Environment and Climate Change Canada | Environnement et Changement climatique Canada

Environmental Protection Operations Directorate
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ECCC File: 6100 000 011/004
NWB File: 2AM-MRY1325

January 21, 2019

Via email at: licensing@nwb-oen.ca

Ida Porter
Licensing Administrator
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0

Dear Ida Porter:

**RE: 2AM-MRY1325 – Baffinland Iron Mines Corporation – Mary River Project – Interim Waste Rock Management Plan**

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Nunavut Water Board (NWB) regarding the above-mentioned Interim Waste Rock Management Plan and is submitting comments via email. ECCC's specialist advice is provided based on our mandate, in the context of the *Canadian Environmental Protection Act*, and the pollution prevention provisions of the *Fisheries Act*.

The following comments are provided:

1. **Section 1.0**

   Proponent Conclusion

   The Proponent stated that, "Baffinland has retained Golder Associates Ltd. (Golder) to assist with developing an updated Waste Rock Management Plan (WRMP) for deposition of potential acid generating (PAG) and non-PAG waste rock at their Waste Rock Facility (WRF). An updated WRMP is required to accommodate current operational constraints, address the occurrence of acid rock drainage (ARD) from the WRF, and improve the chemical stability of future PAG waste rock deposition" (Page 1).

   The Proponent acknowledged that the updated WRMP is to accommodate the current operational constraints, and address the occurrence of ARD from the WRF.

In the Section 4.0 of the Proponent's 2017 Environment and Climate Change Canada Metal Mining Effluent Regulations Annual Report, , the Proponent indicated the key actions that will be taken to address the ARD concerns at the WRF are:

- injecting rhodamine dye into the WRF pond to identify the potential source of observed seepage; and
- continued work with Golder on developing the appropriate corrective actions to address concerns identified at the WRF in 2017.

In addition, the Proponent has stated that the thermistors installed in December 2018 are expected to provide internal temperatures at shallow boreholes and trench locations, whereas additional thermistors will be installed in deeper boreholes in 2019.

ECCC Conclusion

It is unclear to ECCC if there was an effort to determine what caused the occurrence of the ARD issue (e.g. misclassified/misplaced PAG/non-PAG rock, unfrozen core, hot spots, etc.). It is also unclear to ECCC how rhodomine dye injected into the WRF pond (i.e. the pond where the seepage from WRF drains into) will assist with determining how or what caused the ARD.

ECCC notes that if the thermistors in the deeper boreholes determine that at depth the WRF is not frozen, it is unclear what mitigation the Proponent proposes to address the issue.

There is no indication whether or not there is a liner beneath the waste rock pile.

ECCC Recommendations

ECCC recommends that the Proponent:

- Provide an explanation of what caused the Acid Rock Drainage;
- Provide an explanation of how injecting rhodamine dye into the Waste Rock Facility pond will assist in identifying the potential source of observed seepage;
- Identify mitigation measures that could be used if the Thermistors determine that the Waste Rock Facility at depth is not frozen; and
- Clarify whether or not there is a liner beneath the waste rock pile.

**2. Section 2.2 – Geochemistry Update**

Proponent Conclusion

The Proponent states that, "a field program was undertaken in December 2018 to further characterize the waste rock deposited at the WRF. It is anticipated that preliminary data from the field program (lab results and site measurements) will be available in February 2019" (Page 2).

ECCC Conclusion

ECCC notes that the Proponent conducted a field program in December 2018, possibly when the WRF pile was frozen. In addition, the details of the field program are unclear (e.g., the rationale for the field program, timing of the program and if the samples were obtained from the surface or taken from boreholes within the WRF pile).

ECCC Recommendation

ECCC recommends that the Proponent provide a more complete description and rationale for the fieldwork conducted in December 2018, and indicate where the samples were obtained (e.g., from the surface or within the Waste Rock Facility pile).

**3. Section 2.2.1 – 2018 Geochemistry Results**

Proponent Conclusion

The Proponent states that, "seepage water quality was monitored at 13 seepage locations around the WRF as shown in Figure 1. Two of the locations (MS-08-WEST-INFLOW and MS-08-EAST-INFLOW) were sampled between June and September for general field parameters. One sample from MS-08-WEST-INFLOW was submitted for trace metal analysis. The remaining 11 seepage locations were sampled between 1 September 2018 and 4 September 2018 for general field parameters and trace metal analysis. Seepage from all locations monitored is located within the current containment of the WRF and reports to MS-08 (Page 2).

ECCC Conclusion

It is unclear if the sample locations WRP-515 and WRP-S16 imply that the samples were taken from the pile surface rather than at the base where the seepage is likely to emerge from. In addition, it is unclear if any samples were obtained from locations along the length of the base of the waste rock pile adjacent to the pond (see Figure 1: WRF seepage monitoring locations).

In Figure 1, three sampling locations (MS-SP-04, MS-SP-02 and WRP-S10) are located on the left side of the Waste Rock Pile. These locations also appear to drain into the ditch to the left of the pond that continues in the foreground in Figure 1. It is unclear to ECCC if these sampling locations report to the water management pond. Furthermore, it is unclear where the seepage ditch drains and what the water quality parameters are for the water that is pooled in the ditch.

