

Acoustic Assessment

Of

Environment One 2000i Series Grinder Pumps

Prepared for: Peter Moseley
Service Manager - Australia
Environment One Corp

By: Tim Kuschel
M Des Sci (Audio), M.A.E.S., M.A.A.S
Acoustic Consultant
GUZ BOX design + audio

Date issued: 31 March 2006

GUZ BOX design + audio

PO Box 830, Wollongong NSW 2520

ABN 26 141 879 892

t: 02 4227 3040

w: www.guzbox.com.au

e: info@guzbox.com.au

GUZ BOX design + audio has been engaged by *Environment One* to provide an acoustic assessment of installed *Environment One 2000i Series Grinder Pumps*.

The scope of work for the acoustic assessment includes:

- Site investigation
- On-site noise assessment and acoustic measurement of installed pumps
- Analysis of data
- Preparation of report

1. On-site noise assessment

1.1. Description of pumps

The pumps subject to this acoustic assessment are *Environment One 2000i Series Grinder Pumps*. The pumps are installed in a variety of in-ground tanks and particularly used for the disposal of sanitary waste.

The pump unit is common to all *Environment One* installations and is installed in simplex and duplex configurations depending on the application, pumping requirements and size of in-ground tank. The tanks may be plastic or concrete depending on size. A steel lid is installed over the larger diameter tanks. A remotely located electronic switch panel controls the pump automatically.

1.2. Procedure

Several existing pump installations in Jamberoo NSW were measured to determine the total noise output above ambient noise in a typical installed setting.

Jamberoo is a small town south of Wollongong, located in a valley, surrounded by rural properties. Jamberoo is a quiet town, typically free from excessive traffic and environmental noise.

In each test location, a 15-minute acoustic measurement was first taken to determine the ambient noise level in the absence of pump noise.

A second 15-minute test was then taken with pump noise to measure the contribution of pump noise above the measured ambient noise levels.

The tanks were filled with water to provide maximum representation of as-installed applications. The acoustic tests to assess pump noise were carried out with pump unit emptying the tank of water for the duration of the test period.

The 0.6m and 0.9m diameter tanks emptied within 10 minutes, resulting in a shorter test period for these two installations.

Measurements were taken 1.0m from the edge of tank at a height of approximately 1.2m above ground level.

1.3. Equipment used for measurements

A Type 1 sound level meter was used to gather measurements during this site investigation.

Data Logging Integrating Sound Level Meter:

Brand: Bruel & Kjaer
Model: Type 2260 'Investigator'
Serial #: 2124596
Class 1 according to standard IEC 651

A wind shield was used during the measurement periods.

Height of SLM: Approx. 1.2m above ground level.

The Sound Level Meter provided frequency specific measurements and average background level measurements. These measurements were taken at each location and typically averaged over a 15-minute measurement period.

Measurements were carried out in accordance with Australian Standard AS 1055.1 1997 *Acoustics - Description and measurement of environmental noise - General procedures*

2. Results

2.1 General observations

Temperature: Varied during the measurement period 19-26°C

Wind: Typically nil to slight with clear skies

Short-term measurements typically of minimum 15-minute duration were taken at various times over the measurement period to provide representative sample measurements.

The maximum recorded levels throughout the short-term measurement periods typically remained constant. Bird calls in nearby trees during the acoustic testing contributed to the maximum level measurements. It is felt that the $L_{01, 15 \text{ minutes}}$ measurements present a more accurate indication of maximum levels occurring during the measurement periods.

Refer Appendix A for a summary of short-term measured results.

As experienced during the site investigation, the pump noise in each location was barely audible at the test measurement location. Slight vibrations could be felt through the ground near to each tank installation. Measurements were taken using the C-weighting to better determine the low-frequency components in the pump noise.

2.2 Assessment of noise

Figure 1 shows the measured results at Location 1, where two different pump installations were measured adjacent to a golf course and bowling green. The smaller 0.6m diameter simplex pump typically follows the measured ambient noise with maximum contribution above ambient of approximately 6dB. This pump installation was not audible at a distance of 5m.

The larger 1.5m duplex pump in this location provided higher noise readings as indicated in Figure 1. This larger pump unit provides larger pumping capacity and is typically installed in larger commercial developments. This pump was not audible at 5m and was barely audible when standing next to the installed unit.

Figure 2 shows the measured results at Location 2 of a 1.5m diameter simplex pump installed adjacent to an existing residential property. The low frequency rumbling of the pump was barely audible at 5m and was masked by nearby passing traffic. The pump noise was slightly more noticeable as the tank emptied. The measured results indicate the pump noise typically following the ambient noise measurements, with maximum contribution of approximately 6dB at very low frequencies and 10dB at 125Hz.

