

November 28, 2014
Project No: 1CG021.003

Mr. Richard Tremblay
General Manager, Gibraltar
Gibraltar Mines Ltd.
10251 Gibraltar Mine Road
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V0L1P0

Attention: Mr. Tremblay

RE: Third Party DSI Review at the Gibraltar Mine Tailings Facility

1 Introduction

In August 2014, British Columbia's Chief Inspector of Mines issued an order for all of the tailings dams in the province to be inspected. The owners, agents or managers responsible for tailings dams are ordered to:

- Conduct a Dam Safety Inspection (DSI) by a certified professional engineer;
- The completed DSI must be reviewed by an independent qualified third party professional engineer from a firm that has not been associated with the tailings dam;
- An emergency preparedness plan (EPP) and a dam break inundation study completed by a qualified professional engineer for dam consequence classification (DCC) above "High". The plan and study must be reviewed, updated, and tested consistent with the Canadian Dam Association, Dam Safety Guidelines (CDA GL); and
- A letter by the mine manager outlining the commitment to carry out the recommendations. All of the components above must be completed and submitted to the Chief Inspector by December 1, 2014.

SRK has been retained by Gibraltar Mines Ltd to carry out the third party independent review of the DSI for the tailings dam at the Gibraltar Mine. While SRK is involved in other aspects of consulting work with the Gibraltar Mine, SRK has not been associated with any work on the site's tailings dams. This document provides the independent review approach, findings, conclusion and recommendations.

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2 Scope of Work and Reviewed Documents

The third party independent DSI review was carried out as a desktop study, without a site inspection. A site inspection was deemed unnecessary as the 2014 DSI and dam break inundation documents provide sufficient information for the review. The objective of the review is to evaluate the completeness of the DSI report and the dam break inundation study and the validity of their findings and recommendations as per the Chief Inspector's order.

The evaluation is done in accordance to the Canadian Dam Association Dam Safety Guidelines issued in 2007 (CDA 2007) and Section 10.5.3 of the Health, Safety and Reclamation Code for Mines in British Columbia Section (Code).

According to the Code, the DSI report shall contain the following information:

1. Executive Summary
 - (a) Classification of the dam(s) in terms of Consequence of Failure in accordance with Table 2.1 of the CDA Dam Safety Guidelines (2007).
 - (b) Significant changes in instrumentation and/or visual monitoring records.
 - (c) Significant changes to dam stability and/or surface water control.
 - (d) For major impoundments, as defined in Part 10 of the Code, a current Operation, Maintenance and Surveillance (OMS) Manual are required. The annual report shall indicate the latest revision date of the OMS manual.
 - (e) For tailings dams classified as High, Very High, or Extreme Consequence, an Emergency Preparedness Plan (EPP) is required. The annual report shall indicate the latest revision date of the EPP document.
 - (f) Scheduled date for the next formal Dam Safety Review in accordance with Table 5-1 of the CDA Dam Safety Guidelines (2007). Formal Dam Safety Reviews are required every five to ten years (depending on consequence classification) and differ from annual dam safety inspections. The requirements for Dam Safety Reviews are included in Section 5 of the CDA Dam Safety Guidelines. Dam Safety Reviews may be conducted by the Engineer of Record with third party review, or by an independent third party with involvement of the Engineer of Record.
2. Summary of past years' construction (if any) with a description of any problems and stabilization.
3. Plan and representative cross sections.
4. Site photographs.
5. Review of climate data.
6. Water balance review.

7. Freeboard and storage availability (in excess of the design flood).
8. Water discharge system, volumes, and quality.
9. Seepage occurrence and water quality.
10. Surface water control and surface erosion.
11. Instrumentation review including:
 - (a) Phreatic surfaces and piezometric data.
 - (b) Settlement.
 - (c) Lateral movement.

The review of the dam consequence classification is evaluated according to the CDA Guideline shown below.

Table 2-1: Dam Consequence Classification as shown in Table 2.1 of CDA GL

Dam Class	Population at Risk ¹	Incremental Losses		
		Loss of Life ²	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of <i>important</i> fish or wildlife habitat Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 or fewer	Significant loss or deterioration of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100	Major loss of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

¹ Definitions for population at risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

² Implications for loss of life:

Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

The following documents were assessed for this review:

- Klohn Crippen Berger, 2014. Gibraltar Mine Tailings Storage Facility, 2014 Annual Dam Safety Inspection, Rev. 3. Report prepared for Gibraltar Mines Ltd.
- Klohn Crippen Berger, 2011. Gibraltar Mines Tailings Facility – Dam Failure Classification. Report prepared for Gibraltar Mines Ltd.

