August 10, 2023

Mr. Dan McDevitt
Endurant Energy
150 N. Michigan Avenue
Suite 150
Chicago, IL 60601

SUBJECT: Environmental Sound Evaluation
Taylor and Fenn BESS Facility
Windsor, CT

Dear Mr. McDevitt,

Cavanaugh Tocci Associates has evaluated the environmental sound impact associated with the proposed Battery Energy Storage System (BESS) at 22 Deerfield Road in Windsor, Connecticut. The objectives of this evaluation were:

- To define acoustic design goals based on applicable noise regulations,
- To estimate and evaluate the acoustic impact of the proposed project in the surrounding community.

Results of the evaluation are summarized herein. Appendix A of this report is a glossary of relevant acoustic terminology.

Environmental Noise Regulations

To the best of our knowledge, state and local noise regulations apply to sound produced by the proposed project. A brief summary of these regulations follows:

State of Connecticut Noise Regulation

The State of Connecticut Noise Regulation (Section 22a-69-1 to 7.4) defines limits for environmental sound produced by this project. The sound level limits are based on both emitter and receptor land use classifications, and are listed below in Table 1:

TABLE 1
Connecticut Regulations for the Control of Noise Sound Level Limits (dBA)

	Receptor Class			
Emitter Class	**C**	**B**	**A/Day**	**A/Night**
C	70	66	61	51
B	62	62	55	45
A	62	55	55	45

Definitions

In the above table, day is defined as the time interval 7:00 a.m. to 10:00 p.m. Night is defined as the time interval 10:00 p.m. to 7:00 a.m. Noise Zone Classifications are based on the actual land use (not zoning). Where multiple land uses exist on the same property, the least restrictive limits apply.

A Class A noise zone is land generally designated for residential use or areas where serenity and tranquility are essential to the intended use.

A Class B noise zone includes land uses generally of a commercial nature.

A Class C noise zone includes uses generally of an industrial nature, including utilities.

Exceptions and Other Limit Provisions

Section 22a-69-3.3 Prominent Discrete Tones

To offset the undesirable nature of tonal sound in the environment, the regulation penalizes sources of prominent, audible discrete tones. If a facility produces such sounds, the applicable limits in Table 1 are reduced by 5 dBA. In its definitions (Section 22a-69-1.2), the regulation defines a method for identifying prominent discrete tones based on measuring one-third octave band sound levels.

Town of Windsor, CT Noise Ordinances

The Town of Windsor, CT Code of Ordinances addresses noise in Chapter 9, Article III. This article is modeled on the State regulation described above; in particular, specific sound level limits are identical. The article omits the tone requirement from the State regulation, and does not introduce any restrictions not covered by the State regulation.

Facility Acoustic Requirements

Our interpretation of the above referenced regulations follows:

- The State of Connecticut Noise Regulation is more restrictive than the Town of Windsor Nosie Ordinance. Accordingly, compliance with the state noise regulation will ensure compliance with the local regulation.
- The Taylor and Fenn property at 22 Deerfield Road is in an I zone (industrial district), and the current use is for manufacturing. Both the zoning and the use are consistent with a noise emitter classification of C.
- Abutting properties are industrial uses within the I zone.
- The nearest Residential Zone (R8) and use is to the south of Interstate 291 at a distance of approximately 650 feet.
- The facility may produce sound during daytime and nighttime hours. As such, where the regulations provide more stringent limits for nighttime operation, these will apply.

At the nearest residential property boundaries south of the project (Class A receptors), the most stringent nighttime limit for a Class C emitter is 51 dBA. At the nearest industrial land uses surrounding the project (Class C receptor) the limit is 70 dBA. If the sound produced by the facility is determined to produce a "prominent discrete tone" as defined by the state noise regulation these limits would be reduced by 5 dBA.

Facility Sound Analysis

Facility-related sound impacts that are associated with equipment at the proposed BESS facility have been calculated using CadnaA environmental sound modeling software (Version 2023 MR2 DataKustic GmbH). The CadnaA sound modeling software uses algorithms and procedures described in International Standard ISO 9613-2:1996 "Acoustics- Attenuation of sound during propagation outdoors – Part 2: General method of calculation". This standard and its associated methodology are the most universally accepted approach for environmental sound modeling of industrial and transit sound sources. The methodology described in this standard provides estimates of A-weighted sound levels for meteorological conditions that are favorable for the propagation of sound (downwind with a wind speed of 1-5 meters/sec). This methodology is also valid for sound propagation under well-developed moderate ground-based temperature profile inversions, which commonly occur on clear calm nights.