Figure 3 shows the measured results at Location 2 of a 0.9m diameter simplex pump installed approximately 8m from a residence. Once again the measured data indicates a peak at 125Hz and some low frequency contribution. The pump was barely audible at the measurement location. Beyond this distance it was very difficult to determine any audible contribution above the ambient noise.

Figure 4 shows the measured results of all pump noise measurements compared to the average background noise from all three ambient noise tests. It is interesting to note the peak at 125Hz from each of the simplex pump tests irrespective of tank size. This may be a resonance within the pump motor, which is masked in the duplex pump configuration. It is also interesting to note the peak at 80Hz common to both 1.5m tank diameter measurements. This is most likely due to physical resonance within the tank.

The acoustic measurements were taken at a distance of 1m from the noise source. Basic acoustic modelling predicts that the pump noise would fall below the measured ambient level at a distance of approximately 3m.

3. Summary

The noise produced by the *Environment One 2000i Series Grinder Pump* is insignificant and as experienced during the acoustic assessment, does not contribute any intrusive noise to the surrounding environment.

Minor vibrations may be felt when the pump is in operation up to several meters from the installed pit and will be dependant on installation detailing and density of adjacent ground materials.

The *Environment One 2000i Series Grinder Pump* would be suitable for installation in critical noise sensitive applications.

4. Definitions:

dB Abbreviation for decibel - a unit of sound measurement.

dB(A) Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound level measurement to approximate the response of the human ear.

dB(C) Unit used to measure 'C-weighted' sound pressure levels. C-weighting is an adjustment made to sound level measurement to approximate the response of the human ear at louder volume levels and is more sensitive to lower frequencies.

L₀₁ The A-weighted sound pressure level which is exceeded 1 per cent of the time over which a given sound is measured.

L₁₀ The A-weighted sound pressure level which is exceeded 10 per cent of the time over which a given sound is measured.

L₉₀ The A-weighted sound pressure level which is exceeded 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise.

