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Merriam Junction Sands, Inc.

BLAST MONITORING PLAN

Louisville Township

Scott County, MN

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BLAST MONITORING PLAN

1.0 INTRODUCTION

This Blast Monitoring Plan has been prepared for Merriam Junction Sands (MJS) proposed limestone and sandstone quarry location in Louisville Township, MN. All blasting must be performed by a licensed blaster who will be responsible for the design and execution of all blasts. This plan outlines minimum monitoring requirements to verify that ground vibration and air over pressures do not exceed federal guidelines established to protect adjacent structures.

Blasting of limestone and sandstone will be required at the MJS Site in order to loosen and extract these resources. Blasting creates some vibration and noise. The effects of blasting have been studied for over 100 years and surface blasting rules and performance standards have been established by the Office of Surface Mining Reclamation and Enforcement (OSMRE).

The purpose of this Blast Monitoring Plan is to:

1.1 Describe the anticipated blast process;
1.2 Discuss industry standards in terms of acceptable limits of ground vibrations and air blasts established to provide protection to infrastructure and structures; and
1.3 Establish a monitoring program for the project that will provide the framework for documentation of the existing condition of adjacent structures, set forth blasting standards protective of structures and infrastructure adjacent to the Doucette Quarry, establish monitoring as a means to collect ground vibration and air blast data, and to develop contingency actions to be followed in the event a blasting standard is not achieved.

2.0 BLASTING PROCESS

After overburden has been removed, holes are drilled into the rock and carefully loaded with explosives by trained blasters from an independent blasting company. A timing sequence is engineered to progressively detonate the explosives loaded in the holes. This timing sequence reduces overall vibration, reduces noise impacts, and improves fracturing of the rock. The timing sequence is engineered by professionals with experience in similar quarry operations. The actual blasting is then conducted and tracked with data collected by the seismographs. Subsequent blasts are designed using data collected from the previous blast monitoring results. The blast immediately fractures the rock and the explosives are consumed.

Blasting causes ground vibrations as the energy from the blasts travels through the ground and eventually dissipate. Blasting also creates an air blast or impulse noise. Both ground vibrations and air blasts have been studied by the OSMRE and the United States Bureau of Mines to establish safe levels which will not cause damage to adjacent receptors. Ground vibrations and air blasts are measured during each blast so that the blasting program can be adapted to changing geologic conditions, the location of the blast in the mine, as well as changes such as location relative to receptors. For example, larger blasts may be acceptable further from receptors but as the active quarry face approaches structures, blasts may be

reduced in size and increased in frequency to reduce ground vibrations and air blast at the adjacent structures.

Blasting is accomplished by first drilling a series of holes, typically 3-5 inches in diameter into the rock. A small booster charge and blasting cap is placed in the hole followed by the blasting agent. A booster provides just enough energy to detonate the blasting agent. Boosters in each hole are detonated individually by the blasting caps that have built in time delay. Using delays just thousands of a second apart is enough to greatly disperse the energy released by the total amount of explosives involved. To an observer, a blast seems to happen instantaneously. What actually takes place, however, is a rapid progression of smaller explosions.

The three environmental effects that can result from blasting include; ground vibration, airblast and flyrock. "Ground vibration" is measured in inches per second and is a measure of the vibration of individual rock particles. The majority of energy in a well-designed blast is absorbed as it fractures and moves the rock away from the mine face into a pile for loading. This efficiency is achieved by adjusting the amount of explosives to match the amount of rock to be broken and utilizing the per delay intervals, to control ground vibration and frequency of the blast. The permanent displacement of rock associated with the blast is limited to only a few feet of the blast hole. Structural damage can occur when particles vibrate at levels greater than current blasting standards. Ground vibrations decrease by a mathematical formula and very rapidly as the distances from the source increase. Seismographs will be used at adjacent structures to measure ground vibration and air blast. This information is used to verify that ground vibrations at the structures are within nationally recognized standards for safe blasting.