The DSI references a number of technical reports for support and details. These reports were not reviewed by SRK but they are all certified and signed by professional engineers. SRK relies on the professional qualifications by others for the appropriateness and completeness of the referenced technical reports for verification on the review DSI. These main supporting reports include:

- EBA Engineering Consultants, 2011. Gibraltar Mines Tailings Facility – Dam Safety Review.
- Klohn Crippen Berger, 2013. TSF Emergency Preparedness and Response Plan.
- Klohn Crippen Berger, 2014. Water Balance Update for Gibraltar Mine.
- Klohn Crippen Berger, 2014. Gibraltar Mine Tailings Storage Facility operation, maintenance and surveillance manual.

3 Independent Review Findings

The summary of the DSI review is outlined in Table 3-1.

Table 3-1: Summary of Third Party DSI Review

Article ID	Topic	DSI Report and Dam Classification Report Summary					CDA GL Completeness	SRK Comments and Recommendations
1	Executive Summary							
a	Classification of the dam(s) in terms of Consequence of Failure in accordance with Table 2-1 of the CDA Dam Safety Guidelines (2007).	Dam	Classification (as shown in Dam Safety Inspection Report)				Completed	SRK concurs with the DCC classifications of the dams.
			Loss of Life	Economic and Social Loss	Environmental and cultural loss	Dam Consequence Classification		
		ESD	Extreme	High	Very High	Extreme		
		CSD	Very High	Extreme	Very High	Extreme		
b	Significant changes in visual monitoring records and/or instrumentation.	Section 4 of the DSI reports the elevated alert level piezometric readings are based on the historical levels and are not calibrated to the current dam configurations. The downstream slopes of the dams had been flatten so it is deemed that elevated piezometric levels are still within design requirements for stability. The DSI recommends weekly monitoring of the piezometers and revising the piezometric alert level in the OMS reflects the as-built conditions of the dams.					Completed	SRK concurs with the DSI recommendation on weekly monitoring and re-elevate the piezometric alert level to suit existing dam conditions.
c	Significant changes in dam stability and/or surface water control.	The executive summary states that there is no indication of dam instability. Minor localized deformations in the CSD are noted in Section 10 of the report. The minor slumps, cracks and sinkholes are deemed to be associated with the downstream face re-slope construction work and they are expected due to buried ice and snow. These deformations are regularly monitored, assessed and backfilled.					Completed	SRK concurs with the assessment for the minor deformations and concurs with the recommendations on regular monitoring and maintenance on them. We further recommend that a system be developed to quantify these deformations to document their movements.
		Section 4 indicated turbidity was reported in one of the seepages and it was determined the turbidity was associated with the re-sloping work. The assumption is confirmed one week after the completion of the construction when the seepage cleared up.						SRK concurs with the observations and clearing of seepage quality. SRK recommends periodical monitoring ensuring the turbidity does not return.
d	For major impoundments, as defined in Part 10 of the Code, a current Operation, Maintenance and Surveillance (OMS) Manual are required. The annual report shall indicate the latest revision date of the OMS manual.	The executive summary indicated the latest version of OMS was updated on January 31, 2014.					Completed	SRK recommends updating the piezometric alert level in the next revision of the OMS.
e	For tailings dam classified as High, Very High, or Extreme Consequence, an Emergency Preparedness (EPP) is required. The annual report shall indicate the latest revision date of the EPP document.	The executive summary indicated the latest version EPP was updated on September 23, 2014.					Completed	The DSI report indicated the EPP was updated this year. SRK did not review EPP to determine its adequateness and completeness. SRK relies on the professional engineer that drafted and reviewed it.
f	Schedule date for the next formal Dam Safety Review in accordance with Table 5-1 of the CDA Dam Safety Guidelines (2007). Formal Dam Safety Reviews are required every five to ten years (depending on consequence classification) and differ from annual dam safety inspections. The requirements for Dam Safety Reviews are included in Section 5 of the CDA Dam Safety Guidelines. Dam Safety Reviews may be conducted by the Engineer of Record with third party review, or by an independent third party with involvement of the Engineer of Record.	The executive summary indicated the latest version of DSR was done by EBA in 2011 and the next review is scheduled in 2016.					Completed	SRK concurs that the last DSR was done within the last five years and the next review scheduled date was provided.

