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Memo

To:	Mark Palmer, INAC	**Date:**	December 13, 2010
cc:		**From:**	Daryl Hockley
Subject:	Response #2 to MVEIRB Deficiency Statement – Risks and Impacts of Intentional Thaw	**Project #:**	1CS019.010.0060

The second item request provided by the Review Board identifies the following two questions related to the risks and impacts of intentionally thawing the frozen block:

A. Will it be possible to deliberately thaw the frozen block if adaptive management deems it desirable in the future?
B. If so, how, and what are the risks and impacts of deliberate thawing?

Response Summary

Yes, it would be possible to deliberately thaw the frozen block. Each frozen block will be created by cooling the rock around an arsenic-containing chamber or stope, and each frozen block could be thawed simply by heating the same rock.

While simple in concept, the details associated with a thawing program would require roughly the same amount of investigation, design and environmental assessment as the freezing process. In the absence of that level of work, any discussion of risks and impacts is speculative. It is likely, for example, that some of the risks that the frozen block method seeks to mitigate, such as the risk of bulkhead failure, would need to be carefully managed in any thawing program. However, the investigation, design and environmental assessment of the thawing program would presumably address those risks, along with many others that would arise from the thawing equipment, installation, operation, monitoring, etc.

Detailed Response

A: Will it be possible to deliberately thaw the frozen block if adaptive management deems it desirable in the future?

Deliberate thawing of the frozen block is possible. In simple terms, the general approach used to cool the arsenic trioxide could be reversed to promote thawing of the frozen block.

Once each frozen block is fully established, it will remain frozen for an extended period under natural conditions. As discussed in Section 6.2.8.2 of the DAR, even under the warmest climate change scenarios, many decades would be required to fully thaw a frozen block. Taking into consideration the extended period required for natural thawing, it is reasonable to assume that additional energy would be required to accelerate thawing.

One option would be to convert the initial freezing system to distribute warm fluid, rather than coolant, from a central plant. Construction costs for such a system would likely be in the same order of magnitude as the costs for the freezing system, with the exception that site preparation and underground development would not be required. Operating costs would be higher, because of the additional energy involved in heating. The time required for thawing by this method would also be in the same range that is estimated for the freezing process, i.e. around ten years.

B: What are the risks and potential impacts of deliberate thawing?

The thawing program would need to be supported by investigation, engineering design and environmental assessment phases. These would identify risks associated with the specific methods, equipment, etc., and allow for development of the required mitigation measures.

But there are underlying risks that can be foreseen even without the method details. These are largely the risks that the frozen block method seeks to mitigate. The escape of dissolved arsenic to minewater and risks of crown pillar failure are examples of risks that are well discussed in the DAR, and that would re-occur if the frozen blocks were deliberately thawed.

One risk that could in fact be heightened by a sequence of freezing and then deliberate thawing is the risk of bulkhead failure. The current risk is described in Section 10.6.1 of the DAR. However, the thawing of water in the frozen blocks could, if not controlled, lead to significantly increased pressures on the lower bulkheads, thereby increasing both the risk of a bulkhead failure and the amount of arsenic trioxide dust that could be expelled into the lower reaches of the mine.

Even in this scenario, however, if a bulkhead were to fail, the released arsenic would remain within the minewater collection system. The primary impact would be an increased concentration of arsenic in the minewater and a subsequent requirement for additional operation of the minewater treatment plant. Other impacts would include a commensurate increase in sludge volumes, reagent quantities and costs. However, the continued drawdown of the minewater would ensure that elevated concentrations of arsenic are captured, thereby preventing releases to the environment. As a result, there are no anticipated environmental impacts associated with deliberate thawing.