PRINCIPALS

Theodore A Barten, PE
Margaret B Briggs
Michael E Guski, CCM
Samuel G Mygatt, LLB
Dale T Raczynski, PE
Cindy Schlessinger
Lester B Smith, Jr
Victoria H Fletcher, RLA
Robert D O'Neal, CCM

ASSOCIATES

Andrew D. Magee
Michael D Howard, PWS
Laura E Rome

3 Clock Tower Place, Suite 250
Maynard, MA 01754
www.epsilonassociates.com
978 897 7100
FAX 978 897 0099

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Mr. Lee Ecker
Clough, Harbour, & Associates LLP
3 Winners Circle
Albany, NY 12205

Re: Rapp Road Landfill Expansion: Evaluation of Equipment Noise Mitigation

This letter describes discusses noise mitigation options for three pieces of large mobile equipment within the Rapp Road Landfill in Albany, NY. Sound level measurements for a bulldozer, excavator, and a compactor were conducted. The primary goal was to determine the frequency content for each machine, so as to determine the possible effectiveness of a retrofitted sound-suppression package. Modified sound levels were then calculated to reflect the attenuation provided by the package.

Equipment Measurements

The original DEIS sound levels are presented below in Table 1, showing three primary mobile machines of interest, a compactor (Caterpillar 836H), a bulldozer (Caterpillar D6R), and an excavator (Caterpillar 330C).

Table 1: DEIS Measured Operational Equipment Noise Levels

Equipment Type	Machine Make/Model	L_{eq} (dBA)
Compactor	Caterpillar 836H	82
Bulldozer	Caterpillar D6R	80
Excavator	Caterpillar 330C	73

Noise sources are often described in terms of octave or one-third octave band sound pressure levels, in dB, with the octave frequency bands being those established by standard (ANSI S1.11, 1986). The noise section of the landfill expansion DEIS listed measured overall A-weighted operational equipment noise levels, but no octave-band measurements were made. In the design of noise control treatments, it is often very useful to know something about the frequency spectrum of the source.

Epsilon measured the same three pieces of equipment, simultaneously collecting broadband (A-weighted) and one-third-octave band data (12.5 hertz to 20,000 hertz center frequencies). Sound levels were measured with a Norsonic Model Nor140 precision sound analyzer, equipped with a Norsonic-1209 Type 1 Preamplifier, a Norsonic-1225 half-inch microphone and a foam windscreen. The instrumentation meets the "Type 1 - Precision" requirements set forth in American National Standards Institute (ANSI) S1.4 for acoustical measuring devices. The microphone was tripod-mounted at a height of five feet above ground. Sound levels were measured from 50-feet away during non-operating hours for the landfill, so as to avoid contamination from competing noise sources. The compactor was measured at high idle but remained stationary. The bulldozer and excavator were measured while moving in a straight line (parallel to the microphone). The measured sound levels are shown in Table 2 (attached).

For the compactor, the overall A-weighted sound levels shown in Table 1 are considerably higher than those presented in Table 2 (L_{eq} is 82 dBA versus 70 dBA). Also, the bulldozer sound levels in Table 1 are slightly higher than in Table 2 (L_{eq} is 80 dBA versus 76 dBA). The sound levels for the excavator are practically identical. This suggests that the measured sound levels presented in the DEIS are likely worst case, particularly for the compactor and bulldozer. The operational conditions of a machine (idling versus moving, etc.) can significantly change the noise output. The Epsilon measurements for the compactor were taken at high idle and facing the engine, but the machine was stationary. The sound levels in the DEIS reflect a moving machine. The L_{eq} sound level of 82 dBA is more conservative, because the compactor will not be moving at all times during the day. Furthermore, the engine-end of the compactor (which emits most of the noise) will not always face the noise-sensitive receptors. The bulldozer and excavator were measured while the machines were moving, so the Table 1 and Table 2 sound levels do not differ as much.

Modified Sound Levels and Sound Suppression Package

When installed on the compactor or the bulldozer, the Caterpillar "Sound Suppression Package" provides 3-dB of sound level reduction at frequencies above 300 hertz. For noise-modeling purposes, it is acceptable to subtract 3-dB from the measured frequency-band data for both the bulldozer and the compactor, but only within the 500 through 16,000-hertz octave bands. Modified sound levels reflecting the contribution of the sound suppression package were calculated using the measured octave-band data. 3 decibels were subtracted to sound levels in the 500-hertz through 16,000-hertz octave bands. The sound levels for the compactor and bulldozer were then increased by 12 decibels and 4 decibels within all octave bands, respectively, so that the sound levels would reflect worst-case operating conditions. This is a very conservative assumption.

Table 3 (attached) presents the overall A-weighted and octave-band sound levels for each piece of equipment, at a distance of 50 feet away. The excavator sound level did not change, but the resulting sound level is 80 dBA for the compactor and 78 dBA for the bulldozer. The bulldozer and compactor sound levels decreased by 2 dBA, not 3-dBA, because the sound suppression package only applies to frequencies above 300 hertz. Overall A-weighted sound levels are calculated by accounting for sound levels at all frequencies.

The modified sound levels in Table 3 are conservative, because they reflect higher sound levels due to mobile operating conditions and worst-case orientation (i.e., with the compactor engine directly facing noise-sensitive receptors). Actual operating conditions will likely result in lower sound levels at the receptor locations. This is because the machines will often be stationary (at idle), and the engines will not always point towards the noise-sensitive receptors.

If you have any questions about this letter, please call me at (978) 461-6265.

Sincerely,
EPSILON ASSOCIATES, Inc.

Damien Bell

Damien Bell
Project Engineer

Table 2 Measured Sound Pressure Levels at 50 Feet, August 27, 2008

Equipment	Sound Pressure Level (dBA) (L_{eq})	L_{max} Level (dBA)	Sound Pressure Level per Octave-Band Center Frequency (Hz)									
			31.5 L_{eq} (dB)	63 L_{eq} (dB)	125 L_{eq} (dB)	250 L_{eq} (dB)	500 L_{eq} (dB)	1k L_{eq} (dB)	2k L_{eq} (dB)	4k L_{eq} (dB)	8k L_{eq} (dB)	16k L_{eq} (dB)
CAT 836H Compactor	70	71	68	67	73	65	68	66	62	54	48	36
CAT D6R Bulldozer	76	81	66	73	80	76	74	71	67	64	59	50
CAT 330C Excavator	74	78	66	80	76	71	69	71	61	57	57	50

Table 3 Modified Sound Levels at 50 Feet

Equipment	Sound Pressure Level (dBA) (L_{eq})	Sound Pressure Level per Octave-Band Center Frequency (Hz)									
		31.5 L_{eq} (dB)	63 L_{eq} (dB)	125 L_{eq} (dB)	250 L_{eq} (dB)	500 L_{eq} (dB)	1k L_{eq} (dB)	2k L_{eq} (dB)	4k L_{eq} (dB)	8k L_{eq} (dB)	16k L_{eq} (dB)
CAT 836H Compactor	80	80	79	85	77	77	75	71	63	57	45
CAT D6R Bulldozer	78	70	77	84	80	75	72	68	65	60	51
CAT 330C Excavator	74	66	80	76	71	69	71	61	57	57	50