Our analysis considers the following sound sources:

1. ***Six Energy Storage Containers***

   Canadian Solar SolBank Energy Storage Systems with a maximum sound level of 68 dBA at a distance of 1 meter (based on manufacturer's test report dated 1/11/2023).

2. ***Six Inverters***

   EPC CAB 1000 1500 kVA inverters with a maximum sound level of 75 dBA at a distance of 1 meter (based on manufacturer's test report dated 11/24/2022).

3. ***Two Transformers***

   4000 kVA transformers with a maximum NEMA sound rating of 60 dBA.

Figure 1 presents the results of the acoustic modeling for proposed BESS facility. Table 2 below provides a summary of our estimates of facility A-weighted sound levels at relevant property boundaries. Figures 2 and 3 present 1/3 octave band spectra of the property line estimates. Our review of the spectra concludes that the proposed project will not produce "prominent discrete tones" (as defined by the state noise regulation) at any of the surrounding receptors.

TABLE 2
Estimate of Facility Sound Levels at Property Boundaries (dBA)

Receptor	BESS Sound	Produces Tone	Limit
I1	65	No	70
I2	44	No	70
R1	18	No	51
R2	29	No	51

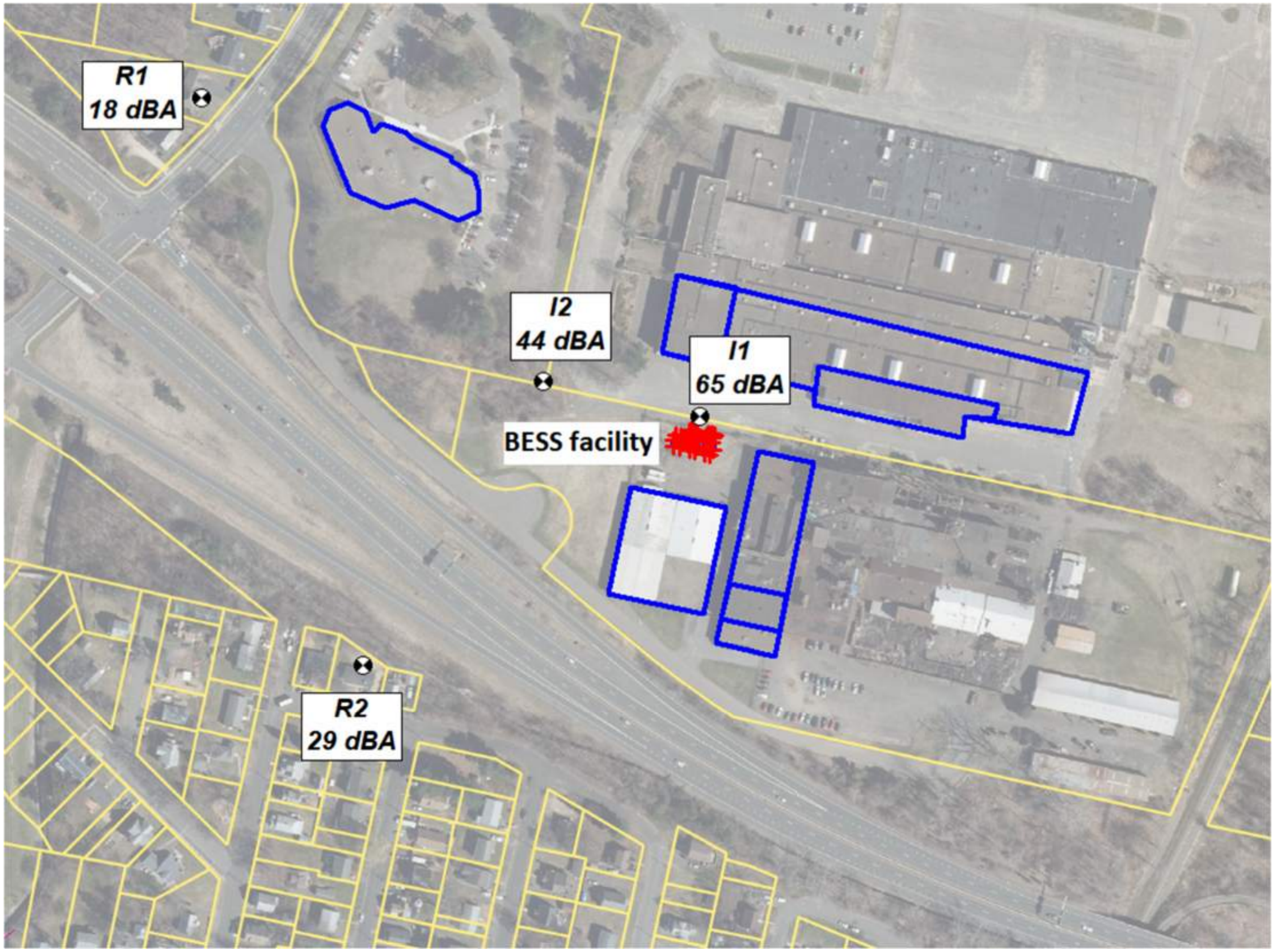
Conclusion

Based on our review of the data presented in Table 2, it is our professional opinion that sound produced by the proposed BESS project at 22 Deerfield Road in Windsor, Connecticut will comply with the most stringent requirements of the state and local noise regulations. Furthermore, sound emitted by the project will not produce a noticeable impact on the acoustic environment and will not have an unreasonable adverse effect at any surrounding properties.

Sincerely,
CAVANAUGH TOCCI

Douglas Bell

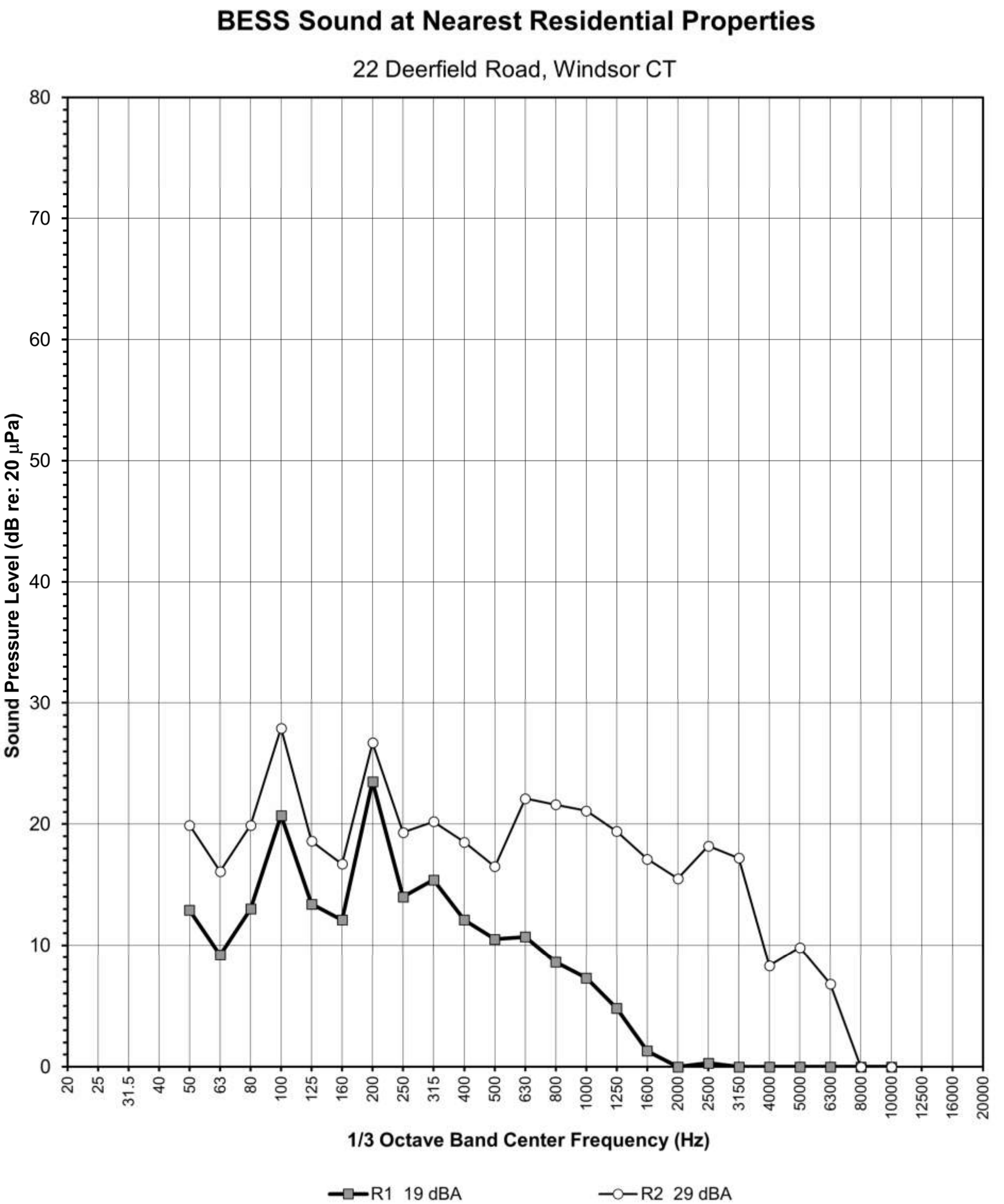
Douglas H. Bell
23164/Taylor and Fenn Windsor CT BESS Sound Evaluation.docx



