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**Project Memorandum**

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**To:** KGHM Ajax Mining Inc. **Doc. No.:** BGC-016  
**Attention:** Nettie Ore **cc:**  
**From:** Cassandra Koenig, Sophie Penhall **Date:** June 3, 2016  
**Subject:** Ajax Project EA/EIS – Responses to concerns raised in SLR Memorandum SLR020  
**Project No.:** 1125011-10-02

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## **1.0 INTRODUCTION**

The Ajax Project Environmental Assessment Certificate Application/Environmental Impact Statement (Application/EIS) was issued in September 2015 (KAM 2015). Initial comments and permit information requirements (IRs) were provided to KAM by SLR Consulting (SLR) on behalf of the City of Kamloops (COK) following a review of the Application and supporting documents.

This memorandum documents responses for to concerns raised in SLR Memorandum SLR020.

## **2.0 PERMIT INFORMATION REQUIREMENT RESPONSES**

### **2.1. Information Requirement Issue within SLR020:**

*The yield accelerations that are presented in Appendix 6-2D Assessment of the Potential Influence of Production Blasting on Slope Stability in Aberdeen Hills Area are comparable to earthquake shaking corresponding to 1:100 yr PGA (Peak Ground Acceleration) (2010 NBCC) and 1:475-yr PGA (2015 NBCC).*

*The new 2015 NBCC has PGAs reduced by a factor of almost 2 for this site. Of importance for the Aberdeen Hills area are the 1.0 second period spectral accelerations because the slide mass is about 50 m thick with a shear wave velocity of about 250 m/s, which gives a site period of about 0.8 seconds. The 2015 NBCC Sa (1.0s) values only reduce to about 70% of the 2010 NBCC values.*

*The reported peak particle velocities (PPVs) for Stability Region A, from site-specific blast attenuation relations vary from 0.6 to 0.8 mm/s. In comparison, simplified methods proposed by Wong and Pang (2000) predict considerably larger values; i.e. 20 to 40 mm/s. The Wong and Pang formulations are applicable for blast vibration frequencies varying from 30 Hz to 100 Hz. There is already site-specific evidence that the dominant frequencies of PPV spectrum at 500 m distance are 8 to 12 Hz. Considering the topographic amplifications associated with the terrain and the larger distance from source to areas of instability, predictive methods may not be reliable for this site. If this has not already been completed, it would be prudent to perform direct*

*measurements in Stability Region A for a blast with characteristics similar to a production blast to confirm the anticipated PPVs.*

Response:

Blasting Analysis International (BAI) undertook a comprehensive review of blast designs for the Ajax Project in 2014 (BAI, 2014), as referenced in Appendix 6.2-D. BAI stated that the maximum allowable PPV close to Jacko Lake during the spawning period is 13 mm/s, as stipulated by the Department of Fisheries and Oceans Canada (DFO). PPVs at the edge of Aberdeen are predicted to be significantly smaller than 13 mm/s, due to the distance of the neighborhood from the open pit. At Pacific Way Elementary School, the structure in Aberdeen closest to the open pit (2.46 km), the predicted PPV for the design blast is 1.0 mm/s. The vibration associated with this PPV is approximately equivalent to the vibrations from a person walking briskly across an uncarpeted floor (BAI, 2014).

KAM has not undertaken direct measurement of PPVs in Stability Region A for a production blast as part of the Environmental Assessment (EA). Estimates of PPVs have been made based on:

- Tests blasts completed by Orica in 2011; the results of which were used to derive a vibration attenuation relationship for bedrock at the Ajax site (Appendix 6.2-D).
- Assessments by BAI and Knight Piesold Consulting (KP) in 2014 (Appendix 6.2-D). BAI developed a generalized blast energy attenuation relationship and subsequently recommended blast designs to maintain PPVs in the Aberdeen area below a design threshold.

KP recommended (Appendix 6.2-D Section 7) and KAM has committed to a plan to monitor, evaluate and adapt blasting practices in the pit to maintain PPVs and changes in pore water pressure (PWP) in the Aberdeen area below design thresholds. The following practices are planned:

1. As stated in Appendix 6.2-D: “In the unlikely event that a blast vibration PPV of >5 mm/s is recorded at the seismograph at the margin of the Aberdeen Hills area and/or an excess PWP of >10% is recorded in the adjacent vibrating wire piezometer during production blasting, blasting would cease immediately and the blast design would be modified by a Qualified Professional in order to maintain the vibrations and excess PWP’s below the alarm levels.”
2. As outlined in Section 7 of Appendix 6.2-D, monitoring of blast vibrations and PPVs through the installation of a linear array of permanent seismographs between the Project and the Aberdeen Hills area to provide daily record of blast effect at different distances.
3. As outlined in Section 7 of Appendix 6.2-D, monitoring of excess PWP through the installation of a vibrating wire piezometer in line with the seismographs will be undertaken. KAM is preparing a groundwater monitoring plan for the groundwater monitoring wells/VWPs installed on site. Selected wells may be used as monitoring wells during blast time, to assess the effects of blasting on PWP on the property.
4. As discussed in Section 4.7 of Appendix 6.2-D, Golder Associates developed a Risk Management Plan that allows the City of Kamloops staff to track and monitor well data in

the Aberdeen Hills area, to help mitigate potential groundwater related instabilities. This monitoring plan is currently in effect, and takes place in the 30 pumping wells installed in the Aberdeen area. Opportunities may be sought for KAM to collaborate with the City of Kamloops to augment the monitoring dataset for the purposes of understanding the effects of blasting.

5. Measurements of vibration and changes in PWP can be collected during every production blast, using automated tools (i.e. dataloggers, leveloggers), to ensure a continuous feed of data through a blast time. Data may be collected following each blast, to monitor any delayed effects in PWP. Vibration, PPV and PWP monitoring data from initial blasts may be reviewed to provide real-time opportunities for corrective action if the effects approach exceedance of the design target. Data from select successive blasts may be reviewed, as experience with vibration and groundwater response is gained.
6. Utilize the practice of “scaling up” from a small blast in the initial project phase and monitoring of vibrations during scale-up. As indicated in Appendix 6.2-D Section 5.3 and Section 7, BAI recommended that the charge weight/delay in the initial blasts should be kept well below the maximum 1020 kg, specified in the blast design.
7. As discussed in Appendix 6.2-D, vibration data collected in the initial blast phase may be used to develop a site-specific blast vibration attenuation relationship. Predicted vibrations in the Aberdeen Hills area could then be re-assessed using the updated site-specific blast vibration attenuation relationship. This process may continue throughout the life of the mine.

### **3.0 CLOSURE**

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Yours sincerely,

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## **REFERENCES**

Blasting Analysis International (BAI) 2014. Ajax Mine Blast Review, Conclusions and Recommendations. Report Prepared for KGHM International, dated August 25, 2015