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July 29, 2019

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

Your file - Votre référence
2AM-MEA1526

Our file - Notre référence
CIDM#1257660

**Re: Crown-Indigenous Relations and Northern Affairs Canada Technical Review
Comments of the Meadowbank Gold Project 2018 Annual Report – under
Agnico Eagle Mines Limited's Type "A" Water Licence No. 2AM-MEA1526.**

Dear Mr. Dwyer,

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) reviewed the above-referenced annual report and the review results are provided in the enclosed memorandum for the Nunavut Water Board's consideration. Comments are provided pursuant to the mandated responsibilities of CIRNAC under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

CIRNAC appreciates the opportunity to participate in this review. If there are any questions, please contact me at (867) 975-4555 or david.zhong@canada.ca or Godwin Okonkwo at (867) 975-4550 or godwin.okonkwo@canada.ca.

Sincerely,

David Zhong
Regulatory & Science Advisor

Technical Review Memorandum

To: Richard Dwyer, Manager of Licensing, Nunavut Water Board

From: David Zhong, Regulatory & Science Advisor, Water Resources Division, CIRNAC

Date: July 29, 2019

Re: Review of 2018 Annual Report, Type "A" Water Licence No. 2AM-MEA1526, Meadowbank Gold Project

Applicant: Agnico Eagle Mines Limited (AEM)
Project: Meadowbank Gold Project
Region: Qikiqtani

BACKGROUND

Agnico Eagle Mines Limited (AEM) submitted their 2018 Annual Report to the Nunavut Water Board (NWB) to fulfil the annual reporting requirements of its Meadowbank Gold Project under Type "A" Water License 2AM-MEA1526. Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), pursuant to its mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*, reviewed the 2018 Annual Report and the following results are provided to the NWB for consideration.

RESULTS OF REVIEW

1. Structure Integrity of Dikes and Dams and Central Dike Seepage

Reference:

- [Section 3.1, Meadowbank Gold Project 2018 Annual Report;](#)
- [Appendix 7;](#)
- [Appendix 8;](#)
- [Appendix 17.](#)

Comment:

High seepage rate through the bedrock foundation of the Central Dike of the Tailings Storage Facility (TSF), observed since 2014, persisted in 2018. The Second Portage Fault under the Central Dike was identified by AEM as a potential pathway for the seepage. Tension cracks have been observed along the Stormwater Dike of the TSF since 2016. These two issues have been flagged with yellow Trigger Action Response Plan (TARP) levels. In addition, in 2018, the Meadowbank Dikes Review Board noted

the unusual linear settlement features in the tailings surface and determined that further study and explanation would be required.

CIRNAC notes the potential structure integrity concerns associated with the referenced issues and echoes the technical recommendations made in the 2018 Annual Geotechnical Inspection Report and the Meadowbank Dikes Review Board Report #24 on these issues.

Recommendation:

CIRNAC recommends that the recommendations made in the 2018 Annual Geotechnical Inspection Report and the Meadowbank Dikes Review Board Report #24 be implemented and the results be reported and discussed in the 2019 Annual Report.

2. ARD/ML in Tailings Storage Facility and Central Dike Seepage Water Quality

Reference:

- [Sections 3.1 and 5.1, Meadowbank Gold Project 2018 Annual Report;](#)
- [Appendix 1.](#)

Comment:

The 2018 Annual Report stated *“In the summer of 2017 the water in the downstream pond became orange and this was associated with rapid temperature variation. This event was investigated by chemical analysis and was found to be caused by the precipitation of iron oxide from bacterial process. As predicted this event re-occurred in the summer of 2018.”*

Monthly water quality monitoring data presented in Table 8.36 in Appendix 1 showed elevated sulfate and total iron concentrations in the Central Dike seepage. Since the seepage was believed to be originated from the TSF, these results would suggest iron sulfide mineral oxidation in the TSF. Both iron sulfide oxidation and ferric iron precipitation reactions produce acid and could result in the formation of acid rack drainage and metal leaching (ARD/ML) if the acid is not neutralized completely, which could happen if the neutralization potentials of the tailings and along the seepage pathways are low or become depleted.

Table 5.3 presented the results of four tests conducted in 2018 on the acid base accounting (ABA) and metal leaching of the tailings. Strong acidic condition was produced in all the tests (i.e, pH values ranged from 1.54 to 1.79). One test conducted in October 2018 resulted in an arsenic leaching concentration of 0.67 mg/L, exceeding the MDMER guideline limit. No leaching data on lead was provided.

Monthly tailings reclaim pond water quality monitoring results presented in Table 8.25 in Appendix 1 also showed elevated sulfate and total iron concentrations. All monthly copper concentrations, with the exception of December 2018, exceeded the MDMER guideline limit.

Given the above observations, CIRNAC considers that there exists a potential risk of deterioration in water quality of the Central Dike seepage in the future if no mitigation measure is taken.

Recommendation:

CIRNAC recommends that the quantity and quality of the Central Dike seepage be closely monitored and that proactive measures be taken to mitigate ARD/ML formation in the TSF and to reduce or stop the Central Dike seepage.

3. Turn Lake Water Level Monitoring

Reference:

- [Section 4.2.1, Meadowbank Gold Project 2018 Annual Report.](#)

Comment:

In the review of the 2017 Annual Report of the Meadowbank Gold Project, CIRNAC noted that no monitoring results on the water level of Turn Lake were presented and requested that the Proponent do so in its 2018 Annual Report.

Section 4.2.1 of the 2018 Annual Report indicated that Turn Lake water level monitoring would be initiated during the 2019 open water season and the results would be reported and compared to predictions in the next annual report.