Estimates of BESS Sound – at Nearby Properties

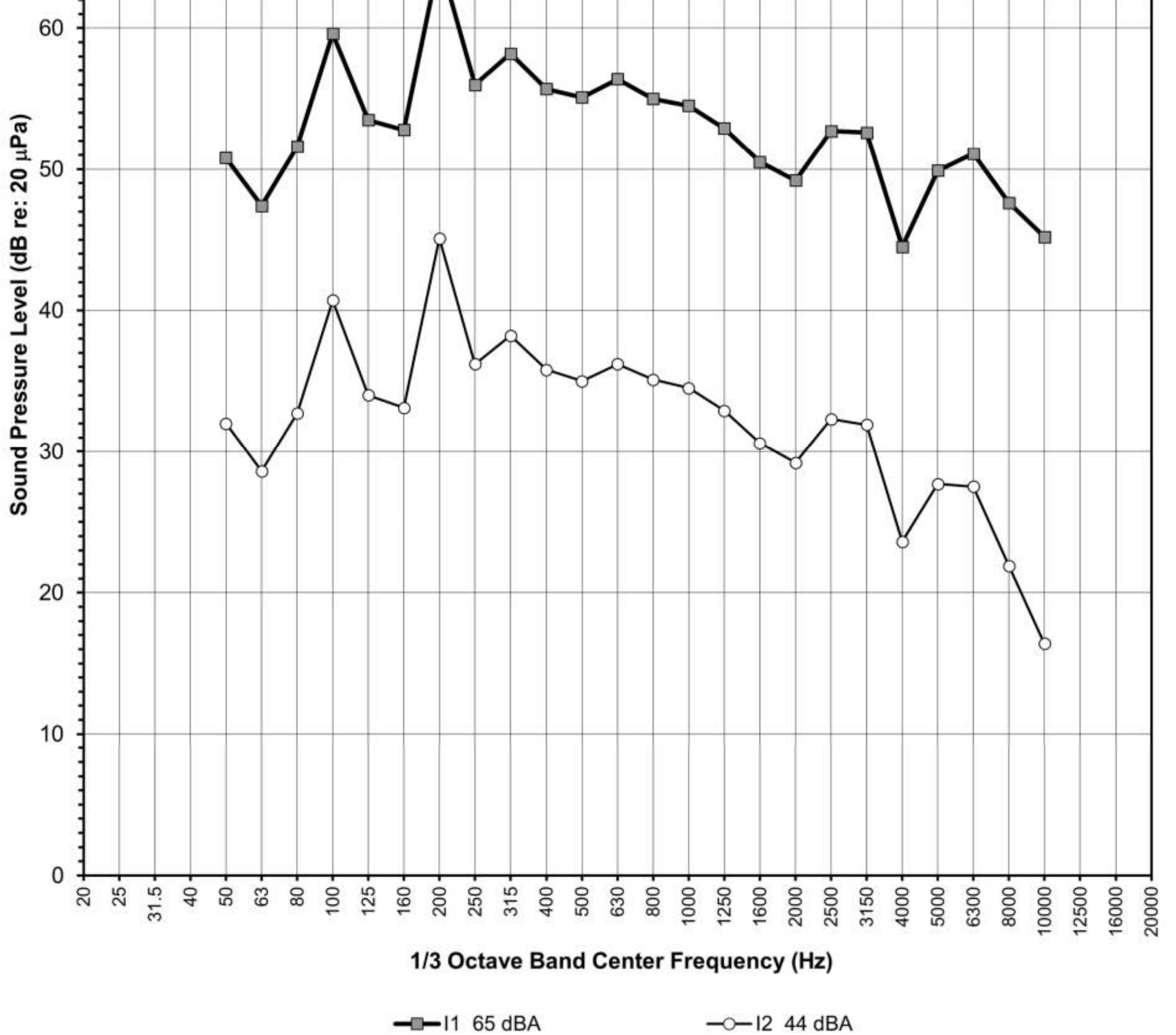
Figure 1

CAVANAUGHTOCCI



BESS Sound at Nearest Residential Properties
22 Deerfield Road, Windsor CT
Sound Pressure Level (dB re: 20 μPa)
80
70
60
50
40
30
20
10
0
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
1/3 Octave Band Center Frequency (Hz)
R1 19 dBA
R2 29 dBA

Figure 2



BESS Sound at Nearest Industrial Properties
22 Deerfield Road, Windsor CT
Sound Pressure Level (dB re: 20 µPa)
80
70
60
50
40
30
20
10
0
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
1/3 Octave Band Center Frequency (Hz)
I1 65 dBA
I2 44 dBA

Figure 3

Appendix A

Sound Measurement Terminology

SOUND MEASUREMENT TERMINOLOGY

In order to quantify the amplitude, frequency, and temporal characteristics of sound, various acoustical descriptors are used. The following is an introduction to acoustic terminology that is used in this report.

Sound Level

Sound levels are typically quantified using a logarithmic decibel (dB) scale. The use of a logarithmic scale helps to compress the wide range of human sensitivity to sound amplitude into a scale that ranges from approximately 0 to 180 dB. Note however, that the use of the logarithmic scale prevents simple arithmetic operations when combining the cumulative impact of sources. For example, two sources of equal sound level operated simultaneously results in a combined sound level that is only 3 dB higher than if only one source was operated alone. An important feature of the human perception of continuous sound is that an increase or decrease in sound pressure level by 3 dB or less is barely perceptible, and an increase or decrease by 10 dB is perceived as a doubling or halving of noise level.

A-weighting

