

29 November 2014

Sona Resources Corporation  
501 – 3292 Production Way  
Burnaby, BC V5R 4A4

Attn: John P Thompson  
President & CEO

c. Les Galbraith (Knight Piésold)

**Re: Blackdome Mine Tailings Storage Facility  
Independent Third Party Review of Dam Safety Inspection**

Dear Mr. Thompson:

## **1. INTRODUCTION**

This letter presents the observations and conclusions of a third party review of a Dam Safety Review (DSR) of the Sona Resources Corporation Blackdome Mine Tailings Storage Facility. The review was carried out in accordance with Blackdome's e-mail authorization November 28, 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 Dam Safety Inspection (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 DSR of the Greenwood Mine dams was carried out by Knight Piésold Consulting, dated November 19, 2014. This third party review is based on that DSR. No site visit was made for the third party review.

## **2. BACKGROUND**

Blackdome Mine is an underground gold mine located approximately 70 km northwest of Clinton, British Columbia. The mine has been on a care and maintenance basis since operations were suspended in May of 1999.

Tailings from the Blackdome mill were deposited in the tailings storage facility (TSF) located directly below the mill. The TSF was created by construction of an embankment dam, which has a current height of about 35m and a length of about 200m. Design and construction monitoring of the dam were carried out by the following engineering firms:

- Stage 1 by Reimchen Ulrich Geological Engineering in 1985
- Stage 2 by Robinson Dames and Moore in 1987
- Stage 3 by SRK-Robinson Inc. in 1988, and

- Stage 4 by Knight Piésold Ltd. in 1998.

The initial Stage 1 starter dam was a homogeneous glacial till embankment with a downstream drainage blanket, constructed to a height of about 21m. The Stage 2 expansion was a centreline raise of 5.6m. The Stage 3 raise was a 4.6m raise built over the tailings beach, which had been improved by installation of wick drains to accelerate consolidation and to provide liquefaction resistance. The final, Stage 4 raise was a 2.8m centerline raise on top of the Stage 3 lift.

The dam was well instrumented with standpipe and vibrating wire piezometers and crest survey monuments. The instrumentation has survived well to date, with 15 of 19 initial standpipe piezometers and 3 of 4 vibrating wire piezometers functioning.

Knight Piésold (2014) assessed the classification of the tailings dam by considering the incremental consequence of failure on life safety and economic, social and/or environmental impacts and population at risk, according to the 2013 CDA Dam Safety Guidelines and the 2014 CDA Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams. The dam classification was judged by Knight Piésold to be “Significant” during the care and maintenance period.

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

Les Galbraith, P.Eng. of Knight Piésold carried out a site on inspection October 9, 2014. Following were the significant findings of the 2014 site inspection:

- The TSF embankment appeared to be in good condition. No signs of deformation were identified on the TSF embankment.
- The fundamental water management objectives for the facility during the care and maintenance period are to keep the tailings pond as low as possible. This is successfully being achieved by diverting clean surface water from the 1870 portal around the TSF via the South Diversion Ditch and by diverting water from the 1920 portal around the tailings facility via a ditch on the access road to the 1920 portal.
- Surplus water in the TSF is routed through a spillway, which was in good condition and showed no signs of erosion. The TSF spillway was designed to pass the 200 year 24-hour storm event. There was no water flowing through the spillway at the time of the inspection.
- The TSF currently has 4.3 m of freeboard, which is approximately 3.2 m more than the Stage 4 design as mine operations were suspended in 1999 prior to the additional storage capacity provided by the Stage 4 embankment raise was fully realized.
- The elevation of the tailings pond increased slightly (approximately 0.1 m) compared to observations from the 2013 inspection. The water level is within the range observed in previous inspections. The water levels in the standpipe piezometers and the vibrating wire piezometers are similar to previous measurements. There are no concerns with the standpipe or vibrating wire piezometer data.
- The flows measured in Weirs No. 1, No. 2 and the Lou Creek Weir are similar to previous measurements. The flows in the three weirs were clear.

#### 4. 2014 DSI RECOMMENDATIONS

Recommendations of the 2014 DSR were as follows:

- Continue with regular inspections of the dam and monitoring of the dam instrumentation.
- Develop an OMS Manual as per the CDA guidelines.
- Schedule a DSR for 2015. The recommended frequency for DSR's for a dam with a "Significant" classification is every 10 years. The DSR will include confirmation of the appropriate annual exceedance probabilities (AEP) for a dam with a "Significant" classification. The suggested AEP's for a dam with a "Significant" classification are between 1/100 and 1/1000 for both the flood and earthquake events.

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

- 5.1 The DSI provides a good summary of the status of the Blackdome TSF. The DSI has addressed the key issues as per the Ministry of Energy and Mines Guidelines for Annual Dam Safety Inspection Reports. Recommendations provided in the DSI are considered appropriate and should be followed.
- 5.2 A CDA dam safety consequence category was not previously assigned for the Blackdome tailings dam. Knight Piésold has concluded that the dam should have a "Significant" dam classification according to the CDA (2014). The writer agrees that Significant is likely an appropriate classification for this facility in a non-operating, care-and-maintenance mode. This is a remote site, with no permanent population at risk and little potential for economic loss other than the facility itself. However, the environmental values downstream need to be confirmed to support the classification of Significant. A Dam Safety Review is scheduled for 2015. As part of this DSR, a dam breach analysis should be undertaken and the resulting potential downstream environmental impacts assessed.
- 5.3 The tailings dam embankment as described by Knight Piésold is apparently in good condition and there appears to be a low risk of failure.

#### 6. CLOSURE

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

Yours truly,

 November 29, 2014

Peter C. Lighthall, P.Eng.

Consulting Geotechnical Engineer

## 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.

Knight Piésold Consulting, 2014. Blackdome Mine Tailings Storage Facility – Report on 2014 Annual Inspection. Report prepared for Sona Resources Corporation, November 19, 2014.