"Airblast" is a term that describes air movement (pressure change) created by the breaking and movement of the rock through the expansion of the blasting agents. This pressure change travelling through the air transmits noise from a blast, although most of the energy is below the frequency range of human hearing. Airblast is measured in decibels. Although the airblast may not be audible, it may be felt. The lower frequency air pressure may cause windows to rattle, which is then a sound that is noticed by the receptor.

"Fly rock" is a term used to describe pieces of rock that could be ejected from the blast area. Fly rock is controlled by properly engineering the blast design, proper explosive volume per volume of rock to be moved and by providing sufficient stemming materials, (rock fill located in the top of the drill holes to contain the blast).

3.0 BLASTING STANDARDS:

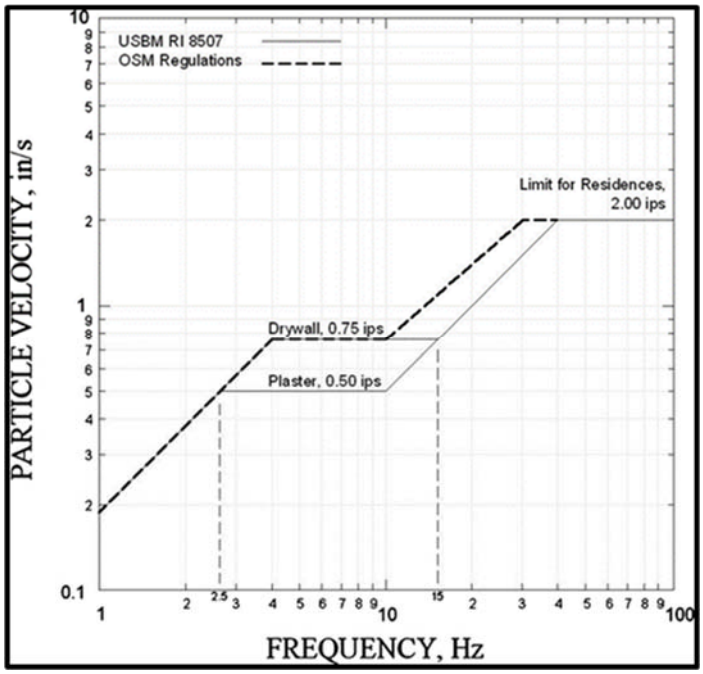
3.1 Ground Vibration: Blasting standards have been adopted by the OSMRE. Research has verified that at lower blast vibration frequencies the thresholds at which cosmetic damage may begin to occur (with appropriate safety factors) are lower than higher blast vibration frequencies. This is because structural resonance (a condition in which a response is amplified) is associated with low frequency vibrations.[1] As a result, blasting standards are frequency dependent as illustrated on the chart below.

Two seismographs will record the particle velocity of each blast performed at the MJS Quarry. The seismographs will typically be placed at the location of the nearest structures to the blast

[1] Konya, Calvin J. 1995 Blasting Control at Meridian Aggregates. Precision Blasting Services Montville, OH 44064

as ground vibration is reduced with distance from the blast. The seismographs measure and record particle velocity in three mutually perpendicular directions. The maximum allowable peak particle velocity shall be the vector sum of the three. In all blasting operations, the maximum ground vibration shall not exceed the values indicated in the blasting-level chart at adjacent structures.

Chart 1. BLASTING LEVEL CRITERIA



3.2 Airblast: shall not exceed the maximum limits listed below at the location of any dwelling, public building, school, church, or community or institutional building, or historic structures outside the project boundary.

Lower frequency limit of measuring system, in Hz (+/- 3 dB)	Maximum level, in dB
2 Hz or lower--flat response	133 peak

3.3 Flyrock: Flyrock shall be controlled by blasting design and the use of blasting mats. Blasting mats are placed over the drilled and filled holes prior to a blast. The mats suppress the ejection of material resulting from a blast, helping to control flyrock from leaving the blast area.

4.0 MONITORING PROGRAM

MJS has developed the following blast monitoring program to be followed throughout the mining operation.

