

28 November 2014

Province of British Columbia  
Ministry of Energy and Mines  
1810 Blanshard Street  
Victoria, BC V8W 9N3

Attn: Diane Howe, P.Geo.  
Deputy Chief Inspector, Reclamation and Permitting

**Re: Cheni Mine Lawyers Tailings Dam  
Independent Third Party Review of Dam Safety Inspection**

## **1. INTRODUCTION**

This letter presents the observations and conclusions of a third party review of the dam safety inspection (DSI) of the Cheni Mine Lawyers tailings storage facility. The review was carried out in accordance with Klohn Crippen Berger (KCB) Subconsultant Agreement dated November 24, 2014. The third party review was mandated by the British Columbia Ministry of Energy and Mines (MEM), Chief Inspector's Orders, dated August 18, 2014, which stipulated that a DSI be carried out to cover all dam structures for all tailings storage facilities in British Columbia, and that the DSI must be reviewed by an independent qualified engineer from a firm that has not been associated with the tailings dam. The Independent Third Party Review must include a review of the dam consequence classification.

The DSI of the Cheni tailings dams was carried out by KCB, dated November 28, 2014 (Klohn Crippen Berger, 2014). This third party review is based on that DSI. No site visit was made for the third party review.

## **2. BACKGROUND**

Cheni Mine was an underground gold/silver mine, located in the Toodoggone region of northern British Columbia, about 280 km north of Smithers, BC. The mine operated from 1989 to late 1992. The Lawyers TSF is located alongside a 0.7 km length of the west bank of Attorney Creek, a north flowing tributary to the Toodoggone River.

The Lawyers TSF dam was designed as a zoned earthfill embankment, with an upstream lower permeability core zone and a general fill shell, with a horizontal blanket drain below the downstream shell. The Stage 1 embankment was constructed in 1987 and 1988, with subsequent raises constructed in 1990 and 1992. The dam had a maximum height of approximately 20 m prior to reclamation. The mid points of the north and south limb were approximately 12 to 15 m high. The TSF was reclaimed in 1996.

Klohn Leonoff, a predecessor to KCB, designed the original tailings dam and was on site in 1988 during construction. Klohn Leonoff also designed the dam raise of 1991. Piteau Associates Engineering Ltd. designed the closure and reclamation work.

The TSF does not have a Classification according to the Canadian Dam Association Dam Safety Guidelines (CDA, 2007). The TSF has not had a Dam Safety Review. There have been no documented operational, maintenance or surveillance (OMS) or construction activities undertaken on the TSF since the 1996 reclamation work and the 1996 Annual Review were completed.

### **3. 2014 DAM SAFETY INSPECTION**

Chris Gräpel, P.Eng. visited the site by helicopter on October 30, 2014 to undertake the Dam Safety Inspection. There was a covering of about 10cm of snow at the time of the site visit so not all conditions could be fully assessed.

Significant findings of the 2014 site inspection included:

- The TSF dam crest and slopes appeared in good condition and there was no sign of significant deformations.
- Erosion rills were noted approximately 50 m from the right abutment extending from the downstream crest to approximately 1/3 embankment height above the downstream toe. The drainage causing this erosion is believed to be due to surface water discharging off of a local high area of the reclaimed tailings surface.
- Significant erosion has occurred at the spillway channel and extends from the toe to the downstream crest of the dam.
- Standpipe piezometers could not be located during KCB's 2014 site visit and no piezometer data was available.
- There was only an estimated 1m of freeboard between the pond level and crest of the reclaimed TSF dam during normal conditions. KCB expects that either the dam will overtop or the spillway will continue to be eroded, with possible loss of tailings especially during a peak flood event.
- There was no data to assess whether the quality of water being released from the site meets discharge requirements.
- There appeared to be no OMS Manual or Emergency Preparedness and Response Plan in place.

Recommendations of the 2014 DSI are as follows:

- Place a 300mm thick layer of granular fill over seepage zones noted near the right abutment of the TSF dam. (This item was from a 1996 Piteau inspection. The need for this work should be assessed during the next inspection.)
- Consider reducing water sampling program to permit completion of water sampling and TSF inspection in one day with helicopter access (1996 Piteau recommendation). This would depend on the water quality results from upcoming sampling results.
- Resume annual inspections. A follow up inspection after the snow clears in 2015 is recommended due to snow cover at time of the 2014 inspection.

- Obtain current topography of the dam and TSF.
- Construct short term repairs of spillway.
- Assess capacity of current TSF drainage system.
- Conduct a Dam Safety Review
- Design TSF drainage system upgrade.
- Prepare OMS Manual and assess if an Emergency Preparedness and Response Plan is required.

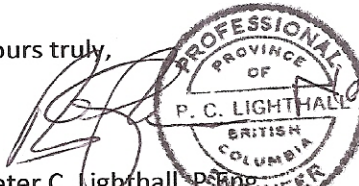
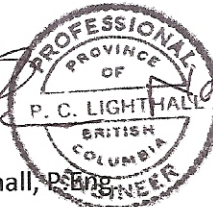
#### 4. CONCLUSIONS AND RECOMMENDATIONS OF 3RD PARTY REVIEW

- 4.1 The 2014 DSI appears to provide a good summary of the status of the Lawyers Creek TSF, within the limitations of the site conditions which were snow covered at the time of inspection. Confirmation of site conditions should be carried out in 2015 after snow is gone. The DSI addressed the key issues as per the Ministry of Energy and Mines Guidelines for Annual Dam Safety Inspection Reports. Recommendations provided in the 2014 DSI are considered appropriate and should be followed.
- 4.2 No CDA dam safety consequence classification is currently assigned to the Lawyers Creek TSF dam. Given that the TSF is located alongside Attorney Creek, which is a tributary of the Toodoggone River, a classification of Significant or High would be appropriate. A Dam Safety Review should be carried out in 2015 to assess the dam classification.
- 4.3 The embankment as described by KCB is apparently in good condition, however there appears to be potential risk of erosion of the spillway at the left abutment and also at the right abutment as a result of flow from the tailings surface. These water management and potential erosion conditions, which could lead to significant tailings release or dam failure, should be assessed as a priority and should be addressed in 2015.
- 4.4 Annual inspection and monitoring should be carried out in future years, in accordance with the OMS Manual. It may be possible in future to reduce the inspection frequency to every two or three years, but any reduction in inspection frequency should only be done with the agreement of MEM

#### 5. CLOSURE

Thank you for the opportunity to undertake this 3<sup>rd</sup> party review of the Cheni Mine Lawyers TSF DSI. I would be pleased to provide any additional information or clarification you may require.

Yours truly,

  
November 28, 2014  
  
Peter C. Lighthall, P.Eng.  
Consulting Geotechnical Engineer

- c. Heather Narynski, P.Eng. (MEM)  
Neil Singh, P.Eng. (KCB)

## **REFERENCES**

British Columbia Ministry of Energy and Mines, August 2013. Guidelines for Annual Dam Safety Inspection Reports.

Canadian Dam Association, 2007. Dam Safety Guidelines.

Canadian Dam Association, 2014. Mining Dams Technical Bulletin.

Klohn Crippen Berger, 2014. Cheni Mine - Lawyers Tailings Storage Facility - 2014 Dam Safety Inspection. Report prepared for Province of British Columbia Ministry of Energy and Mines, November 28, 2014.