In Section 2.2.1 the summary of the key parameters shows that pH ranged from 6.8 to 9.4 yet in the same section the Proponent indicated that some samples had a pH range from 4.5 > pH > 3.5, with a minimum observed value of pH of 4.2. It is unclear

to ECCC which of these statements is correct. The Proponent also listed the total concentration of all key metals in this summary of key parameters, indicating that they are all below MDMER levels, but did not list iron which is a contributor to ARD. However, further in the report, the Proponent gave the result of iron concentrations ranging from <0.10 to 6,870 mg/L but did not indicate which sample location that contained the highest iron concentration.

ECCC Recommendations

ECCC recommends that the Proponent:

- Clarify where the samples were obtained from at locations WRP-515 and WRP-S16;
- Confirm whether samples were obtained from locations along the length of the base of the waste rock pile and adjacent to the pond;
- Confirm if MS-SP-04, MS-SP-02 and WRP-S10 drain into the ditch to the left of the pond in Figure 1 and clarify where the seepage from that ditch drains; and
- Confirm the pH values for each of the samples reported, include iron as a key parameter and indicate which sample contained the highest iron concentration.

**4. Section 2.2.1 – Geochemistry Results: ABA and Total Sulphur**

Proponent Conclusion

The Proponent stated that, “Neutralization Potential Ratio (NPR), expressed as the NP divided by the AP, ranged from 0.3 to 3.7 in the non-PAG samples and from -0.15 to 3.81 in the PAG samples. It should be noted that a direct comparison of blast hole data and the core sample results from the geochemical characterization is difficult, because NPR was determined mostly on blastholes samples of >0.2% sulfur (thus skewing the average to lower NPR values)” (Page 4).

ECCC Conclusion

ECCC notes that if the NPR value is 0.3, the sample should not be classified as non-PAG. Sampling blast holes is one method of sampling rock units before the ore/waste rock are blasted in order to determine how to classify the rock. The sampled results from blast holes are a good indication of what to expect when the rock is mined or blasted because they identify if a unit is PAG or non-PAG and therefore if that unit needs to be managed as such.

ECCC notes that the Prediction Manual for Drainage Chemistry from Geologic Sulphidic materials – MEND Report 1-20.1 published December 2009, provided ranges of NPR that are used to classify rock units into PAG (NPR ≤ 1), uncertain (1< NPR≤2) and non-PAG (NPR>2) although some authors have classified non-PAG rocks as NPR>3.0.

ECCC Recommendation

ECCC request that the Proponent clarify how they came to the conclusion that samples with a NPR value of 0.3 were classified as non-PAG when MEND (2009) states values of NPR below 1.0 should be classified as PAG.

**5. Section 2.2.1 – Geochemistry Results: Soluble sulphates**

Proponent Conclusion

The Proponent states that, "soluble sulphate minerals release stored acidity upon dissolution unlike sulphide minerals which release acidity based on their rate of oxidation. Soluble sulphate minerals provide an immediate source of acidity but typically over a shorter time frame when compared to the acidic generation from sulphide oxidation. The iron sulphate mineral melanterite has been observed within the WRF" (Page 4).

ECCC Conclusion

ECCC notes that soluble sulphate may be key to the source of the acidic rock drainage currently observed in the WRF. The Proponent has stated this could imply that when the oxidation of sulphide occurs at a later stage, the occurrence of ARD issues probably would increase and result in worsening the incidence of ARD in the WRF.

ECCC Recommendation

ECCC recommends that the Proponent confirm if soluble sulphate is a key source of the acid rock drainage currently observed in the WRF.

**6. Section 5.0 – Waste Rock Facility Development Strategy**

Proponent Conclusion

The Proponent states that, at a minimum, placement within 10 m of the stockpile edge should be completed in winter, and/or the lift should be allowed to freeze prior to layering activities, and that, "when the waste rock temperature at the time of placement is <0°C successive lifts may be continuously placed over a given footprint" (Page 16).

ECCC Conclusion

ECCC notes that the Proponent did not indicate how long it would take the 10 m to freeze before layering activities can begin, or indicate whether the temperature referred to (<0°C) is pertaining to WRF surface temperature or internal temperature.

ECCC Recommendation

ECCC recommends that the Proponent:

- Clarify the amount of time for the lift to freeze before layering activities start and whether the previous lift would be frozen before the successive lift is placed over it; and
- Clarify whether the temperature is on the surface of the lift or throughout the whole layer below surface.

Should you require further information, please do not hesitate to contact me at (867) 669-4746 or Gabriel.Bernard-Lacaille@canada.ca.

Sincerely,

*[original signed by]*

Gabriel Bernard-Lacaille
Senior Environmental Assessment Coordinator

cc: Georgina Williston, A/Manager, Environmental Assessment North (NT and NU)
Lou Kamermans, Baffinland Iron Mines Corporation