Generally, the sensitivity of human hearing is restricted to the frequency range of 20 Hz to 20,000 Hz. However, the human ear is most sensitive to sound in the 500 Hz to 5,000 Hz frequency range. Above and below this range, the ear becomes progressively less sensitive. To account for this feature of human hearing, sound level meters incorporate filtering of acoustic signals that corresponds to the varying sensitivity of the human ear to sound at different frequencies. This filtering is called A-weighting. Sound level measurements that are obtained using this filtering are referred to as A-weighted sound levels and are signified by the identifier, dBA. A-weighted sound levels are widely used for evaluating human exposure to environmental sounds. To help place A-weighted sound levels in perspective, Figure A-1 contains a scale showing typical sound levels for common interior and environmental sound sources.

Spectral Characteristics – Octave and 1/3 Octave Band Sound Levels

To characterize a sound, it is often necessary to evaluate the frequency distribution of the sound energy. As mentioned before, the frequencies of most interest where human exposure is concerned range between 20 Hz and 20,000 Hz. This frequency range is commonly divided into octave bands, where an octave band is a range of frequencies. Each octave band is referred to by its center frequency and has a bandwidth of one octave (a doubling of frequency). To cover the full range of human hearing, it is necessary to measure sound in 10 separate octave bands. Typically, the lowest frequency band measured has a center frequency of 31.5 Hz. The next frequency band has a center frequency of 63 Hz. This geometric series continues to the highest frequency band that has a center frequency of 16,000 Hz. A set of octave band sound levels to describe a particular sound is called an octave band spectrum. Covering the full range of hearing, an octave band spectrum would have 10 values, one for each band. Under certain circumstances, more frequency resolution in acoustical data is needed to identify the presence of tonal sounds. A 1/3 octave band spectrum uses filters that divide each octave band into 3 separate frequency bands. Note that octave band and 1/3 octave band sound levels are not usually A-weighted, with their units being dB.

