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July 8 2011

Our File # NWT-142

Chuck Hubert  
Environmental Assessment Officer  
Mackenzie Valley Environmental Impact Review Board

*Sent via email: [chubert@reviewboard.ca](mailto:chubert@reviewboard.ca)*

**Re: EA0809-002 - Undertakings from June 23-24 Prairie Creek Mine Hearings**

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This letter is in response to the undertaking by Natural Resources Canada (NRCan) to the Mackenzie Valley Environmental Impact Review Board (the Board) at the June 24, 2011 public hearings for the Prairie Creek Mine in Fort Simpson, summarized by the Board as follows:

- *Natural Resources Canada to provide written contents of discussions between the geochemist with Natural Resources Canada and developer (see hearing transcripts June 24, 2011 p 208).*

Meeting notes (attached) were drafted by NRCan, Canadian Zinc Inc., and its consultant Phase Geochemistry, were provided an opportunity to identify any errors or omissions on a draft of the meeting notes. As a result, NRCan believes that the attached version fairly and accurately represents the contents of the technical discussion. The other parties, of course, may choose to provide their views separately to the Board.

In summation, it is our view that the technical discussion with the proponent's consultant did not change the content of NRCan's Technical Report, in particular, the observation that predictions made in the Developer's Assessment Report regarding of leachate water quality can be confirmed through further testing and analyses. NRCan technical review would be supportive of a commitment by the proponent to conduct such tests as early as practical, before irreversible actions are taken.

Should the Board require any clarification on the attached response to the undertaking, please do not hesitate to contact me at (613) 943-0773 or at [John.Clarke@NRCan.gc.ca](mailto:John.Clarke@NRCan.gc.ca)

Sincerely,

**Original signed by**

John Clarke  
A/Director  
Environmental Assessment, SPI

Attachment: (1)

cc: R. Johnstone, MMS  
C. Hogan, MMS



## Attachment

### **Prairie Creek Geochemistry Pre-hearing Meeting Between NRCan and Phase Geochemistry Ltd.**

**June 21 2011**

#### **Attendees**

Shannon Shaw (Phase Geochemistry)  
Dr. Nand Davé (NRCan)  
John Clarke (NRCan)  
Rob Johnstone (NRCan)  
Amie Baker (NRCan)

*Notes prepared by NRCan*

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#### **Purpose**

Natural Resources Canada (NRCan) identified that certain technical experts, including those involved in the review of mine waste management at the proposed Prairie Creek Mine, would be unable to participate in the Mackenzie Valley Environmental Impact Review Board's Hearings on June 23 and 24 in Fort Simpson, NWT.

Following discussion with Board staff, where it was identified that Canadian Zinc (CZN) had questions with NRCan's Technical Report (June 3 2011), a meeting was arranged between CZN's consultant Shannon Shaw of Phase Geochemistry (PG) and Dr. Nand Davé, Senior Research Scientist with NRCan's CANMET Mining and Mineral Sciences Laboratories.

#### **Topics Discussed**

The discussion generally followed specific recommendations or comments in Section 7 – Mine Waste Management, of NRCan's Technical Report.

- 1. In keeping with the developer's commitment (May 6, 2011) to determine a final composition for the Waste Rock Pile cover based on monitoring during operation, and to re-construct, upgrade or decommission ditches and other water control facilities as required, the Developer's design consideration should include the need to minimize or avoid contaminant loadings to Prairie Creek (p. 29)*