Article ID	Topic	DSI Report and Dam Classification Report Summary					CDA GL Completeness	SRK Comments and Recommendations
2	Summary of past years' construction (if any) with a description of any problems and stabilization.	Summary of re-sloping work and associated deformation are documented and addressed in Section 4 and 10 of the report.					Completed	SRK concurs with the interpretation of the deformation and monitoring recommendations.
3	Plan and representative cross sections.	2014 plan and sections are included in Section 10.					Completed	Completed
4	Site photographs.	2014 inspection photos are included in Appendix II.					Completed	Completed
5	Review of climate data.	2014 site weather review are included in Section 5.					Completed	Completed
6	Water Balance review.	Water balance and storage availability are reviewed and included in Section 7.					Completed	Completed
7	Freeboard and storage availability (in excess of the design flood).	Dam	Dam crest (ft.)	Total freeboard (ft.) (Oct. 2014)	Min. freeboard above flood level (ft.)	Freeboard available for storm event (ft.)	Completed	The Figure 7.1 of the DSI report indicated flood event water level is around 12.5 feet, which would indicate there is sufficient freeboard as per design criteria shown in Table 3.1 of the report.
		CSD	3586	22.5	10	12.5		
		ESD	3590.5	27	4	23		
		NED	3581.9	18.4	4	14.4		
8	Water discharge system, volumes and quality.	Section 8 included the water discharge and quality summaries.					Completed	Completed
9	Seepage occurrence and water quality.	Section 9 described the seepages from the dams are pumped back to TSF.					Completed	Completed
10	Surface water control and surface erosion.	Section 6 included the surface water control and erosion summary and there are no concerns					Completed	Completed
11	Instrumentation review including:							
a	Phreatic surfaces and piezometric data.	2014 review of piezometric data are included. Noted above alert level readings in piezometers in CSD and ESD.					Completed	The review of the alert levels of the piezometer is recommended as for DSI report.
b	Settlement.	Section 4, article of 7 of the report indicated that movement and settlement are part of routine monitoring program because of the periodic raising of the dam. While movement and settlement are not monitoring during operation, they should be considered as part of closure monitoring.					Completed	While SRK concurs that some settlement and movement are to be expected due to construction, SRK recommends that significant cracks and sinkholes found be documented and quantified for long term monitoring and comparison purposes.
c	Lateral movement.	Same as above.					Completed	See recommendation above.

4 Conclusion and Recommendations

SRK concurs with the overall assessment of the DSI and the DCC of “extreme” for the Gibraltar TSF dams. Associated with the “extreme” DCC classification, Gibraltar has completed an EPP and the next dam safety review is scheduled in 2016, within five years of the previous DSR. Both of the requirements meet the CDA GL. While SRK did not review the DSR and the EPP, they are certified by other professionals and SRK relies on the professionals’ judgments and qualifications on the appropriateness and completeness of these reports. SRK concluded the recommendations outlined in the DSI report are adequate, with emphasis on the following:

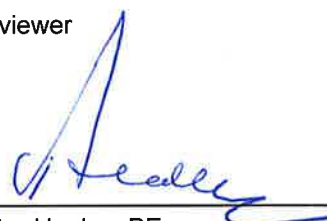
- Update instrumentation alert levels for all dams based on current geometry, phreatic surfaces and stability assessments.
- Weekly monitoring for turbid flow in weirs.
- Continuation of monitoring for and maintenance of any cracks and/or sinkholes to design lines.

In addition to the DSI recommendations, SRK’s recommendation is that Gibraltar continues to engage KCB to monitor and quantify the settlements and movements along the re-sloped areas to ensure the deformations are limited to local areas and are not deteriorating further elsewhere in the dam.

Sincerely,
SRK Consulting (Canada) Inc.


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Reviewer


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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are

entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

5 References

Klohn Crippen Berger, 2014. Gibraltar Mine Tailings Storage Facility, 2014 Annual Dam Safety Inspection, Rev. 3. Report prepared for Gibraltar Mines Ltd.

Klohn Crippen Berger, 2011. Gibraltar Mines Tailings Facility – Dam Failure Classification. Report prepared for Gibraltar Mines Ltd.