Appendix 14

Noise Analysis

Giroux & Associates
Environmental Consultants

1820 East Garry St., #211
Santa Ana, CA 92705

Ph: 949.387.5477
Fax: 949.387.5477

NOISE IMPACT ANALYSIS

AZUSA ROCK REVISED CUP APPLICATION

CITY OF AZUSA, CALIFORNIA

Prepared by:

Giroux & Associates
1820 E. Garry St., #211
Santa Ana, California 92705

Prepared for:

Vulcan Materials Co.
3200 San Fernando Road
Los Angeles, CA 90065

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EXECUTIVE SUMMARY

The following discussion constitutes the project noise and vibration technical study for the proposed amendment to the existing Azusa Rock operation located at the northern terminus of Fish Canyon Road in the City of Azusa California. The project proposes to amend the existing conditional use permit to allow for shifting of mining operations into an 80-acre parcel west of the current mining operations. In turn, mining operations on the easternmost portion of the 270 total acre parcel will cease and the reclamation plan for that portion of the parcel will be implemented.

Since the Azusa Rock operation is an existing, permitted quarry, the focus of this noise analysis is on the net difference between the noise conditions resulting from the presently approved project and those that would exist under the proposed project. This includes the potential noise and vibration impacts that would derive from a gradual westward shift of mining and of blasting required to fracture the hard rock found in the formation. However, it does not include an analysis of noise associated with existing equipment and operations that will carry over into the new project, as these are considered part of the baseline noise conditions.

Although future operations will continue to remain shielded by an intervening terrain ridge from the nearest homes on Brookridge Road in adjacent Duarte, the closest point of possible site mining operations will decrease from a present 2,500 feet to a point 2,250 feet from the nearest homes. However, the proposed westward shift in mining operations will not create noise or vibration effects that would exceed adopted significance thresholds or cause a substantially noticeable difference than the effects that will occur under the existing plan for the closest receptors.

Noise Scales and Definitions

Sound is technically described in terms of the loudness (amplitude) of the sound and frequency (pitch) of the sound. The standard unit of measurement of the loudness of sound is the decibel (dB). Since the human ear is not equally sensitive to sound at all frequencies, special frequency-dependent rating scales have been devised to relate noise to human sensitivity. The A-weighted decibel scale dB(A) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. Any further reference to decibels in this report written as “dB” should be understood to be A-weighted.

Decibels are based on the logarithmic scale. The logarithmic scale compresses the wide range in sound pressure levels to a more usable range of numbers in a manner similar to the Richter scale used to measure earthquakes. In general, a 1 dB change in the sound pressure levels of a given sound is detectable only under laboratory conditions. A 3-dB change in sound pressure level is considered a "just detectable" difference in most situations. A 5-dB change is readily noticeable by most people and a 10 dB change is considered a doubling (or halving) of the subjective loudness. It should be noted that, generally speaking, a 3 dB increase or decrease in the average traffic noise level is realized by a doubling or halving of the traffic volume. Because few projects individually cause a doubling of traffic volumes on already heavily traveled roadways, most traffic noise impacts tend to be cumulative in nature.

In terms of human response to noise, a sound 10 dB higher than another is judged to be twice as loud; 20 dB higher four times as loud; and so forth. Everyday sounds normally range from 30 dB (very quiet) to 100 dB (very loud). Examples of various sound levels in different environments are shown in Table 1, Sound Levels and Human Response.

There are three general methods used to measure sound over a period of time: the Community Noise Equivalent Level (CNEL), the equivalent energy level (Leq), and the Day/Night Average Sound Level (Ldn).

CNEL: The predominant community noise rating scale used in California for land use compatibility assessment is the Community Noise Equivalent Level (CNEL). The CNEL reading represents the average of 24-hourly reading of equivalent levels, known as LEQ's, based on an A-weighted decibel with upward adjustments added to account for increased noise sensitivity in the evening and night periods. These adjustments are +5 dB for the evening (7:00 p.m. to 10:00 p.m.), and +10 dB for the night (10:00 p.m. to 7:00 a.m.). CNEL may be indicated by "dB CNEL" or just "CNEL."

