

Agnico Eagle Mines Limited – Meadowbank Division

2AM-MEA1526 Notice of Application & Commencement of Technical Review

**Responses to Environment and Climate Change Canada and Crown-Indigenous Relation and
Northern Affairs Canada Technical Review Comments**

January 25 2019



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ENVIRONMENT AND CLIMATE CHANGE CANADA (ECCC)

Environment and Climate Change Canada (ECCC) reviewed the information submitted to the Nunavut Water Board (NWB) regarding the Type A Water Licence Amendment. ECCC's specialist advice is provided based on their mandate, in the context of the Canadian Environmental Protection Act, and the pollution provision of the Fisheries Act.

Interested Party:	Environment and Climate Change Canada (ECCC)	Rec No.:	ECCC#1
Re:	Updated Hydrogeological Modelling: Climate Change		

References

- *SNC Lavalin Technical Memorandum dated December 14, 2018. Meadowbank In-Pit Tailings Disposal - Thermal and Hydrogeological Modeling Update to Address Natural Resources Canada's Comments.*

Proponent Conclusion

The SNC Lavalin Technical Memorandum states that, "climate warming was projected for 100 years after pit closure and it is assumed will remain constant beyond 100 years" (Page 3, Section 2.2 – Methodology). The Memorandum also states that, "a projected climate warming with 4°C increase within 100 years after closure was assumed based on IPCC (IPCC, 2014), but no warming trend was projected further beyond" (Page 4, Section 2.3 – Assumptions and Boundary Conditions).

ECCC Conclusion:

Use of a 100 year time frame for climate warming is a reasonable practice, but may understate the timing and extent of talik development and potential groundwater movement in the period beyond 100 years should warming trajectories continue. Following the completion of tailings deposition (2029), the predictions provided in the report should be reviewed and the thermal and hydrogeological modeling updated. This would inform the need for mitigation measures to be developed in the event of potential groundwater quality/transport issues.

ECCC Recommendation:

ECCC recommends that the Proponent conduct updated thermal and hydrogeological modeling following the completion of tailings deposition (2029) and identify the potential requirement for mitigation measures to be developed.

Agnico Eagle's response:

Agnico Eagle appreciates the comments from ECCC. Agnico will use the most updated climate change scenario model from the revision of the hydrogeological and thermal modelling following the completion of tailings deposition. This will be part of the final closure plan.

Interested Party:	Environment and Climate Change Canada (ECCC)	Rec No.:	ECCC#2
Re:	Updated Hydrogeological Modelling: Duration of Tailings Deposition		

References

- *SNC Lavalin Technical Memorandum dated December 14, 2018. Meadowbank In-Pit Tailings Disposal - Thermal and Hydrogeological Modeling Update to Address Natural Resources Canada's Comments.*
- *In-Pit Tailings Deposition Water Balance and Water Quality Forecast. SNC Lavalin. September 12, 2017.*

Proponent Conclusion

The December 2018 The SNC Lavalin Technical Memorandum report and attached presentation state that tailings inputs will go into the pits from April 2018 to June 2029. The September 2017 In-Pit Tailings Deposition Water Balance and Water Quality Forecast report, which much of the updated modeling is based on, uses January 2018 to September 2028 as the period of tailings deposition.

ECCC Conclusion

It is unclear if the additional six months of deposition affects the water quality conclusions. It is also unclear whether or not tailings volumes were different for the two model runs; the 2017 report specifies tonnage of 4,003,786 for Portage/Vault, 11,497,499 for Whale Tail, and 18,882,000 for Future Ore Bodies, the 2018 report does not include tailings tonnage.

ECCC Recommendation

ECCC recommends that the Proponent clarify the currently anticipated timing for tailings deposition and identify any differences between the 2017 and 2019 modeling associated with timing/volumes of tailings deposited.

Agnico Eagle's response:

Modelling done in between 2017 and 2019 was done based on the maximum capacity scenario (32Mt of tailings) which is considered a very conservative approach in terms of water quality and environmental impacts. The timing/volume of tailings deposited may change based on the updated mine plan and different schedule modification related to the in-pit disposal regulatory process. However, Agnico Eagle considers that the water quality forecast that was completed from 2017 and 2019 is conservative based on this maximum capacity approach.

Agnico Eagle only has approval to process 8.3M tonnes of ore from the Whale Tail Pit Project. The deposition of tailings in Portage and Goose pits will only commence once Agnico receives final approval from NWB.