L_{Aeq} The equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

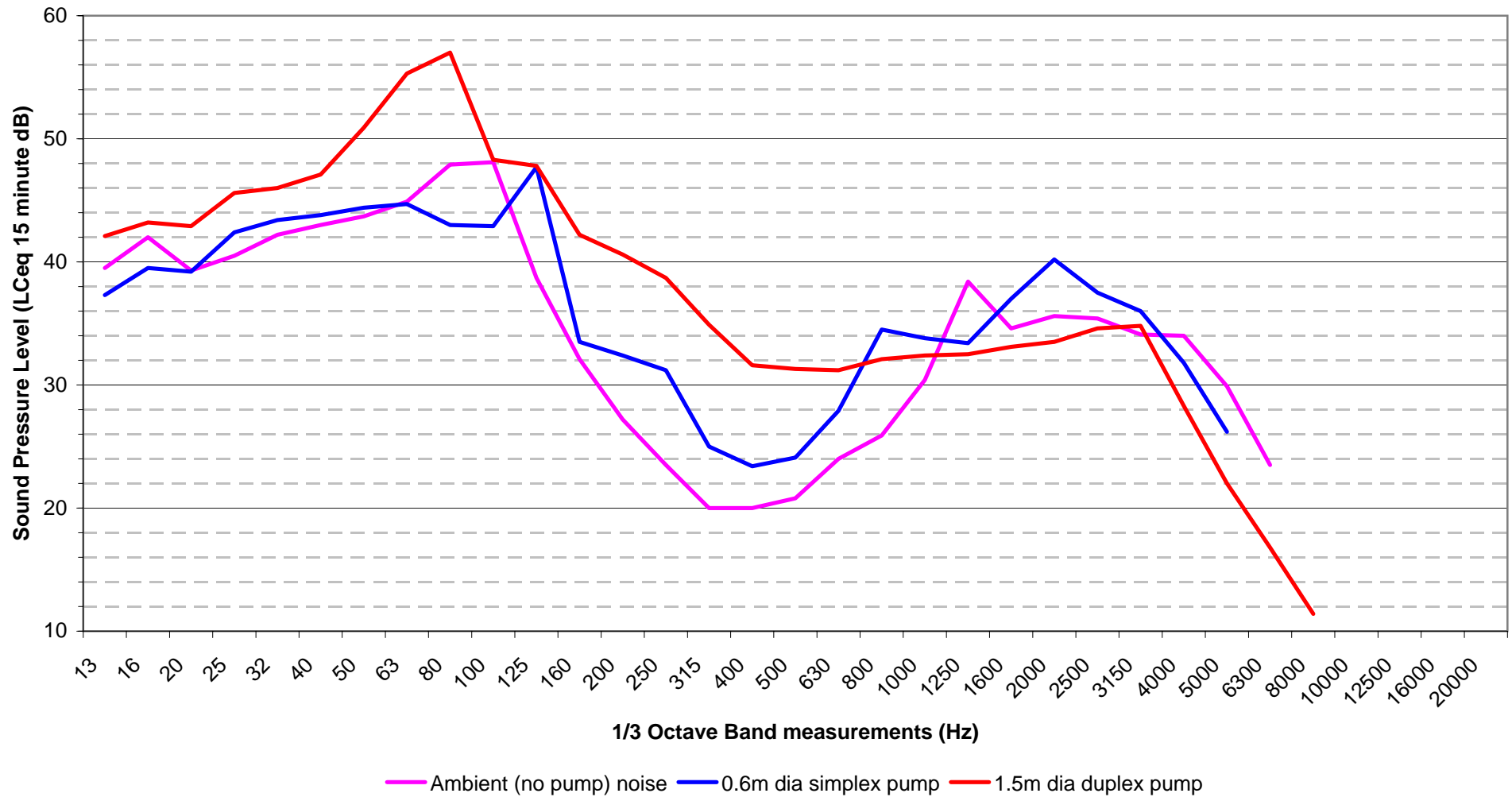
5. References

1. Australian Standard AS 1055.1 1997 "Acoustics - Description and measurement of environmental noise - General procedures"