Leq: The Leq is the sound level containing the same steady-state total energy over a given sample time period as a continuously varying ambient level. The Leq can be thought of as the steady (average) sound level which, in a stated period of time, would contain the same acoustic energy as the time-varying sound level during the same period. Leq is typically computed over 1-, 8- and 24-hour sample periods.

Ldn: Another commonly used method is the day/night average level or Ldn. The Ldn is a measure of the 24-hour average noise level at a given location. It was adopted by the United States Environmental Protection Agency (EPA) for developing criteria for the evaluation of community noise exposure. It is based on a measure of the average noise level over a given time period called the Leq. The Ldn is calculated by averaging the Leq's for each hour of the day at a given location after penalizing the "sleeping hours" (defined as 10:00 p.m. to 7:00 a.m.), by 10 dB to account for the increased sensitivity of people to noises that occur at night. In most applications, CNEL and Ldn are generally indistinguishable. The maximum noise level recorded during a noise event is typically expressed as Lmax. The sound level exceeded over a specified time frame can be expressed as Ln (i.e., L_{90}, L_{50}, L_{10}, etc.). L_{50} equals the level exceeded 50 percent of the time.

Table 1

Sound Levels and Human Response

Noise Source	**Noise Level dB(A)**	**Response**
	150	
Carrier Jet Operation	140	Harmfully Loud
	130	Pain Threshold
Jet Takeoff (200ft.) Discotheque	120	
Unmuffled Motorcycle Auto Horn (3 ft.) Rock'n Roll Band Riveting Machine	110	Maximum Vocal Effort Physical Discomfort
Loud Power Mower Jet Takeoff (2,000 ft) Garbage Truck	100	Very Annoying Hearing Damage (Steady 8-Hour Exposure)
Heavy Truck (50 ft.) Pneumatic Drill (50 ft.)	90	
Alarm Clock Freight Train (50 ft.) Vacuum Cleaner (10 ft.)	80	Annoying
Freeway Traffic (50 ft.)	70	Telephone Use Difficult
Dishwashers Air Conditioning Units (20 ft.)	60	Intrusive
Light Auto Traffic (100 ft.)	50	Quiet
Living Room Bedroom	40	
Library Soft Whisper (15 ft.)	30	Very Quiet
Broadcasting Studio	20	Just Audible
	10	Threshold of Hearing

Source: Melville C. Branch and R. Dale Beland, Outdoor Noise in the Metropolitan Environment, 1970 (p.2).

Noise Standards

State of California Guidelines: The State of California has established guidelines for acceptable community noise levels that are based on the CNEL rating scale. The guidelines rank noise land use compatibility in terms of "normally acceptable", "conditionally acceptable", and "clearly unacceptable" noise levels for various land use types. As shown in Table 2, Land Use Compatibility for Community Noise Exposure, single-family homes are "normally acceptable" in exterior noise environments up to 60 CNEL and "conditionally acceptable" up to 70 CNEL based on this scale. Multiple family residential uses are "normally acceptable" up to 65 CNEL and "conditionally acceptable" up to 70 CNEL. Schools, libraries and churches are "normally acceptable" up to 70 CNEL, as are office buildings and business, commercial and professional uses. Industrial, manufacturing, and utilities are “normally acceptable” up to 75 CNEL.

CNEL or Ldn-based standards are designed to insure land use compatibility with the acoustic environment for those noise sources pre-empted from local control. Such sources are mainly mobile sources such as cars, trucks, airplanes, trains, etc. Because local jurisdictions cannot regulate the noise strength of the source, they control the pattern of land use exposed to such sources. “Stationary” sources such as mining operations are amenable to control of the source itself rather than through general plan siting considerations.