Interested Party:	Environment and Climate Change Canada (ECCC)	Rec No.:	ECCC#3
Re:	Updated Hydrogeological Modelling: Arsenic and Chloride Transport		

References

- *SNC Lavalin Technical Memorandum dated December 14, 2018. Meadowbank In-Pit Tailings Disposal - Thermal and Hydrogeological Modeling Update to Address Natural Resources Canada's Comments.*
- *C.F. Andrade, C.F, H.E. Jamieson, T.K. Kyser, T. Praharaj and D. Fortin. 2009. Biogeochemical redox cycling of arsenic in mine-impacted lake sediments and co-existing pore waters near Giant Mine, Yellowknife Bay, Canada. Applied Geochemistry 25:199-211.*

Proponent Conclusion

The SNC Lavalin Technical Memorandum states that, "higher hydraulic heads at the northern limit of the model along with the open talik below Pit A lead to an upward vertical gradient in the northern part of Pit A. If the maximum chloride upward flux at the northern part of Pit A is applied to Pit A lake area, Chloride and Arsenic mass fluxes into the overlying Pit A lake (and Third Portage Lake) will be 14 and 0.11 g/day, respectively" (Page 9, Section 3.4 – Hydrogeological and Contaminant Modeling Update).

ECCC Conclusion

Stated in mg/L, there will be 14,000 mg/day of chloride, and 110 mg/day of arsenic welling up through the pore water of the tailings in Pit A. Acknowledging that this will be occurring over a fairly large tailings surface with a large overlying volume of water, there is none-the-less concern with the behaviour of arsenic in the tailings. Cycling of arsenic in surficial sediments and pore waters, with remobilized arsenic, has been shown to produce a secondary enriched zone at the sediment water interface (Andrade et al. 2009). While Andrade et al. (2009) had different conditions from the Project conditions (e.g., arsenic source, organic matter, arsenic-reducing bacteria) arsenic accumulation in the pit lake tailings-water interface may still develop over time.

ECCC Recommendation

ECCC recommends that the Proponent identify the potential for accumulation of arsenic at the sediment-water interface of the pit lake.

Agnico Eagle's response:

As highlighted by ECCC, there are a number of differences between the Giant Mine site and the Meadowbank in-pit deposition location for tailings. One of the main differences is that the arsenic in the tailings is present in sulphide minerals and any solid phase arsenic mobilization will require oxidation of arsenic in its most reduced state (i.e. as an arsenide). As the tailings will be stored underwater, sulphide oxidation will be effectively inhibited owing to the low solubility of oxygen in water compared to air (0.001% versus 21%, respectively).

The main accumulation pathway in the Giant Mine site was likely from atmospheric oxidation of tailings on the shore leaching oxidized arsenic (As(V)) into the water, which was later sequestered into the sediments and remobilized as As(III). There will not be a mass of atmospheric exposed tailings around the pit lake so the same level of accumulation will not occur.

In terms of impact, the reduction – oxidation (redox) process described by Andrade et al (2009) is likely naturally occurring in many lakes in the Giant Mine project area owing to small amount of arsenic leaching from the bedrock and as observed in the solid phase concentrations in the lake sediments. If this process occurs in the pit lakes at Meadowbank, the extent of this mobile arsenic is expected to be limited to only a few centimeters (as observed at the Giant Mine) above the sediment water interface and the overall impact on the pit lake water quality should be no different than any of the surrounding lakes. Over the long term once the Meadowbank pits (Portage and Goose) are full of water, there will be no new sources of arsenic entering the pit lakes. As a result, natural sediments will begin covering the tailings and the ability of any sequestered arsenic to diffuse upwards will slow down, with this redox cycling process further diminishing over time.

Interested Party:	Environment and Climate Change Canada (ECCC)	Rec No.:	ECCC#4
Re:	Closure Planning		

References

- *Agnico Eagle Mines Limited. August 17, 2018 03MN107 - In-Pit Tailings Disposal Final Written Submission Response*
- *Nunavut Water Board. Water Licence No: 2AM-MEA1525. Agnico-Eagle Mines Limited. Type A Water Licence Meadowbank Gold Mine. July 23, 2015.*
- *Golder Associates Ltd. for Agnico Eagle Mines Limited. Interim Closure and Reclamation Plan for the Meadowbank Gold Project, Version 2. January 2014.*

Proponent Conclusion

The Proponent has made a number of commitments throughout the technical review process and in the Final Written Submission Response regarding:

- *treatment of reclaim water,*
- *monitoring of the surface water quality at site,*
- *completing updates on an annual basis of the water management plan (which includes an update of the water balance, the water quality forecast and the water treatment requirements at closure),*
- *developing the Final Closure Plan which will include details on the final design of the water treatment plant and the detailed management strategy for pit lake treatment and brine and/or residual waste management of the treatment plant; and*
- *Evaluating the feasibility for capping the tailings.*

ECCC Conclusion

The current water licence for the Project expires in July of 2025, thus the Final Closure Plan would be submitted and much of the water treatment done under this existing licence, as per Part J. Item 2 (Page 21, Part J: Conditions Applying to Abandonment, Reclamation and Closure). This licence condition is not explicit with respect to water quality at closure as it references the 2014 Interim Closure and Reclamation Plan and does not cover the amended Project activities.