- Ms. Shaw indicated that her background is in geochemical characterization, acid generation and metal leaching. Other consultants (O’Kane Consultants Ltd) provided conceptual design, mine cover and infiltration work/expertise. However, it was understood that the amount of infiltration moving through the material will need to be minimized.
  - Dr. Davé asked whether the proponent’s predictions of loading considered change in flows once mine works were flooded, and asked: i) whether a 50% reduction in water infiltration was judged to be sufficient; and, ii) what the expectations were for the timeframe over which zinc would continue to leach from the waste rock pile.
  - Ms. Shaw concurred that the waste rock pile needs to have a suitably engineered and constructed cover to meet the objective of 50% reduction in water infiltration. Ms. Shaw added that two different mineral forms (smithsonite and sphalerite), were expected to continue to release zinc at elevated rates for a sufficient period of time, likely a number of decades.
2. *In follow-up discussions with Parks Canada, post closure leaching and mobility of Se, As, Zn, Hg and other trace metals from the cemented paste backfill under the resulting high pH conditions of the cemented fill was noted as an area of potential concern, as it may add to long-term water quality impacts of mine water discharge to Prairie Creek. (p. 33)*
- Ms. Shaw indicated that only the release of zinc was expected to be significant, but that more testing beyond the work in the DAR was expected to be done to verify conclusions using paste from the plant after operations have commenced. The field scale testing would investigate how paste could leach and weather *in situ*.
  - Dr. Davé noted a particular interest in whether further studies would be done with respect to selenium and mercury.
  - Ms. Shaw replied that the further studies proposed would include selenium and mercury. She acknowledged a degree of uncertainty with respect to actual on-site conditions, as for any project. However, she noted that predictions were conservative, and the proponent would have the ability to control the release of groundwater interacting with the paste backfill, if required.
  - Dr. Davé concurred that during the operating phase, there is the ability to collect more data and there is a better ability to make predictions. Dr. Davé stressed that, before the paste was in-filled and difficult to retrieve, that the appropriate information on the paste should be available, such as through barrel-scale testing at site.



- Ms. Shaw did not agree that testing is necessary before backfilling. The predictions to date are considered to be conservative. However, large scale test work would be undertaken during operations to verify predictions and plan for closure.
- 3. *Prior to operation, as part of planning for hydrogeology and geochemistry data collection and the further studies of attenuation mechanisms, the developer should document and resolve the following questions: (p 33)*
  - a. *What would be the coupled redox drivers in the mine water for Se reduction and precipitation of Hg as tiemannite (HgSe)? Dissolved Se is also known to be precipitated as elemental Se under alkaline pH and reducing conditions, thus, competing directly with the above HgSe precipitation process. Under what conditions would the former reaction be favoured?*
  - Ms. Shaw acknowledged that the anticipated reactions are dependent on many variables, and while modelling has identified some of the reactions possible, field scale testing would allow verification of the reactions occurring and which processes dominate. The context for this is that mercury is not currently mobile in mine drainage, and testing will seek to determine why this is and confirm it will also occur after closure.
  - b. *Are the surface complexation and adsorption processes for metal attenuation in the two aquifers capacity limiting in the long-term such that a breakthrough would eventually occur?*
  - Ms. Shaw indicated that the applicable partition coefficients would be assessed through on-site testing to verify that a breakthrough would not occur.
  - c. *Would the above scenario impact long-term, post closure Prairie Creek water quality?*
  - Ms. Shaw indicated that work related to post-closure conditions would verify predictions in terms of paste leaching. However, there is a high level of certainty that control the mine water 'pool' will be possible and practical.
  - d. *Would the precipitation of ferrihydrite through groundwater discharge in the oxic environment of Prairie Creek impair its aesthetic as well as chemical water quality?*
  - Ms. Shaw indicated that presently there is no ferrihydrite visible in local creeks, it is localized on the mine site in ochre deposits.



- Dr. Davé noted that under natural mechanisms of attenuation, ferrihydrite precipitate in the creek bed would have aesthetic impacts. He also noted that such precipitate would have elevated concentrations of other metals.
- Ms. Shaw indicated that controlling mine area groundwater would mitigate this effect as a contingency plan, if necessary, but that it was not expected to be required.
- e. *Would these processes gradually impact the sediment quality and its toxicity level in Prairie Creek?*
- Toxicity work is being done by another consultant.
- f. *Would there be any surface or shallow sub-surface discharge from the backfilled mine workings directly to Prairie Creek.*
- This work is largely being conducted by Robertson Geoconsultants who can better answer this question. She acknowledged that discharge into Prairie Creek is included in the load calculations, and that in future work there would be confirmation of numbers (during the operating phase).

The discussion concluded with some questions of general interest on available contingency measures.

- Mr. Johnstone asked what range of mitigation measures have been considered should metal leaching prove higher than predicted
- Ms. Shaw indicated that CZN is confident that they will meet standards they put forward, recognizing that any predictions at this stage have some degree of uncertainty and there is a recognition of the need for contingency. Ms. Shaw indicated that CZN had recognized that “pump and treat” was one potential contingency measure, and that there had also been conceptual discussion of passive treatment, such as enhancing reducing conditions by adding organic material to the waste.

## Conclusion

The meeting concluded with Ms Shaw noting that the recommendations and questions from NRCan in section 7, within her areas of expertise, were understood.