ACID MINE DRAINAGE RISK

Bowdens Project SSD 5765

IPC Presentation

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Uncertainties around Acid Mine Drainage

- The majority of waste rock (greater than 50%) and the process tailings are classified as being potentially acid forming (PAF)

- This Project proposes to manage this risk by encapsulating PAF waste rock and tailings in impermeable material:
  - Underneath the Waste Rock Emplacement (WRE) using an HDPE (Hi density polyethylene) liner and underneath the Tailings Storage Facility (TSF) using clay and a BGM (bituminous geomembrane liner)
  - Above the PAF material using Store and Release covers including a GCL (Geosynthetic Clay Liner) for both the WRE and TSF

My EIS Review

AMD Management – Designs and Strategy

- There is No Track Record of Success

In order for the community and government to be satisfied that such designs as contained in this Project proposal are effective, safe and successful in both the short and long term there would need to be evidence of this at similar scale elsewhere.

The Proponent has not identified any other mine sites where the use of this design and technology at this scale has been successfully employed in either the short term or the long term.

My EIS Review

Concerns with Design, Construction and ongoing Management

This proposed Project is using predictive modelling and small area field trials to claim its containment designs will manage and prevent AMD impacts on the surrounding environment during the project lifespan and for generations to come. There is no certainty that it will be effective.

- There are many factors in these proposed designs which could compromise the integrity of encapsulation both during construction and in the longer term.

- The design is complex and difficult to construct and difficult to monitor for integrity until after leachate has escaped into the surrounding environment.

- Finding and repairing leak locations would also be problematic.

The DPE Assessment

"In line with best practice AMD management, Bowdens Silver would separate the PAF material extracted during mining and encapsulate it within the waste rock emplacement, which has been designed to limit the ingress of water and oxygen and consequent formation of acid."

"The Department engaged independent experts Earth Systems to provide advice about AMD management for this project.
Based on this advice, the Department has recommended a range of strict conditions, including a further verification process to confirm volumes of PAF material, and the preparation of a detailed AMD management plan"

DPE Assessment Report, Executive Summary, page v

Earth Systems: Key Conclusions and Recommendations(Draft)

The AMD risk classification system is considered inappropriate for this Project, resulting in inaccurate predictions of PAF and NAF material tonnages. This will affect waste rock dump design and the availability of non acid forming (NAF) materials for construction / rehabilitation requirements.

Earth Systems has little confidence in the current AMD management strategy for waste rock and tailings. For example:

- The waste rock dump design is unproven and appears substantially problematic, with initial indications that the site could be establishing the need for water treatment in perpetuity.

More detailed assessment of potential AMD impacts from tailings during operations and post-closure is warranted. AMD from the tailings (surface water and seepage) could become a particularly significant issue post-closure as the tailings are progressively drained. Kinetic test work and a strategy for management of PAF tailings is required.

Store-and-release covers are used widely, but almost never in recent years for the purposes of AMD control. The proposed store-and-release cover systems are not considered an appropriate strategy for PAF waste rock or PAF tailings management.

Earth Systems Technical Memorandum to DPE 31/5/2022
Independent Review: Acid and Metalliferous Drainage (Draft) page 12/16

Earth Systems:Final Advice November and December 2022

"No changes have been made to the proposed waste rock dump design since the EIS....."
"....Considering the limited design life of any GCL, long term control of air entry and AMD generation from PAF waste rock (or tailings) remains a key concern"
Earth Systems Technical Memorandum to DPE 23/11/22
Update on Independent Review page 6/13

"Residual concerns of Earth Systems (2022a) documented on 23 November 2022, primarily relate to the need for a reliable method for classifying and segregating mine wastes as potentially acid forming (PAF) or non acid forming (NAF), and the need to modify the waste rock dump (and TSF) AMD management strategy / closure design to avoid the post closure risk of water treatment in perpetuity."
Earth Systems Technical Memorandum to DPE 16/12/22
Independent Review Outcomes page 1

Earth Systems: Final Advice November and December 2022

"Regarding management of long term AMD risk from the PAF waste rock dump and TSF, it remains our advice that the design of these facilities will need to be updated, noting that GCL liners have a limited design life, store-and-release covers are not suitable for AMD control, and the longevity of AMD generation from PAF waste rock is unknown but may continue for hundreds of years. These factors will need to be considered in future test work."

Earth Systems Technical Memorandum to DPE 16/12/22
Independent Review Outcomes page 1

Summary

Classification of NAF and PAF volumes are fundamental building blocks for mine design and volumetric fit – the accuracy of this basic classification is in doubt according to Earth Systems

The Departments own independent expert says the Projects Waste Rock Emplacement and Tailings Storage Facility designs won't work to control acid mine drainage

The Departments own independent expert says GCL (Geosynthetic Clay Liner) store and release covers are NOT SUITABLE for Acid Mine Drainage control

The DPE proposes to resolve all these fatal flaws post approval through application of the recommended conditions of consent

Summary

Following the final Earth Systems Independent Review document Bowdens wrote to the Department in December regarding the AMD Independent Review outcomes stating:

“Importantly it is noted that the matters raised by Earth Systems do not include issues that present risks that are fundamental to the development of the Project”

Letter 1 December 2022 RW Corkery and Co to Director Resource Assessments DPE

Fatal Flaws

Major unresolved technical issues dealing with fundamental controls of agreed risks (AMD) do not belong in Conditions of Consent Management Plans.

This Projects location is unsuitable as an experimental test site

Because robust and proven technical solutions to AMD are not included as part of the EIS then the IPC must refuse this project

Uncertainties around Final Void Water Through Flow:

an uncertainty analysis indicated that a groundwater through flow system could develop in some sections of the void. Bowdens Silver considers that this is unlikely, however has committed to implementing mitigation options to prevent this, including increasing the evaporative surface to ensure groundwater levels remain below the throughflow level threshold. The Department's independent groundwater expert has confirmed that this option would be sufficient to ensure the void remains a sink.

Departments Assessment Report Exec. Summary, page v

The DPE surface water expert acknowledges this would resolve the through flow risk but what other risks or issues would this "mitigation option" cause?

Bowdens Proposed Final Void Solution (Not assessed in the EIS)

- Increase final void footprint by up to 28 ha
(The EIS design footprint is 53ha. A 52% increase)

- Moving an additional 16.3 million cubic metres (bcms) of rock (a 50% increase)
  - The EIS total Project volume of material (ore and waste rock) to be removed from the currently proposed open cut pit is approximately 32.5 M cubic metres.

  - At $3-$4 /cubic metre this is would be an additional closure cost of $49M-$65M . A closure cost increase of 224% and 265%

EIS Current mine rehabilitation and Closure costs are $39.4M.

It is physically possible but is it practical? Is it economically real?