ECCC Recommendation

ECCC recommends that the commitments made by the Proponent throughout the technical review process regarding closure planning be incorporated into the next version of the Interim Closure and Reclamation Plan.

Agnico Eagle's response:

Agnico Eagle agrees with ECCC and will incorporate these commitments into the next version of the Interim Closure and Reclamation Plan.

CROWN-INDIGENOUS RELATIONS AND NORTHERN AFFAIRS CANADA (CIRNAC)

CIRNAC reviewed the amendment to Type “A” Water Licence No: 2AM-MEA1526 associated with the In-Pit Tailings Disposal Modification Proposal at the Meadowbank Gold Mine pursuant to its mandated responsibilities from the Nunavut Waters and Nunavut Surface Rights Tribunal Act and the Department of Indian Affairs and Northern Development Act.

As of November 30, 2018, CIRNAC had three outstanding concerns in regards to the in-pit tailings disposal.

1) Thermal monitoring and hydrogeological connectivity – *As per the email notice, received on January 15, 2019 from the NWB, CIRNAC will provide comment on the thermal monitoring and hydrogeological connectivity concern by January 24, 2019.*

2) Flooding strategy - *CIRNAC considers the flooding strategy concern resolved.*

3) Interim Closure and Reclamation Plan (ICRP) and Security – *CIRNAC considers the ICRP concern resolved. The security increase of \$1,100,000 up to \$5,900,000 is described in further detail in the following sections.*

Interested Party:	Crown-Indigenous Relations and Northern Affaires Canada (CIRNAC)	Rec No.:	CIRNAC#1
Re:	Thermal monitoring and hydrogeological connectivity		

CIRNAC Comment:

As per the email notice, received on January 15, 2019 from the NWB, CIRNAC will provide comment on the thermal monitoring and hydrogeological connectivity concern by January 24, 2019.

Agnico Eagle Response:

Agnico Eagle received the comments regarding the thermal monitoring and hydrogeological connectivity from CIRNAC on January 24, 2019. Responses to these comments can be found in this response package and are identified as CIRNAC #4 and CIRNAC #5.

Interested Party:	Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	Rec No.:	CIRNAC#2
Re:	Flooding strategy		

CIRNAC Comments:

CIRNAC's concerns have been addressed through the additional information that was provided by AEM on the flooding strategy in the memorandum dated December 12, 20182, and the subsequent clarification provided at the January 10, 2019 meeting with CIRNAC and Arcadis where AEM provided general and technical clarification of the flooding strategy. The closure sequence flowchart is useful in visualizing the water levels in Portage and Goose Pit during Operation, Closure, and Post Closure. Based on CIRNAC's review of the available information, we believe that the flooding strategy concern is resolved.

Agnico Eagle Response:

No comment.

Interested Party:	Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	Rec No.:	CIRNAC#3
Re:	Interim Closure and Reclamation Plan (ICRP) and Security		

CIRNAC Comments:

CIRNAC recommended that the ICRP be updated to account for changes associated with In Pit Deposition and that security be revisited to ensure AEM is sufficiently bonded for additional tailings disposal in the mined out Goose and Portage pits at the Meadowbank Gold Mine Project.

AEM provided additional information to CIRNAC through a letter to Luis Manzo (KIA) and Ian Parsons (CIRNAC) dated December 12, 2018³ and a memorandum from SNC Lavalin to AEM dated December 12, 2018⁴. The memorandum details changes that were made to the Closure and Reclamation Cost Estimate that was submitted to Indigenous and Northern Affairs Canada (INAC) and the Kivalliq Inuit Association (KIA) on June 29, 2018⁵ to include for the change from tailings disposal in the existing TMF to the proposed tailings in-pit deposition. It is noted that the December 2018 security estimate update did not include funds for potential capping of the in pit tailings surface / water interface with rock materials as may be needed.

CIRNAC prepared two separate scenario RECLAIM security estimates as follows:

1. Evaluation of the Security Estimate as currently envisioned by AEM excluding the capping of the in-pit tailings, and
2. Evaluation of the Security Estimate including the capping of the in-pit tailings as requested by Environment and Climate Change Canada (ECCC) and Department of Fisheries and Oceans (DFO) in their recent review of AEM's application.

Summary findings of the estimate review are as follows:

Scenario 1 – Tailings In-Pit Deposition with No Cover (as currently proposed by AEM)

Upon review of the AEM December 12, 2018, it was determined that there were no costs carried by AEM to deal with a potential 3-year care and maintenance period should it arise. While it is agreed that interim water treatment costs are not applicable during an interim period, the costs associated with maintenance, surveillance, monitoring and inspection would still be required for the site. Given that the rate of \$282,600 per annum had been previously accepted by the Nunavut Water Board, we have used this rate in our evaluation of the ICM costs for the site. The incremental value associated with the ICM costs is estimated to be on the order of \$1.1M.