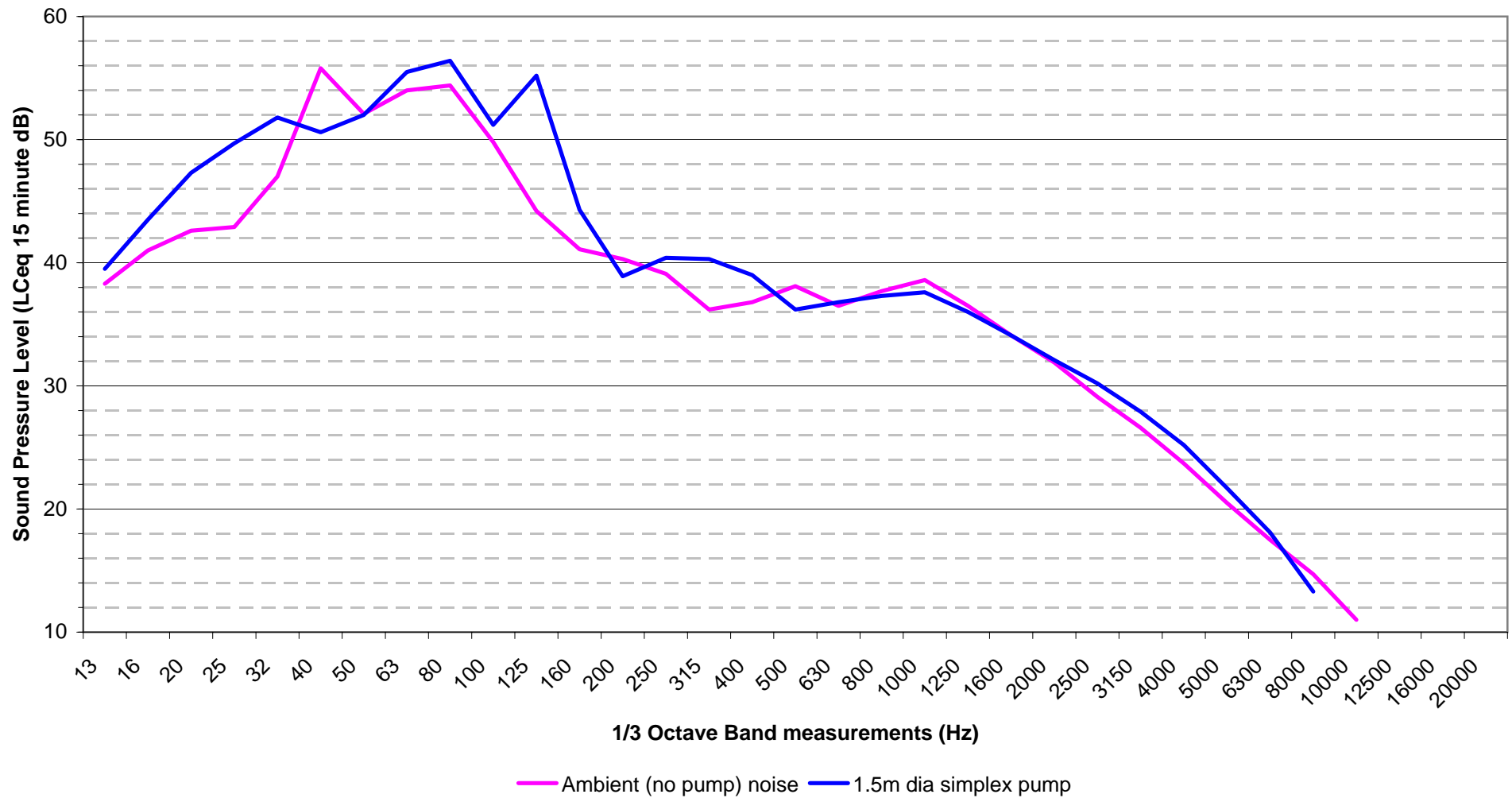
Appendix A: Short-term measured results

<i>Measurement Summary</i>								
<i>Value</i>	<i>P01 Location1 Ambient</i>	<i>P02 600 dia Simplex Pump</i>	<i>P03 1.5m dia Duplex Pump</i>	<i>P04 Location2 Ambient</i>	<i>P05 1.5m dia Simplex Pump</i>	<i>P06 Location3 Ambient</i>	<i>P07 0.9m dia Simplex Pump</i>	
<i>Time</i>	15:41 min	10:00 min	16:02 min	15:01 min	15:05 min	15:12min	10:26 min	
<i>LA_{max}</i>	73.5	71.4	67.1	66.1	69.6	67.2	64.4	
<i>LA₀₁</i>	57.6	57.8	53.2	55.2	57.4	55.4	51.4	
<i>LA₁₀</i>	43.8	48.6	47	50.2	49.4	46.2	46.8	
<i>LA_{eq}</i>	45.4	46.8	45.1	46.1	47	45	45.1	
<i>LA₉₀</i>	32.4	38.4	40.4	37.8	37.6	37.8	41.6	
<i>Measurement Data LC_{eq} 15 minute dB</i>								
<i>1/3 Octave Measurements (Hz)</i>	12.5	39.53	37.27	42.08	38.31	39.51	40.35	46.35
	16	41.98	39.53	43.16	41.01	43.52	41.03	46.53
	20	39.33	39.16	42.87	42.57	47.31	40.74	45.51
	25	40.54	42.41	45.55	42.88	49.69	42.72	47.63
	31.5	42.19	43.37	45.99	47.01	51.82	43.12	46.14
	40	42.97	43.76	47.11	55.79	50.62	43.04	45.28
	50	43.73	44.35	50.85	52.14	51.95	45.83	50
	63	44.87	44.66	55.28	53.96	55.52	44.49	47.23
	80	47.86	42.97	57.04	54.43	56.38	46.76	46.79
	100	48.13	42.93	48.28	49.83	51.17	46.67	45.89
	125	38.74	47.71	47.82	44.23	55.18	41.39	51.32
	160	32.13	39.45	42.21	41.11	44.29	38.45	44.51
	200	27.24	32.40	40.61	40.26	38.9	33.14	37.13
	250	23.46	31.23	38.66	39.08	40.43	30.85	34.32
	315	---	24.98	34.94	36.19	40.34	29.99	35.29
	400	---	23.39	31.56	36.79	39.03	30.08	30.63
	500	20.83	24.08	31.34	38.13	36.19	32.01	32.27
	630	24.02	27.88	31.19	36.51	36.84	34.22	33.06
	800	25.86	34.53	32.08	37.68	37.29	33.08	33.82
	1000	30.39	33.76	32.42	38.59	37.64	33.49	36.26
	1250	38.42	33.42	32.49	36.5	35.97	33.74	35.51
1600	34.58	36.99	33.11	34.08	34.06	33.91	32.37	
2000	35.58	40.17	33.48	31.88	32.13	33.11	35.1	
2500	35.42	37.53	34.56	29.1	30.16	33.3	30.86	
3150	34.14	36	34.82	26.62	27.9	36.26	29.57	
4000	33.99	31.77	28.27	23.73	25.15	32.18	29	
5000	29.87	26.15	22.04	20.48	21.73	29.68	27.36	
6300	23.5	---	16.84	17.53	18.13	27.38	25.77	
8000	---	---	11.42	14.72	13.33	22.29	23.44	
10000	---	---	---	10.98	---	16.19	19.86	
12500	---	---	---	---	---	---	15.11	
16000	---	---	---	---	---	---	---	
20000	---	---	---	---	---	---	---	

