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TOWN OF OSCEOLA

Polk County, Wisconsin

To: Plan Commission

From: Steve Stroshane, Chairman
George Kamperman, Kamperman Associates

Date: March 1, 2009

Re: Summary of Kamperman Report

The following summarizes the Kamperman Report submitted January 22, 2009 and the January 26, 2009 phone conversation with the Plan Commission. The summary was prepared by Steve Stroshane and reviewed by George Kamperman.

Operational Noise

1. Trucks climbing the quarry incline moving rock from quarry to crusher
2. Front end loader loading blasted rock into trucks
3. Rock crushing equipment including vibratory screens (note: this item usually receives the most complaints from nearby residents)

Blasting/Ground Vibration/Air Overpressure

1. Both ground vibration and air overpressure effects result from a blast
2. Without seismic monitoring equipment, it would be difficult to determine if it was either air overpressure or ground vibration affecting a house. Both affect the house in the same manner by causing a "House Rattle" (house rattle is not always present with a blast but when it is present the perceived annoyance is more than doubled).
3. Ground vibration decays faster than air overpressure with distance and would typically be the dominant blast impact at a house 1000 feet or less from a quarry blast site
4. Air overpressure blast impact may affect houses greater than ground borne vibration at distances of 1000 feet to 2000 feet from the quarry
5. The ground vibration limit is 0.5 inches/second is the limit without damage to drywall. Plaster walls are less resilient than drywall construction and are subject to damage from blast events of 0.5 inches/second.
6. The air overpressure limit is 133 dB with a level between 110 dB and 120 dB expected to cause a "House Rattle" that is perceived as annoying.
7. If the ground vibration is less than 0.1 inches/second and air overpressure is less than 110 dB, residents are not normally bothered by the event.
8. Residents north of the quarry are expected to experience air over pressure in excess of 110 dB and R2, R3, R4, R5, R7 will experience ground vibration greater than 0.1 inches/second.

Atmospheric Effects on Operation Noise

1. On summer evenings, a temperature inversion often occurs on clear nights and refracts sky borne sound back down to the earth.

2. Even with adequate noise mitigation during the day, in the evening any sounds from the quarry, traveling up are frequently refracted down outside of the noise mitigation boundaries (berms).

Noise Mitigation

1. Berms would only be useful if they were high enough to be above the line of sight between the noise source and second floor windows of any house.
2. Trees planted on berms would lessen the berms effectiveness as the noise would follow the tree up vertically and then the leaves would reflect the noise down, over the top of the berm.
3. A dense forest of trees would lessen sound
4. Piles of rock located around the rock crusher could reduce sound transmission but the effectiveness of obtaining 10 dB of sound reduction seems questionable. The ability to both maintain adequate pile height (to reduce the sound) and yet have adequate workspace would be challenging.
5. Once the quarry had a pit established, the walls would mitigate some of the sounds within the quarry but would not assist with lessening refracted rock crusher noise emanating during nighttime.

Noise Levels

1. It is your belief that that without the noise shielding of the stock piles, the sounds levels will be as follows:

Receptor	Kamperman (dBA)	Braslau With Assumed Noise Shield (dBA)	Noise (dBA) in Excess of IL Category 5
R1	53.1	42	18.1 – 23.1
R2	55.7	44	20.7 – 25.7
R4	58.4	48.5	23.4 – 28.4
R6	52.1	41	17.1 – 22.1
R15	46.2	35	11.2 – 16.2
R20	49.8	37	14.8 – 19.8

2. The Braslau calculations with noise shielding are only valid during daytime hours before the effect of a temperature inversion which reduces the effectiveness of the sound shields
3. Evening Legal Limits in Illinois are expressed in 9 octave frequency band limits that would be approximately 43 dBA as measured at the nearest property line. The limit was designed for the urban/suburban environment and too permissive for a rural development
4. The rural, environment from the Illinois standard would be Category 5 and estimated to be between 30 dBA to 35 dBA.
5. An example to put noise levels into real terms:
   - 60 dBA of noise is equivalent to a normal conversation 3 feet apart
   - 30 dBA of noise is equivalent to a normal conversation 95 feet apart over a flat sound reflecting surface such as a concrete road or water (normal hemispherical spreading and no atmospheric influence present)

Follow-up Questions

1. Can you determine how far north and south the overpressure, "house rattle" will be observed? Will we need to obtain that from Braslau or is 2000 feet per your report a typically valid assumption? (Note: Kamperman Response in italics).

   The field research paper you received on blast induced house rattle is: Schomer, P.D. & A. Averbuck. "Indoor Human Response to Blast Sounds that Generate Rattle. J Acoust. Soc. AM 86(2), August, 1989. This field study showed that house rattle was excited somewhere between 110 and 120 dB peak blast overpressure. The subjects in the test house were more than twice as annoyed by a blast that caused house rattle. The 24 November 2008 Memo from db Associates showed in Table 2 the Predicted Average Air Overpressure at ten home locations (R1 to R21). The average blast level ranges from 115 dB to 121 dB. (Double the distance of the homes from the blast wall for Table 2 then reduce all values 6 dB in Table 2)

   From the above paragraph one may expect house rattle with blasting ranging from Sometime to Most of the Time during blasting. The magnitude of the blast overpressure would be expected to decrease at least 6 dB for each doubling of distance between source and receiver. For a blast in the middle of a clear and calm day, an acoustic shadow zone would develop around the quarry adding excess sound attenuation to all sounds from the quarry. This is the preferred time of day to minimize blast noise impact on nearby residents. The most common, worst case for blast noise is 6 dB noise reduction per doubling of distance. On rare occasions there may be upper atmospheric sound refraction and focusing to cause house rattle at locations one or more miles away.