Environmental Noise Descriptors

Sound levels in the environment are continuously fluctuating and it is difficult to quantify these time-varying levels with single number descriptors. Statistical approaches, which use *percentile sound levels* and *equivalent sound levels*, are often used to quantify the temporal characteristics of environmental sound.

Percentile sound levels (L_n) are the A-weighted sound levels that are exceeded for specific percentages of time within a noise measurement interval. For example if a measurement interval is one hour long, the 50th percentile sound level (L_{50}) is the A-weighted sound level that is exceeded for 30 minutes of that interval.

- L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. The 90th percentile sound level represents the nominally lowest level reached during the monitoring interval and is typically influenced by sound of relatively low level, but nearly constant duration, such as distant traffic or continuously operating industrial equipment. The L_{90} is often used in standards to quantify the existing background or residual sound level.

- L_{50} is the median sound level: the sound level in dBA exceeded 50 percent of the time during the measurement period.

- L_{10} is the sound level exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder noises like those from passing motor vehicles or aircraft.

By using percentile sound levels, it is possible to characterize the sound environment in terms of the steady-state background sound (L_{90}) and occasional transient sound (L_{10}).

The equivalent sound level (L_{eq}) is the energy average of the A weighted sound level for the measurement interval. Sounds of low level and long duration, as well as sounds of high level and short duration influence this sound level descriptor.

Noise levels at night generally produce greater annoyance than do the same levels which occur during the day. It is generally agreed that a given level of environmental noise during the day would appear to be 10 dBA louder at night – at least in terms of potential for causing community concern. The day night average sound level (Ldn) is a 24 hour average A-weighted sound level where a 10 dB "penalty" is applied to sound occurring between the hours of 10:00 p.m. and 7:00 a.m. The 10 dB penalty accounts for the heightened sensitivity of a community to noise occurring at night.

When a steady continuous sound is measured, the L_{10}, L_{50}, L_{90} and L_{eq} are all equal. For a constant sound level, such as from a power plant operating continuously for a 24-hour period, the L_{dn} is approximately 6 dBA higher than the directly measured sound level.

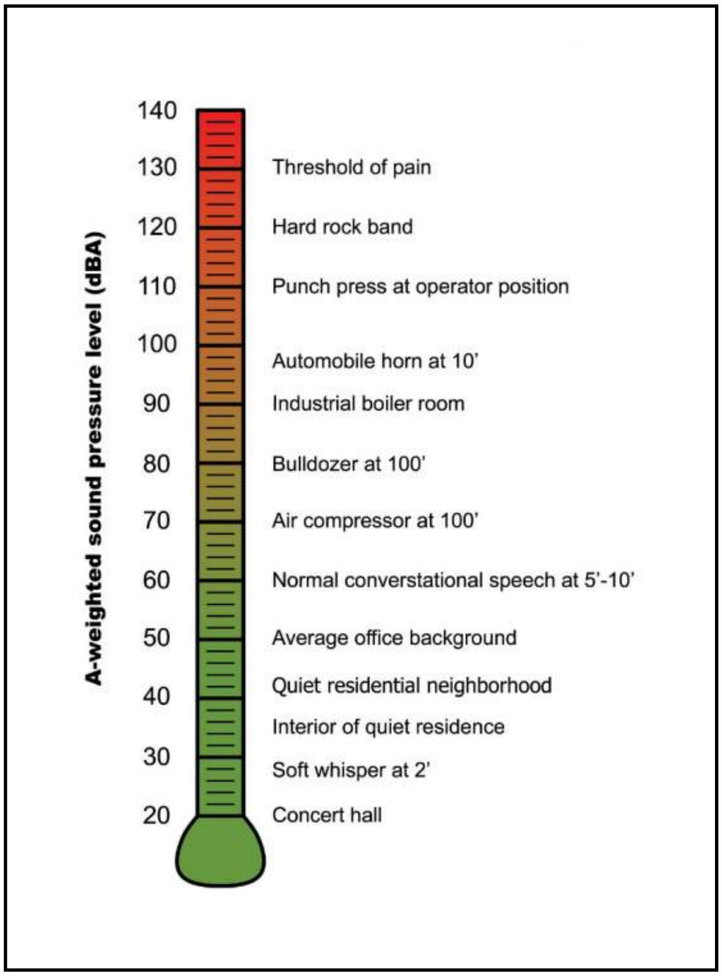


Figure A-1
Typical Sound Levels for Common Interior and Environmental Sources

Figure 3