4.1 Pre-Blast Surveys: Pre-blast surveys will be offered to owners of structures located within one-half mile of the mining limits to document the existing condition of nearby structures and

log any pre-mining defects and structural issues. The survey is intended to establish a starting point for independent professional review should any damage be claimed. Pre-Blast surveys will be conducted by an independent contractor. Owners of structures located within one-half mile of the quarry limits will be contacted by MJS at least 20 days prior to initial blasting operations with instructions as to how a pre-blast survey may be conducted. Survey requests received more than 10 days before the initiation of blasting will be conducted before blasting begins. Those received less than 10 days before the initiation of blasting will be conducted within 30 days of receipt of a survey request. Pre-Blast surveys will be conducted by an independent contractor on those structures where property owners grant permission. The pre-blast survey inspects the exterior and interior of a structure, including basements and foundations. These surveys provide documentation of the pre-blast condition of the structure. A copy of the pre-blast survey will be provided to the property owner and one will be kept at the Bryan Rock office.

4.2 General: Blasting will be conducted to prevent injury to persons, damage to public or private property outside the permit area.

4.3 Hours: All blasting will be performed during daylight hours and within the operating hours of the quarry.

4.4 Blasting will be performed by an independent blasting specialist.

4.5 Monitoring: at least two seismographs will be utilized to record each blast. The seismographs will be placed at a location between the nearest structure and the blast site and a location roughly 90 degrees to that orientation. Seismographs will record the airblast and particle velocity. Locations of monitoring points will change as mining progresses to provide comprehensive monitoring of all adjacent structures.

4.6 Records: Records will be maintained of each blasting event. The records will record:

(1) date and time of blast;
(2) type of explosive used;
(3) ignition layout with locations of blast holes and time intervals of delay;
(4) pounds of explosives per each delay of eight milliseconds or more;
(5) total pounds of explosives;
(6) type of material blasted;
(7) monitoring locations and results of monitoring when conducted;
(8) meteorological conditions, including temperature inversions, wind speed, and directions as can be determined from the U. S. Weather Bureau, and ground-based observations;
(9) directional orientation of free faces of bench to be blasted

4.7 Maximum acceptable levels: The results of each blast will be reviewed for compliance with the standards outlined in Section 3.0 above.

4.7 Results of all blasts will be maintained at the MJS office and submitted to the Township or County upon request.

4.9. In the event that a blast exceeds the standards outlined above, the County will be notified within seven days and results of the next three blasts will be submitted for review.

4.10 Any resident with a complaint regarding blasting is encouraged to contact MJS directly. Contact information Matt Bryan: Office 952 445-3900 Cell 612 384-5594.

5.0: CONTINGENCY ACTIONS:

5.1 Ground Vibration: If the ground vibration standard is exceeded, one or more of the following contingency actions will be implemented at the next blast. The monitoring results of the blast will be analyzed and reported to Scott County within seven days of the blast. These contingency actions will continue to be implemented as required to until the blasting is found to be in compliance with OSM standards.

1) reduce pounds of explosive per delay period
2) adjust/change timing sequence
3) adjust size of shots
4) adjust size of drill holes
5) log drill holes

If after three subsequent blasts to the first exceedance, the contingency actions 1-5 fail to reduce the vibration at the structures to the OSM standards, one of the following additional contingency actions will be undertaken.

6) expert outside review
7) change blasting vendor

5.2 Air Blast: If the air blast standard is exceeded, one or more of the following contingency actions will be implemented at the next blast. The monitoring results of the blast will be analyzed and reported to Scott County within seven days of the blast. These contingency actions will continue to be implemented until the blasting is in compliance with OSM standards.

1) utilize crushed rock stemming
2) increase stemming depth
3) change timing sequence
4) change hole size
5) utilize stemming plugs

In after three subsequent blasts to the first exceedance, contingency actions 1-5 fail to reduce the Airblast to OSM standards, one of the following additional contingency actions will be undertaken.

6) expert outside review
7) change blasting vendor