

August 25, 2013

Mr. Yves Lacasse
External Affairs Manager
KGHM International, Ltd.
330 Seymour Street
Kamloops, BC, V2C 2G2, Canada

Re: BAI Comments on Mr. Bruce Bosdet's Assessment of Airblast Impacts

Dear Yves,

I have reviewed Mr. Bruce Bosdet's assessments and opinions regarding the airblast impacts on people and homes in Kamloops, BC. Mr. Bosdet is employed by Golder Associates. It would have been helpful if Mr. Bosdet had included his CV, giving everyone an idea of what his qualifications and experience are with blasting, as a geotechnical engineer.

While some of Mr. Bosdet's statements were correct, much of his assessments on the airblast impact were very misleading, in view of the control programs the Ajax mine will have in place. Thus, the following BAI comments are meant to alleviate everyone's concerns regarding airblast in terms of any structural damage, and its effects on people living within the surrounding communities to the Ajax mine. They also serve to provide specific information on how mine management intends to control all airblast effects.

1. First, no windows will be broken in any of the surrounding communities from the Ajax mine blasts. And second, no "sonic booms" will be experienced in any of the surrounding communities.
2. I have designed, monitored, analyzed, audited, and/or supervised well over 7,000 full scale blasts, covering all 50 States in the U.S.A. and 26 other countries, in a variety of very diverse blasting environments. In Canada, I have assisted mines with the control of ground vibrations and airblast in British Columbia, Alberta, Ontario, Quebec and

Newfoundland. Never in my 40 year career, did I ever experience airblast breaking windows in any community in the world from a mining blast. My CV is included in Appendix A.

3. In reference to the Orica report which Mr. Bosdet referred to, the measurements were taken within a relatively close test distance range relative to how far the City of Kamloops was located. Because of this, it is not unusual for the airblast data to end up clumped together, and thus any statistical analyses and extrapolations into the far field would be questionable. But, given the same test parameters and atmospheric conditions, airblast amplitudes will always attenuate with distance.
4. Table 1 lists the Orica test blast parameters versus the parameters used by BAI to estimate the airblast level at the closest part of Kamloops (Aberdeen), which would be located approximately 2,000 m from the final pit edge.

Table 1 – Orica Test Parameters versus Parameters Used by BAI

Parameter	Orica Test Parameters	Parameters Used by BAI
Hole Diameter (mm)	251 (9 7/8-in)	270 (10 5/8-in)
Hole Depth (m)	12.2 – 14.3	16.5
Top Stemming (m)	4.5 – 7.8	7.5
Explosive Density (g/cc)	1.20	1.20
Explosives/Hole (Kg)	315 - 562	618

Note that BAI used a much larger borehole diameter, a deeper hole depth, and a much higher explosive quantity per hole, because these are the intended initial design parameters, which would be used on the full scale production shots when blasting begins. The airblast level estimated in Aberdeen at 2,000 m away would only be 118 dBL, which would be more than acceptable in eliminating any damage or annoyance concerns. This calculation is based on the airblast predictive model developed by the USBM (United States Bureau of Mines).

The accepted airblast levels and norm worldwide to minimize annoyance effects in nearby communities is ≤ 120 dBL.

5. As of now, the current proposed city limit line to the proposed final mine pit limit line is approximately 250 m. As the city of Kamloops expands with homes, industrial structures and utilities towards the 250 m offset from the pit limit, the blast designs will be modified using explosive decking, smaller diameter holes, increased top stemming, and/or lower density explosives, to achieve the equivalent order of acceptable airblast magnitudes. Mine management is prepared and committed to do whatever is necessary to eliminate any potential of structural damage, and to minimize the annoyance effects.
6. The USBM'S safe airblast limit is ≤ 133 dBL to eliminate any permanent structural damage to residential homes.

Airblast levels of at least 150 dBL would be required to cause structural damage at homes, usually starting with cracked single pane window glass. To create airblast levels of 150 dBL, which would begin to crack window panes in Aberdeen at 2,000 m away, approximately 10,000,000 Kg of explosives would have to be fired in each hole. This is simply impossible, because a single hole can only accommodate a maximum of between 315 and 618 Kg of explosives, as outlined in Table 1.

7. Although there are no formal regulations in British Columbia governing safe maximum allowable vibration and airblast limits to eliminate structural damage, it is important to note that the USBM recommended limits have been adopted by over 95% of the countries in the world. The USBM'S recommendations have also been verified with the same degree of extensive testing by independent research groups in England, Germany, India and the U.S.A. BAI also verified the USBM'S conclusions with an extensive two-year joint study involving New Mexico Tech and Vibra-Tech Engineers.
8. It is true that unfavorable weather conditions consisting of low lying inversions, which are coupled with high velocity directional winds, could amplify and focus the airblast overpressure many kilometers away from the blast zones. Under these circumstances, no blasting will take place, or the blasts will be postponed until more favorable weather conditions exist. Blasting operations will only be conducted if weather conditions are conducive to the control of airblast dBL levels. Additionally, a permanent weather station will be installed in Aberdeen, and the weather will be monitored days in advance. Thus, unfavorable weather conditions and "sonic booms" would be non-issues in all of the surrounding communities.

