation of the monitoring wells is proceeding in 2022.

3. Groundwater Well Location

Reference(s)

- 2021 QIA-NWB Annual Report Appendix E.12 2021 Groundwater Monitoring Report
  - Table B
  - Figures 2 & 4

Comment

Figures 2 and 4 show the 2021-installed monitoring site as MS-LF-GW-REF1, although it is at the same site as previously sampled MS-LF-GW1 wells, and the 2019-installed MS-LF-GW-REF1 is up-gradient of that. The UTM location is the same as for down-gradient GW1 sites previously sampled.

Sample results refer to both MS-LF-GW-REF1 and MS-LF-GW1 for 2021 data, but for 2021, Figures 2 and 4 only show MS-LF-GW1-REF1 which is at the location of previous sampling sites designated MS-LF-GW1.

ECCC Recommendation(s)

ECCC recommends Baffinland clarify whether MS-LF-GW-REF1 (2021) is a reference sample or should be designated MS-LF-GW1, noting that the location corresponds exactly to MS-LF-GW1-18, which is a down-gradient sample from 2018.

ECCC recommends Baffinland provide the updated figures which show where the 2021 MS-LF-GW-REF1 and MS-LF-GW1 sites are located.

4. Contaminant Migration in Groundwater Adjacent to Landfill

Reference(s)

- 2021 QIA-NWB Annual Report Appendix E.9.1 CREMP
- 2021 QIA-NWB Annual Report Appendix E.12 2021 Groundwater Monitoring Report
  - Section 4.2.2 Landfill Facility
  - Section 5.1 Landfill Facility
- 2021 QIA-NWB Annual Report Appendix E.14 2021 Responses

Comment

Drive-point piezometers were installed in Sept. 2021 up-gradient and down-gradient of the landfill to evaluate concentrations of various parameters in groundwater. The Groundwater Monitoring Report noted that chloride and sulphate concentrations again exceeded Federal Interim Groundwater Quality (FIGQ) guidelines down-gradient of the landfill at MS-LF-GW1, and for sulphate only at MS-LF-GW2. In Section 5.1.1, the report concludes that chloride is

stable or decreasing, although above FIGQ guidelines, and sulphate is exhibiting increasing trends and impacting groundwater in the vicinity of the landfill.

Additionally:

- “Dissolved metal parameters including boron, cadmium, lead, nickel, and uranium, and total metal parameters including boron, cadmium, chromium, lead, nickel, titanium, and uranium concentrations were greater than their respective FIGQ Guidelines at one or more of the down-gradient drive-point piezometers in 2021; however, these metal exceedances were not detected at any of the reference locations.
- Dissolved silver was reported below the laboratory detection limit (LDL, 0.0005 mg/L) at all monitoring locations; however, the LDL is greater than the FIGQ Guideline of 0.00025 mg/L.
- Dissolved copper, and total metal parameters including aluminum, copper, iron, and zinc were greater than their respective FIGQ Guidelines at one or more drive-point piezometers in 2021 including at one of the reference locations (MS-LF-GW-REF2).”

The report notes in Section 5.1.2 that there are increasing trends in dissolved iron, uranium and nickel with concentrations greater than FIGQ guidelines, indicating groundwater quality impacts due to dissolution from the metal debris that has been disposed of in the landfill.

Section 5.1.3 provides discussion of down-gradient total organic carbon (TOC) and dissolved organic carbon (DOC) concentrations, which were an order of magnitude greater at MS-LF-GW1 and MS-LF-GW2 than other monitoring sites. DOC concentrations at the down-gradient monitoring locations ranged from 4.34 mg/L to 28.6 mg/L, compared to DOC concentrations at the reference locations which ranged from 2.83 to 4.48 mg/L. The highest concentrations occurred down-gradient of the landfill at MS-LF-GW1 (28.6 mg/L) and MS-LF-GW2 (20.8 mg/L). TOC concentrations followed similar patterns, with the highest concentrations detected at down-gradient locations MS-LF-GW1 (30.3 mg/L) and MS-LF-GW2 (21.6 mg/L). There are no FIGQ Guidelines for DOC or TOC, but the report concluded that the measured levels of TOC and DOC combined with historical data indicates potential petroleum hydrocarbon impacts in the groundwater adjacent to the landfill.

