



March 26, 2019

Ms. Leigh Chavez  
Placer County Community Development Dept.  
3091 County Center Drive  
Auburn, CA 95603

**Subject: Peer Review of the Noise and Vibration Assessment - Gazex Avalanche Mitigation System - Placer County, California**

Dear Ms. Chavez:

j.c. brennan & associates, Inc. has completed our peer review of the above-referenced document produced by Bollard Acoustical Consultants, dated February 22, 2019 (*Draft Noise and Vibration Assessment, Gazex Avalanche Mitigation System, Prepared for: Placer County Community Development Department, Prepared by: Bollard Acoustical Consultants, Inc., February 22 2019*). The intent of the review was to determine if the documents met the technical requirements for evaluating potential noise and vibration impacts and determining if the analyses met the requirements of scope of work requested by Placer County.

Specifically, we reviewed the report for accuracy and thoroughness with special attention to the following areas:

- ▶ Noise Metrics;
- ▶ Noise Propagation;
- ▶ Appropriate Criteria;
- ▶ Monitoring Site Selection
- ▶ Proper Use of Noise and Vibration Equipment and Calibration;
- ▶ Analysis and Conclusions.

### **Introduction**

Bollard Acoustical Consultants, Inc. (BAC) was employed by Placer County to evaluate the noise and vibration impacts of the recently deployed Gazex Avalanche Control Systems. The scope of work that the County requested of BAC was to determine if the use of the Gazex systems would result in any potential harm to human health to residents, or structural damage at residences nearest the system. Specifically, the analysis evaluated the 8 Gazex systems along Alpine Meadows Road.

BAC was not requested to determine if the noise and vibration levels would comply with the Placer County Noise Element of the General Plan, the Placer County Noise Ordinance, or any other environmental requirements of CEQA. However, this peer review does provide some recommendations and guidance for additional analysis which is not part of the scope of work.

## **Noise Fundamentals and Metrics**

The discussion of noise fundamentals and metrics is accurate and describes the appropriate metrics to be used for the analysis. These metrics included A-weighted Lmax and Linear Lpeak for noise levels and peak overpressure for airborne vibration, and VdB and Peak Particle Velocity for groundborne vibration levels.

It was noted during the peer review that discussions of Leq and Ldn were probably not required and resulted in more information than the typical person reading the report required.

## **Noise Propagation**

During the review, the discussions on noise propagation and the affects on noise propagation was presented clearly and concisely. The discussions are consistent with the American National Standards Institute (ANSI) / Acoustical Society of America (ASA), American National Standards Test Methods.

## **Use of Appropriate Criteria**

Based upon the scope of work requested by Placer County, the analysis uses the appropriate criteria for evaluating any potential for any harm to human health, or structural damage to residences.

However, It should be noted that the most common human reaction to impulsive sounds such as detonation of a Gazex system can be that it results in rattling of windows. Rattling of windows will generally result from peak overpressures. Although the rattling of windows may not translate to structural damage, it generally results in an adverse reaction to a noise event such as a Gazex explosion.

Some discussion of criteria which describes the potential for annoyance due to peak overpressures should be included. Airborne overpressures produced by blasting or an explosion are typically in the low frequency range of 2 Hz to 25 Hz, and the acoustical energy is concentrated below about 5 Hz. Noise levels in these frequencies are generally not discernable to the human ear until they reach a certain peak overpressure. The threshold for annoyance due to blast-induced air overpressure is a peak value of 0.01 psi (equivalent to 110 dB Linear).

In addition, it was noted that there was no discussion on criteria for determining the potential for sleep disturbance. Maximum noise level (Lmax), and sound exposure level (SEL) criteria have been developed for evaluating the potential for sleep disturbance. Sleep disturbance can be considered a potential health concern. Many jurisdictions implement a maximum noise level standard of 50 dBA in bedrooms for single event noise sources. In addition, ANSI has developed procedures for evaluating single noise events using the SEL descriptor. This procedure accounts for the overall noise exposure and the number of events. It should be noted that no criteria which describes the acceptable "potential" sleep disturbance has been developed, and that recent legal decisions simply state that a disclosure of the potential is required.

## **Monitoring Site Selection**

The monitoring site selection was noted to be very detailed and the sites were selected carefully to account for maximum exposure to the Gazex systems. The report was detailed in describing each site and clearly showing the unobstructed views from residences to the systems. Both noise and vibration meters and their associated microphones and accelerometers were located to ensure that snow removal equipment or other human activities would not interfere with the data collection.

As described earlier, a common human reaction to impulsive sounds within homes is rattling of windows. The relationship between the rattling of windows and measured peak overpressures could have been reinforced by the placing of accelerometers on some windows and building facades.

## **Proper Use of Noise and Vibration Equipment and Calibration**

All equipment meets ANSI standards for Type 1 measurement equipment.

Through the monitoring site selection, the noise and vibration equipment was properly located inside of contractor boxes which protected the equipment from the weather and human activity.

The placement of accelerometers for the vibration monitoring was correctly attached to ground spikes and located under enclosures to ensure accuracy. Noise monitoring microphones were placed at locations which were high enough above the ground and did not result in significant ground absorption, and replicated elevated receivers.

Calibration of equipment was consistent with general practices and is assumed to have recent calibration certifications.

## **Analysis and Conclusions**

The monitoring survey collected a sufficient number of samples of Gazex noise and vibration levels. The sample sizes and standard deviation of the reported levels are considered to be representative of Gazex operations.

The analyses shown in Table 5 and Figures 7 through 11 are detailed and clearly presented to the reader. Figures 9 through 11 should probably note that they are Lmax levels.

The results of the analysis and conclusions are accurate and meet the requirements of the scope of work.

Although the scope of work and analysis was intended to evaluate any potential for adverse affects to human health and damage to structures, the results in Appendix D (Linear Peak Noise Levels) result in consistent levels which exceed the 110 dB level which is the criteria typically used for annoyance. (*Transportation and Construction Guidance Manual, September 2013, California Department of Transportation, Division of Environmental Analysis Environmental Engineering*)

## Conclusions

Based upon our review of the BAC analysis, j.c. brennan & associates, Inc. has concluded that the report accurately measured and analyzed the noise and vibration levels with respect to the scope of work requested by Placer County.

j.c. brennan & associates, Inc. has noted additional information which could have been provided to the community with respect to vibration levels at the building facades, discussions on potential sleep disturbance and the potential for annoyance. Each of these items were not part of the scope of services.

This concludes our peer review. If you have questions, please contact me at 530-823-0960, or [jbrennan@jcbrennanassoc.com](mailto:jbrennan@jcbrennanassoc.com).

Respectfully submitted,  
j.c. brennan & associates, Inc.



Jim Brennan  
President  
Member: Institute of Noise Control Engineering