9. One has to consider that the mine will have offices, plant facilities, utilities, power lines, electrical substations and sensitive electronics equipment, etc. directly on the mine site, which also have to be protected from ground vibration and airblast damage. Because these facilities will always be the closest to the blast zones, they will often dictate the safe vibration and airblast levels for all of the communities surrounding the mine. By default, any structures beyond the mine property will always receive less vibration and airblast amplitudes.
10. Nevertheless, a linear array of three permanent seismographs will be installed from the mine pit edge towards the outer limit of Aberdeen. These units will operate 24 hours/day, monitoring both ground vibrations and airblast, and they will be operated by an independent contractor. Results from each blast will be emailed simultaneously to mine management and the City of Kamloops Officials.

Data collected from the seismographs will be used to verify compliance with the USBM allowable safe levels for residential homes, refining the blast designs, developing site-specific predictive models, and to check for any changing geologic conditions as the blasts progress from one end of the pit to the other end. Additionally, a roving seismograph will be used when needed along the city limit line closest to the Northern part of the pit. Refer to Figure 1.

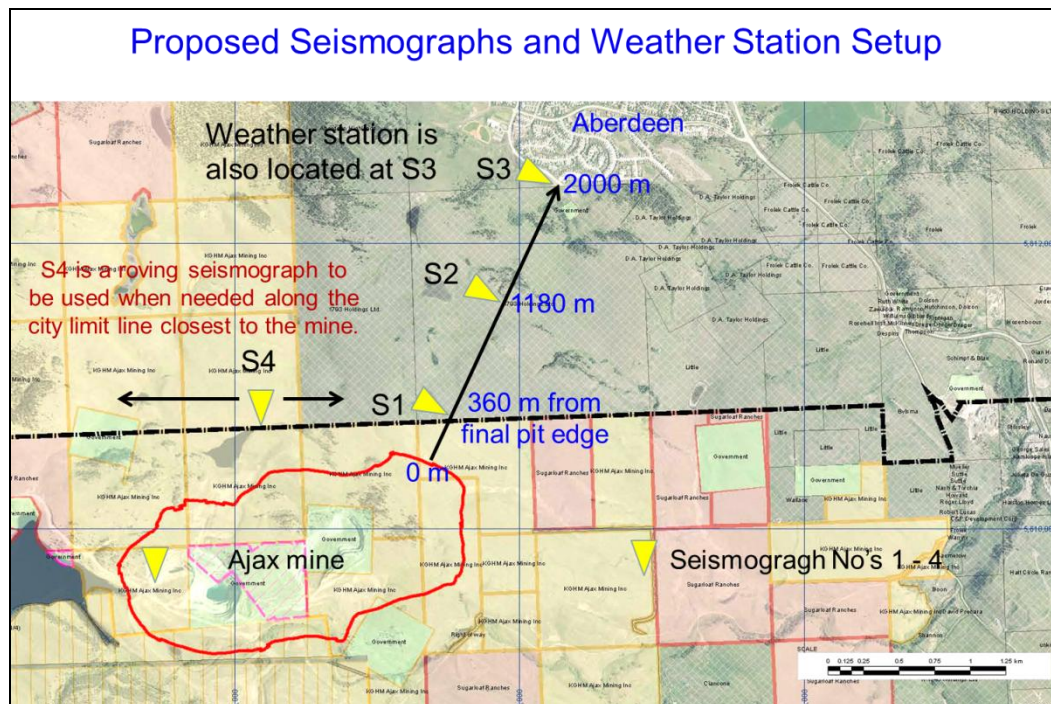


Figure 1 – Proposed seismographs and weather station setup.

11. BAI'S understanding is that electrical storms do occur in and around the city of Kamloops. Nearby lightning activity can result in airblast levels in excess of 140 dBL. In reference to the physiological response of people in the community regarding blasting, home and business owners can rest assured that the airblast levels produced from blasting will be nowhere near that of lightning strikes.
12. No one in Kamloops wants their homes damaged, including all of the mine employees who also live there.

Please contact me should you have any questions or require additional information.

Regards,



R. Frank Chiappetta
Explosives Applications Engineer
BLASTING ANALYSIS INTERNATIONAL
Explosives, Seismic & Mining Specialists