In their response to comments, Baffinland noted that:

“The groundwater monitoring indicated increasing trends of sulphate and dissolved iron, nickel, and uranium. Of these parameters, sulphate and dissolved uranium concentrations were elevated at Sheardown Lake NW and sulphate was elevated at Sheardown Lake SE in 2021, as compared to at the reference lake in 2021 as well as compared to baseline. Despite slight elevation of concentrations of these parameters at Sheardown Lake compared to the reference lake and/or to baseline, concentrations remained well below AEMP benchmarks and/or water quality guidelines. Therefore, Baffinland will continue to monitor concentrations of the parameters indicated above in surface water of Sheardown Lake, and will implement trend analyses in future CREMP studies for these parameters in order to track changes over time.”

ECCC notes that while Sheardown Lake NW parameters were below Aquatic Effects Monitoring Plan (AEMP) benchmarks and guidelines, elevated concentrations of aluminium,

chloride, nitrate, sulphate, and uranium were measured. Sheardown Lake SE was similarly below benchmarks and guidelines, but showed increases in aluminum, nitrate, manganese, molybdenum, uranium and sulphate.

At the Hazardous Waste Berm site there were elevated concentrations of ethylbenzene, zylene, petroleum hydrocarbon (PHC) F2 and naphthalene, with two monitoring locations showing possible groundwater impacts. Further sampling is to be conducted in 2022.

ECCC Recommendation(s)

ECCC recommends assessing the potential for impacts on Sheardown Lake if trends continue to show increasing concentrations of parameters in groundwater. This may include tracking concentrations in Sheardown Lake in 2022 and conducting trend analyses for sulphate and dissolved uranium, as well as flagging any increases in water quality parameters that may be correlated to groundwater inputs.

ECCC recommends using lower detection limits to analyse silver in groundwater (i.e. below guidelines levels of 0.00025 mg/L).

5. Monitoring of Total and Dissolved Metals in Groundwater

Reference(s)

- 2021 QIA-NWB Annual Report Appendix E.12 2021 Groundwater Monitoring Report
    - Section 7.0 Recommendations
- 2021 QIA-NWB Annual Report Appendix E.14 2021 Responses

Comment

The Groundwater Monitoring Report again states in Section 7.0 Recommendations: "Discontinue the analysis of total metals as dissolved metals results are more representative for assessing groundwater quality impacts." The basis for this is to be consistent with the FIGQ Guidelines which apply to dissolved contaminants, potential sorption of contaminants to soil particles, and factors such as turbidity, sediment content, or surface water infiltration.

In response to this recommendation in the 2020 Annual Report, ECCC noted:

However, it would be helpful to have an evaluation of contaminant mobility in the substrate adjacent to the landfill; specifically, the likelihood of movement of particulate-associated contaminants whether through direct transport or desorption processes.

In the response to comments, Baffinland states: "Baffinland has retained a consultant to review existing groundwater data and prepare a memo to evaluate contaminate mobility in the substrate adjacent to the landfill. The analysis is ongoing and Baffinland will submit this memo to the NWB and ECCC by April 30, 2022."

ECCC has not seen this memo yet, and looks forward to reviewing the analysis.

ECCC Recommendation(s)

ECCC notes that focusing the groundwater analyses on the dissolved fraction is reasonable, provided there is an understanding of contaminant mobility and behaviour of particulate-

associated contaminants.

6. Benchmarks for Chromium, Table Notes and Baseline Data

Reference(s)

- 2021 QIA-NWB Annual Report Appendix E.5.3 AEMP
    - Tables 3.1 – 3.3

Comment

Several parameters in the water quality tables have “Not Calculated” shown for the baseline data for Camp, Mary and Sheardown lakes. It is not clear why values have not been included.

For Table 3.1, Note 5 references changing detection limits for chromium 6+ and changes to be made in 2014. The current table includes the Cr3 and not the Cr6 benchmark. It is not clear what the rationale for changing the species of chromium used for the benchmark, noting that this increased the benchmark from 0.001 to 0.089 mg/L. While Mary Lake shows Cr3 baseline at 0.005 mg/L it isn’t clear if this is a detection limit or measured value. No data are provided for Camp or Sheardown Lakes.

Under Table 3.1, Notes 1, 2, 3, 4 and 6 appear to be relevant but Notes 5, 7, and 8 do not appear to be related to current data in the table.

For Table 3.2, Notes 5 and 7 should be removed, and Note 6 should be included in the table for relevant parameter(s).

Table 3.3 would clearer with the abbreviations defined (i.e. NGA, SEL).

ECCC Recommendation(s)

ECCC recommends updating Tables 3.1 and 3.2 of the AEMP document to include baseline data for the 3 sites. Notes under both tables should be updated and corrected for clarity. A rationale or discussion should be provided on the change to Cr3 from Cr6 and use of the associated less conservative benchmark. Abbreviations should be defined for Table 3.3.