The City of Azusa Noise Control regulation is articulated in Chapter 46-403 of the Municipal Code. The code sets a daytime standard of 65 dB at any residential property line for single impulsive sources such as a blasting boom. The nocturnal standard is more stringent, but there are nocturnal blasting events conducted at the site. The City of Duarte noise standard is 70 dB for any noise event lasting less than one minute in duration. Because the City of Azusa standard is more stringent, and because the subject property is in Azusa, the more stringent standard will be applied as a threshold of significance.

Table 2

Azusa Land Use Compatibility Guidelines for Exterior Community Noise

Land Use	Community Noise Exposure CNEL, dB			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Single Family, Multi-Family Homes, Duplex	50-60	60-70	70-75	Above 75
Mobile Homes	50-60	60-65	65-75	Above 75
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-60	60-65	65-75	Above 75
Transient Lodging: Motels, Hotels	50-60	60-70	70-80	Above 80
Auditoriums, Concert Halls, Amphitheaters, Meeting Halls	-	50-60	60-70	Above 70
Sports Arena, Outdoor Spectator Sports, Amusement Parks	50-65	65-75	-	Above 75
Playgrounds, Neighborhood Parks	50-60	60-65	65-70	Above 70
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-65	65-70	Above 70	-
Office Buildings, Business and Professional	50-60	60-70	Above 75	-
Commercial Retail, Banks, Restaurants, Theaters	50-65	65-75	75-80	-
Industrial, Manufacturing, Utilities	50-65	65-80	-	-

Normally Acceptable: Specified land use is satisfactory based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable: New construction or development should generally not be undertaken.

Source: Azusa General Plan Noise Element

Vibration Standards

Vibration may be described in terms of the physical motion of a vibrating object (displacement), the speed of motion (velocity), or the rate of change from negative to positive motion (acceleration). Velocity can be described in terms of the average amount of sway (the "root mean squared" or r.m.s. velocity), or the maximum velocity during a single oscillation. The peak particle velocity (PPV) in inches per second (ips) is the descriptor used in this discussion because it is most closely related to any possibility of structural damage. Table 3 shows some typical PPV's associated with earth disturbance activities and the human reaction to such vibration. Human perception is seen to be relatively pronounced before any structural damage is observed.

The Cities of Azusa and Duarte have no vibration performance standards in their municipal codes. For mining operations, the U. S. Department of the Interior has adopted a PPV standard of 1.0 ips for any home, school, church, etc. within a range of 300 to 5,000 feet from the blast site. Although such a level of vibration generally creates no perceptible structural damage, it is unsettling to people when in direct contact with the ground (carpet and building framework effectively attenuates ground vibration). Therefore, a more conservative threshold of significance of 0.20 ips for any single event is used in this analysis. This is five times more stringent than the USDI standard. Such an event may be noticeable when standing on a slab or other hard surface, but would not be noticeable on carpet or other cushioned floor covering.

TABLE 3

VIBRATION COMPARISONS

Peak Ground Velocity (inches/sec.)	Construction Sources	Structural Damage	Human Perception
0.01	Jackhammer @ 50 feet	None	Barely Noticeable
0.03	Truck or Dozer @ 50 feet	None	Easily Noticeable
0.10	---	Normally None	Strongly Noticeable
0.50	Pile Driver @ 50 feet	Loose Items Shift	Unpleasant
1.0	---	Limited Damage	Very Unpleasant
3.0	Blasting @ 50 feet	Limited Damage	Extremely Unpleasant
5.0	---	Minor Damage	Intolerable
10.0	---	Structural Damage	Intolerable

PROJECT IMPACTS

IMPACT SIGNIFICANCE CRITERIA (THRESHOLDS OF SIGNIFICANCE)

The City of Azusa noise standard of 65 dB for a single event is the applicable standard for project-related noise impacts. For vibration associated with blasting events, a threshold of 0.20 ips is used as the standard of significance in this analysis.