Recommendation:

CIRNAC recommends that AEM fulfil this commitment and present the results in the 2019 Annual Report.

4. Predicted vs Measured Water Quality

Reference:

- [Section 4.4.3, Meadowbank Gold Project 2018 Annual Report;](#)
- [Appendix 15;](#)
- [Appendix C, Appendix 8.](#)

Comment:

Water License 2AM-MEA1526 Part E, Item 9 states: *“The Licensee shall, on an annual basis during Operations, compare the predicted water quantity and quality within the pits, to the measured water quantity and quality. Should the difference between the predicted and measured values be 20% or greater, then the cause(s) of the difference(s) shall be identified and the implications of the difference shall be assessed and reported to the Board.”*

Data presented in the 2018 Annual Report showed that for a number of parameters, the differences between the measured results and the predicted values, even those under the Probable Poor End scenario, were greater than 20%. Furthermore, the results of the current water quality model prediction indicated that the concentrations of some parameters (e.g., aluminium, arsenic, cadmium, chromium, copper, iron, nickel, selenium, fluoride, mercury, lead, etc.) of the pit water would exceed the CCME water quality guidelines or other site specific criteria and may require treatments prior to dike breaching. Given the inconsistencies observed between the measured and the predicted values, it is possible that pit water quality at closure could be even lower than currently predicted.

A brief discussion was provided in the 2018 Annual Report on the possible causes, the potential implications, and various mitigation measures and treatment options. However, given the significance of the differences and the potential implications (e.g., costly treatment of large quality of water in the pits in the closure and post-closure phases), CIRNAC considers it important that the model predictions be updated, and appropriate proactive mitigation measures be identified and implemented to prevent or reduce any adverse impact on water quality and/or avoid any prohibitive closure cost.

Recommendation:

CIRNAC recommends that the water quality predictions be updated, that appropriate proactive mitigation measures be identified, and implemented by the Licensee, and that the results be discussed in the 2019 Annual Report.

5. Freeze-back, Permafrost, Thermal Monitoring and Capping Thickness

Reference:

- [Section 5.4, Meadowbank Gold Project 2018 Annual Report;](#)
- [Appendix 17;](#)
- [Appendix 7;](#)
- [Appendix 21.](#)

Comment:

Thermal monitoring results presented in the 2018 Annual Report showed that the freeze-back of waste rocks and tailings was a complex process and the thickness of the thermal active layer varied from 1.5 to 4.0 meters at different locations. Although additional laboratory and field based collaborative studies (i.e., with the Research Institute in Mine and Environment) have been conducted since 2014, no information or result was provided in the 2018 Annual Report.

CIRNAC notes that promoting and maintaining permafrost condition has been the principle strategy for preventing or mitigating ARD/ML formation in the Waste Rock Storage Facilities (WRSF) and the TSF at Meadowbank. It involves thermal encapsulation of potentially acid generating (PAG) waste rocks or tailings with a cover of non-potential acid generating (Non-PAG) waste rocks. To be effective, the cover

needs be thicker than the thermal active layer so that a permafrost condition will be maintained below the cover. It is important that the maximum thickness of the thermal active layer be reliably obtained or predicted for the WRSF and the RSF where the thermal encapsulation strategy will be applied.

Given that the WRSF and a portion of the TSF at Meadowbank are in the closure phase, CIRNAC considers it important that AEM validate and update its thermal models with thermal monitoring data and when necessary, strengthen its thermal monitoring networks and/or update its Waste Rock and Tailings Management Plans.

Recommendation:

CIRNAC recommends that AEM validate and update its thermal models with thermal monitoring data and present the results in the 2019 Annual Report.

6. Spill Management

Reference:

- [Section 7, Meadowbank Gold Project 2018 Annual Report.](#)

Comment:

Table 7.1 of the 2018 Annual Report indicates that 243 cases of spills were observed, including 26 cases of reportable spills, at Meadowbank in 2019. An examination of Tables 7.2 and 7.3 of the 2018 Annual Report shows that hydraulic oil leak due to hose/pipe failure or “O” ring failure occurred almost daily or once every few days in 2018. The volume of each hydraulic oil spill ranged from 4 to 600 liters, with most falling between 40 and 100 liters.

Although the cases of spills in 2018 were lower than in 2017 (i.e., 411 cases) and spills were contained and cleaned and contaminated material disposed to the appropriate area, CIRNAC believes that further improvement can and should be made.

Recommendation:

CIRNAC recommends that AEM make further efforts to prevent spill or reduce the number and volume of spills and report such efforts in the 2019 Annual Report.

7. Progressive Reclamation Update

Reference:

- [Section 9.1.1, Meadowbank Gold Project 2018 Annual Report;](#)
- [Meadowbank Interim Closure and Reclamation Plan \(ICRP\) – Update 2018, Appendix 51.](#)

Comment:

Progressive reclamation of various components or facilities (e.g., the open pits, the WRSFs, the TSF, and the water management infrastructures) was discussed in the 2018 Annual Report, and the Meadowbank Interim Closure and Reclamation Plan was updated in July 2018.

Amendment No.3 to Water License 2AM-MEA1526 for Meadowbank Gold Project was approved in March 2019, authorizing the disposal of tailings into the mined-out open pits at Meadowbank. This amendment would result in significant changes in the planned project activities and consequently, the current progressive reclamation plans for the open pits, the TSF, and certain water management infrastructures will need to be updated to reflect such changes.

Recommendation:

CIRNAC recommends that AEM update the Meadowbank Interim Closure and Reclamation Plan in a timely manner so that appropriate progressive reclamation can be planned and implemented.