7. New Incinerator Stack Test Results

Reference(s)

- 2021 QIA-NWB Annual Report for Operations
    - Section 2.3.2.3 Modification No. 11 – Installation of an Incineration Unit at Milne Port’s 380-Person Camp

Comment

Baffinland installed one new incinerator at the 380-person camp at Milne Port. Prior to operating the unit, the incinerator was subject to initial stack testing to confirm emissions standards were being met, as per Project Certificate Condition No. 12. Due to the results of the initial stack test, the incinerator unit was not commissioned. However, no details are

given as to why the incinerator unit did not pass the initial stack test. Additional information is valuable to ensure proper incinerator operation and compliance with the Canada-wide Standards (i.e., emissions standards).

ECCC Recommendation(s)

ECCC recommends Baffinland provide the initial stack test results and details on why the new incinerator unit did not meet emission standards.

8. Waste Incinerator Emissions

Reference(s)

- 2021 QIA-NWB Annual Report for Operations
    - Section 5.2.1 Site Incinerators
- Baffinland Iron Mines Corporation Waste Management Plan (BAF-PH1-830-P16-0028, Rev 8, March 2020)
- Canada-wide Standards for Mercury Emissions (2000); Canadian Council of Ministers of the Environment (CCME), Quebec City, QC
- Canada-wide Standards for Dioxins and Furans (2001); Canadian Council of Ministers of the Environment (CCME), Winnipeg, MB
- Mary River Project 2020 NIRB Annual Report – Appendix G.21 2020 Source Testing

Comment

In 2021, two incinerators (one at the Mine Site and one at Milne Port) were operated throughout the year to incinerate solid waste. Waste incineration has the potential to produce air emissions of dioxins, furans, and mercury, which are toxic, persistent, and can bioaccumulate.

Incinerators were operated as per regulatory guidelines, including the Canada-wide Standards (CWS) and the Project's Waste Management Plan (WMP; document BAF-PH1-830-P16-0028). According to Section 3.5 in the WMP, initial incinerator stack tests are completed immediately following commissioning of the incinerators, and follow up stack tests will be completed every five (5) years for dioxins, furans and mercury to ensure incinerators are operating within applicable air emission standards (e.g., the CWS). The annual amount of waste incinerated at the Milne Port and Mine Site are approximately 180 and 450 tonnes per year, respectively.

The CWS are intended to minimize the emissions and potential effects of dioxins, furans, and mercury. The standards stipulate that facilities which incinerate more than 26 tonnes per year of waste annually must confirm compliance with the CWS by annual stack testing (CCME, 2000 and 2001).

The most recent incinerator stack testing for the Mine Site and Milne Port seems to have been completed in August and September 2020 (Appendix G.21 of the 2020 NIRB Annual Report). Both incinerator stacks were tested three times each, and the average of the three stack tests exceeded the CWS for dioxins and furans for both incinerators. According to the Source Testing Report (Appendix G.21 of the 2020 NIRB Annual Report), one of the three

samples for each incinerator stack test may represent an outlier and could be excluded from the average. If the outliers are excluded, then the average of the remaining two stack tests are below the CWS for dioxins and furans. The Source Testing Report stated that the high concentrations of dioxins and furans during the tests identified as 'outliers' was likely caused by process faults (Mine Site test) and high level of wet waste (Milne Port test). However, the report does not indicate how frequent these issues are and whether corrective actions were taken to minimize the chance of these issues reoccurring.

ECCC Recommendation(s)

Given the toxicity, persistence, and ability for dioxins and furans to bioaccumulate, it is important to ensure that emissions from waste incinerators at large facilities are below the CWS. Since recent incinerator stack tests appear to exceed the CWS, ECCC recommends Baffinland:

a) Provide results from all incinerator stack tests that have been conducted on the Mine Site and Milne Port incinerators.

b) Provide rationale for any stack test results that exceed the CWS, as well as actions that can be taken to minimize the likelihood of future exceedances.

c) Update the Waste Management Plan to require annual stack testing for dioxins and furans, and mercury for all incinerator units incinerating more than 26 tonnes of waste per year, consistent with the CWS for dioxins and furans, and mercury.

If you need more information, please contact Melissa Pinto at (867) 445-5384 or Melissa.Pinto@ec.gc.ca.

Sincerely,

[original signed by]

Melissa Pinto
Senior Environmental Assessment Officer

cc: Jody Small, Acting Head, Environmental Assessment North (NT and NU)