ANALYSIS APPROACH

Noise data from a major production blast (a peak charge event) was obtained at a distance of 2,000 feet between the blast site and the noise meter for a direct line of sight condition (no intervening terrain). That reading was adjusted for distance and with terrain obstruction to simulate the maximum plausible noise for the existing site configuration and for the proposed western mining activities.

Blasting vibrations were measured in terms of the peak particle velocity for existing blasting events by an independent contractor at three locations on the project site. Fortunately, one monitoring location is typically at 2,700 feet from the blast to reasonably simulate the maximum plausible vibration exposure at the closest residence for the current mining plan. Another vibration monitoring station averages around 2200 feet from the blast site which is an excellent representation of the vibration effects if future blasting were to occur near the southwestern corner of the proposed mining area.

NOISE IMPACTS

Two noise meters operating in the "Lmax" mode were used to measure the A-weighted noise boom during a heavy charge rock production blast. Both meters recorded 66 dBA at 2,000 feet under direct line of sight conditions. Had that event occurred as close as possible to the closest homes in Duarte, the following noise levels would likely have been observed:

Existing mining plan = 66 dB - 2 dB distance adj. - 5 dB terrain screen = 59 dB Lmax

Prop. mining plan = 66 dB - 1 dB distance adj. - 4 dB terrain screen = 61 dB Lmax

Maximum noise levels will be 4 dB below the City of Azusa's standard of 65 dB, and 9 dB below the City of Duarte's standard of 70 dB for peak single events. Furthermore, the net difference between the existing and proposed noise levels at the nearest receptors will be approximately + 2 dB. The threshold of human perception of noise level differences under ambient conditions is around 3 dB. Therefore, maximum noise levels associated with peak blasting event will not be perceptibly different for either scenario. In addition, the change in mining operations to create micro-benches that require smaller charges may more than off-set the small increase in blasting noise associated with the proposed western mining activities.

VIBRATION IMPACTS

Eleven blast events were monitored to establish vibration levels as a function of ground-borne propagation distance. The measured peak particle velocities for these events at two locations that best simulate possible residential exposure were as follows:

Peak Particle Velocity	**2700' to Blast Site**	**2200' to Blast Site**
Non-detectable	6	2
0.005 inch/second	2	1
0.010 inch/second	3	6
0.015 inch/second	0	2
11-test average	0.005 inch/sec	0.009 inch/second

Neither the peak measured event, nor the 11-blast average, created vibration levels that would exceed the adopted significance threshold of 0.20 ips at the closest Duarte home if the 2200-foot measurement is representative of the maximum plausible future vibration exposure. As noted under airborne noise, the reduction in charge size for the planned micro-benching mining procedures compared to current large bench production methods may more than compensate for any possible vibration increase associated with distance encroachment.

CONCLUSION

In examining the net difference between the noise and vibration conditions that would result from the existing approved Azusa Rock operations and those that would occur as a result of the proposed project, it is concluded that the proposed westward shift in mining operations will not create noise or vibration effects that would exceed adopted significance thresholds or cause a substantially noticeable difference than the effects that will occur under the existing plan for those operations closest to the receptors. Though the proposed project will move operations approximately 250 feet closer to the nearest receptors, maximum airborne noise levels will be 4 dB below the City of Azusa's standard of 65 dB, and 9 dB below the City of Duarte's standard of 70 dB for peak single events. Furthermore, the net difference between the existing and proposed noise levels at the nearest receptors will be approximately + 2 dB, which is considered, which is considered less than significant. For ground vibrations, neither the peak measured event, nor an 11-blast average, created vibration levels that would exceed the adopted significance threshold of 0.20 ips at the closest homes. In addition, the reduction in charge size for the planned micro-benching mining procedures compared to current large bench production methods may more than compensate for any possible vibration increase associated with distance encroachment. Since no significant impacts have been identified, no mitigation measures are proposed.