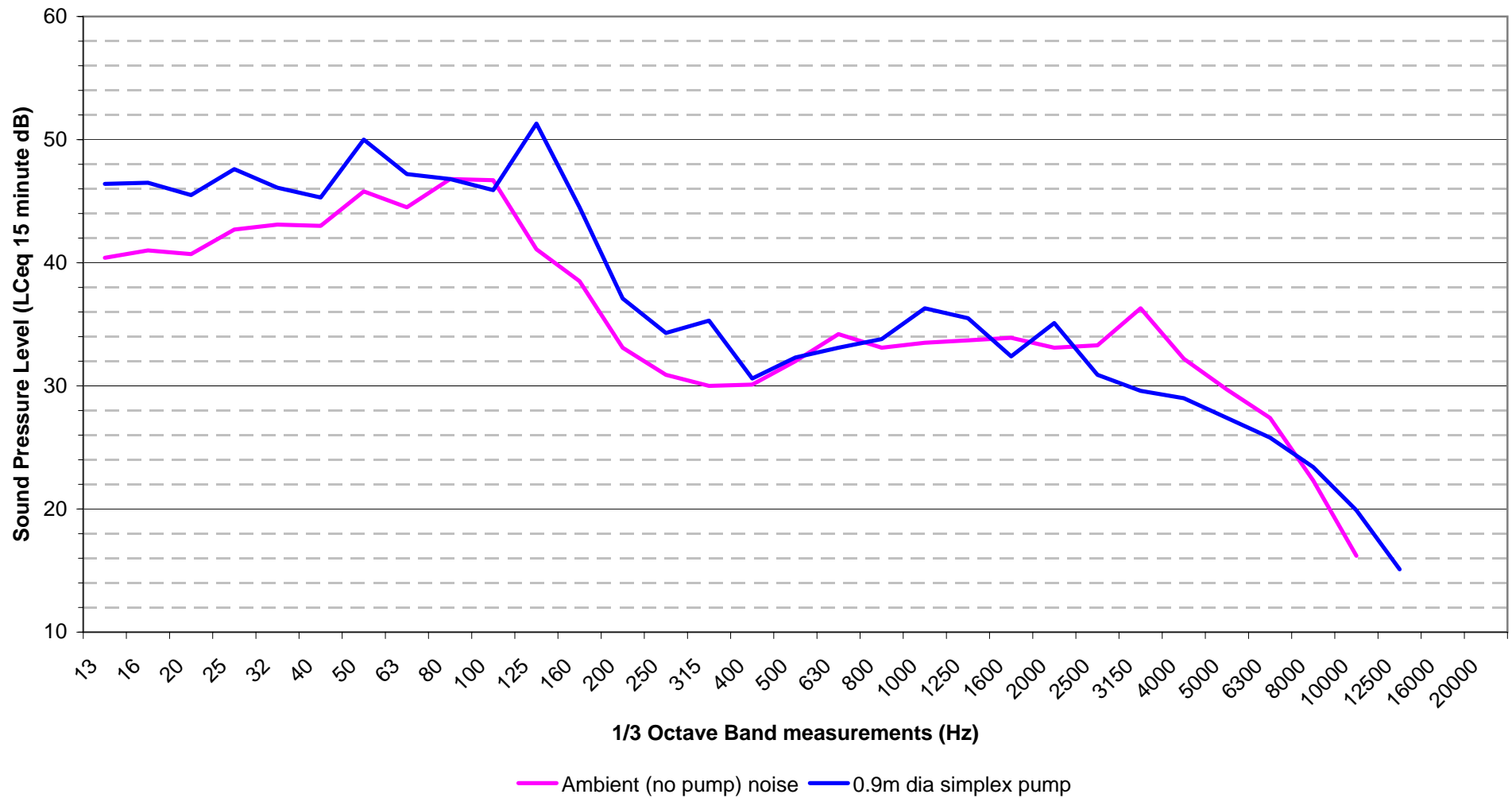
**Environment One: 2000i Series
Grinder Pump Noise Assessment: Location 1**



Environment One: 2000i Series Grinder Pump Noise Assessment: Location 2



**Environment One: 2000i Series
Grinder Pump Noise Assessment: Location 3**



Environment One: 2000i Series Grinder Pump Noise Assessment: Summary