Scenario 2 – Tailings In-Pit Deposition with Cover (not currently proposed by AEM)

Further to recent comments provided by ECCC and DFO regarding installation of an aggregate cover over the in-pit tailings, CIRNAC completed an evaluation of the additional work and associated security should it be required as part of the site closure and reclamation works. The incremental value of the security associated with such efforts is estimated to be on the order of \$5.9M.

Agnico Eagle Response:

Following the technical review comments received by DFO and ECCC on August 3rd, 2018, Agnico Eagle committed on August 17, 2018 to evaluate the feasibility for capping the tailings and identify conditions where this may be warranted in the final closure plan. Currently the cover is not part of the closure plan. For clarification, Agnico Eagle refers CIRNAC to Section 2.2.2 Habitat Suitability rankings which are based on general life history characteristics published for Arctic fishes (eg Evans et al. 2002, Richardson et al 2001, Stewart et al. 2007). Based on Agnico's current evaluation a granular cap covering the tailings is not required to prevent tailings re-suspension (as wind wave induced shear at the tailings interface will be well below critical shear) and literature review suggests the following will occur as the tailings becomes incorporated into the benthic sediments without a cover.

Agnico Eagle agrees with the Scenario 1 incremental value of \$1.1M suggested by NRCan and will update the Meadowbank ICRP following the approval of the in-pit deposition amendment. For further clarity, our revised security that was submitted to the NWB on December 13 2018 for a total of \$83,551,136. Our existing LOC for Meadowbank is \$86,519,614. Based on this additional \$1,100,000 our total will be \$84,651,136 which will remain within our existing LOC of \$86,519,614.

In addition, we will follow-up with CIRNAC to review their costs estimate in reclaim to finalize the security.

Interested Party:	Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	Rec No.:	CIRNAC#4
Re:	Groundwater Monitoring		

CIRNAC Comments:

1. Clearly state the explicit goals of the groundwater monitoring program within the context of the overall monitoring expectations of the regulators; specifically indicate what parameters or variables are to be measured or validated based on the goals of the monitoring program and end use of the data; and, indicate the anticipated duration of the monitoring program as groundwater contaminant migration at this site is predicted to occur after several centuries.
2. Assess the 3-D groundwater flowpaths and travel times to each monitoring well screen using backwards pathlines in FEFLOW. Wells with backwards particle tracks crossing the tailings or not originating near the edge of the tailings are likely of limited value to the monitoring network.
3. Install monitoring wells that will intercept the main axis(es) of each groundwater plume during the monitoring period. The purpose, location and screen interval of each new monitoring well should be justified and initially guided by modelling results (including pathlines as in recommendation 2 above). NRCan and CIRNAC are not convinced of the effectiveness of the proposed new wells and recommend that the current model be used to assess pathlines, travel times and breakthrough curves for these wells. The proposed use of long well screens should be justified.

Agnico Eagle Response:

Agnico Eagle considers that the CIRNAC technical comments regarding the groundwater monitoring are the same as the NRCan technical comments NRCan #1, NRCan, #2 and NRCan #3 that was submitted to NWB on January 18 2019 and refers CIRNAC and NWB to Agnico Eagle response package submitted on January 23rd, 2018.

Reference:

Agnico Eagle – 2019, 2AM-MEA1526 Notice of Application & Commencement of Technical Review - Responses to Natural Resources Canada Technical Review Comments, January 23 2019.

Interested Party:	Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	Rec No.:	CIRNAC#5
Re:	Groundwater Monitoring		

CIRNAC Comments:

The thawing of permafrost below Pit A will not only allow tailings pore water to discharge to Third Portage Lake but will also allow sub-permafrost groundwater to discharge. The potential effects of sub-permafrost groundwater discharge to Third Portage Lake have not been considered or discussed to date. NRCan and CIRNAC are not aware whether sub-permafrost groundwater chemistry have been measured at Meadowbank. If so, these values should be used to assess whether there is the potential for impacts to receptors in Third Portage Lake. If not, conservative estimates of sub-permafrost groundwater chemistry could be used to assess the potential for impacts.

Agnico Eagle Response:

Agnico Eagle considers that the CIRNAC technical comments regarding the sub-permafrost groundwater are the same as the NRCan technical comments NRCan #4 that was submitted to NWB on January 18 2019 and refers CIRNAC and NWB to Agnico Eagle responses package submitted on January 23rd, 2018.

Reference:

Agnico Eagle – 2019, 2AM-MEA1526 Notice of Application & Commencement of Technical Review - Responses to Natural Resources Canada Technical Review Comments, January 23 2019.