

**ACOUSTICAL ANALYSIS**

**PRODUCERS DAIRY PARKING LOT  
450 EAST BELMONT AVENUE  
FRESNO, CALIFORNIA**

**WJVA Project No. 17-001**

**PREPARED FOR**

**SOAR ENVIRONMENTAL  
1401 FULTON STREET, SUITE 978  
FRESNO, CALIFORNIA 93721**

**PREPARED BY**

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## INTRODUCTION

The project is the proposed increase in daily operations and site expansion at an existing Producers Dairy Parking Lot facility, in Fresno California. Since the parking lot is located near existing residential land uses, the City of Fresno has requested that an acoustical analysis be prepared for the project. The findings of this analysis are based upon the project site plan dated November 14, 2016 (Jeff Cazaly Architect), operational information provided by the project applicant (Producers Dairy) and reference noise measurements obtained at the project site on January 23, 2017. Revisions to the site plan or proposed operational information may affect the findings and recommendations of this report. The Project Site Plan is provided as Figure 1.

Appendix A provides a description of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported are in A-weighted decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighting, as it provides a high degree of correlation with human annoyance and health effects.

## NOISE EXPOSURE CRITERIA

### **City of Fresno:**

The City of Fresno Noise Element of the General Plan (adopted 12/18/14) sets noise compatibility standards for transportation noise sources in terms of the Day-Night Average Level ( $L_{dn}$ ). The  $L_{dn}$  is the average equivalent sound level during a 24-hour day, obtained after the addition of ten decibels to sound levels that occur between the nighttime hours of 10:00 p.m. to 7:00 a.m. Implementing Policy NS-1-a of the noise element establishes a land use compatibility criteria as 65 dB  $L_{dn}$  for exterior noise levels in outdoor activity areas of new residential or transient lodging (hotel/motel) developments. Outdoor activity areas generally include backyards of single-family residences, individual patios or decks of multi-family developments and common outdoor recreation areas for multi-family developments and transient lodging facilities. The intent of the exterior noise level requirement is to provide an acceptable noise environment for outdoor activities and recreation

Additionally, Implementing Policy NS-1-h of the noise element requires that interior noise levels attributable to exterior transportation noise sources not exceed 45 dB  $L_{dn}$ . The intent of the interior noise level standard is to provide an acceptable noise environment for indoor communication and sleep.

Implementing Policy NS-1-I of the Noise Element establishes hourly noise level standards for non-transportation noise sources. The standards, provided in Table I, are made more restrictive during the nighttime hours of 10:00 p.m. to 7:00 a.m. Additionally, the noise element states that when ambient noise levels exceed or equal the levels described in Table I, mitigation shall only be required to limit noise to the existing ambient noise levels, plus five (5) dB. It should be noted,

vehicle movements off public roadways are considered a non-transportation noise source.

<p style="text-align: center;"><b>TABLE I</b></p> <p style="text-align: center;"><b>STATIONARY (NON-TRANSPORTATION) NOISE LEVEL STANDARDS, dBA</b></p> <p style="text-align: center;"><b>CITY OF FRESNO NOISE ELEMENT</b></p>			
Daytime (7 a.m.-10 p.m.)		Nighttime (10 p.m.-7 a.m.)	
$L_{eq}$	$L_{max}$	$L_{eq}$	$L_{max}$
50	70	45	60
Source: City of Fresno Noise Element of General Plan (adopted 12-18-14)			

Further, implementing Policy NS-1-j of the Noise Element states that a significant increase in ambient noise levels is assumed if the project would increase noise levels in the immediate vicinity by 3 dB  $L_{dn}$  or CNEL or more above the ambient noise limits established in this General Plan Update.

## VIBRATION

Section 15-2507 of the City of Fresno Municipal Code states that *no vibration shall be produced that is transmitted through the ground and is discernible without the aid of instruments by a reasonable person at the lot lines of the site. Vibrations from temporary construction, demolition, and vehicles that enter and leave the subject parcel (e.g., construction equipment, trains, trucks, etc.) are exempt from this standard.*

Some guidance regarding vibration levels associated with human annoyance as well damage potential is provided by the Caltrans Transportation and Construction Vibration Guidance Manual. The Manual provides guidance for determining annoyance potential criteria and damage potential threshold criteria. These criteria are provided below in Table II and Table III, and are presented in terms of peak particle velocity (PPV) in inches per second (in/sec).

<p style="text-align: center;"><b>TABLE II</b></p> <p style="text-align: center;"><b>GUIDELINE VIBRATION ANNOYANCE POTENTIAL CRITERIA</b></p>		
Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely Perceptible	0.04	0.01
Distinctly Perceptible	0.25	0.04
Strongly Perceptible	0.9	0.1
Severe	2.0	0.4
Source: Caltrans		

TABLE III		
GUIDELINE VIBRATION DAMAGE POTENTIAL THRESHOLD CRITERIA		
Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile, historic buildings, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5
Source: Caltrans		

## PROJECT-RELATED NOISE LEVELS

The project site is located at 450 E. Belmont Avenue within the City of Fresno. The project site is currently being utilized by the applicant as trailer parking lot. According to the applicant, approximately fifty (50) trucks access the site per day. Trailers are transported to and from the Producers Dairy facility located at 250 E. Belmont Avenue for storage at the project site.

The applicant proposes the demolition of two (2) existing on-site structures, the construction of new perimeter fencing as well as a 12-foot CMU sound wall along the southern project site boundary. The applicant proposes to increase average daily operations to approximately 70 trucks per day. Current operations typically occur between the general hours of sunrise to sunset. However, the applicant proposes 24-hour operations within the project site, if needed. Existing sources of noise near the project site include vehicular traffic on Belmont Avenue, Roosevelt Avenue and Ferger Avenue, aircraft overflights associated with Fresno Yosemite International Airport, noise associated with various near commercial activities as well as noise associated with existing project-site operations.

In addition to increased daily operations, the applicant would like to utilize idling refrigeration units on site, on an as needed basis. Currently trailers stored on site do not operate their idling refrigeration units.

It should be noted; the applicant has proposed the construction of a 12-foot CMU sound wall along the southern boundary of the project site. The proposed sound wall will extend toward the north to the project site access areas on both the west and east side of the project site. The proposed sound wall will reduce project-related noise levels at existing residential land uses near the project site.

WJV Acoustics (WJVA) staff conducted ambient and project-related noise monitoring within and near the project site on January 23, 2017. Noise monitoring equipment consisted of Larson-Davis Laboratories Model LDL 820 sound level analyzers equipped with Bruel & Kjaer (B&K) Type 4176

½" microphones. The monitors were calibrated with a B&K Type 4230 acoustical calibrator to ensure the accuracy of the measurements. The equipment complies with applicable specifications of the American National Standards Institute (ANSI) for Type 1 (precision) sound level meters.

Noise level measurements were conducted in the front of the residence located at 437 N. Roosevelt Avenue, the closest existing residential land use to the project site. Noise measurements were conducted while trucks entered and exited the project site. Additionally, a second sound level meter collected continuous ambient and project-related noise levels.

### **Truck Movements:**

Noise levels described below in this section do not consider noise level reduction provided by the proposed 12-foot CMU sound wall. The discussion of the sound wall and resulting noise level reduction is provided later in this report.

Between the hours of 12:00 p.m. and 1:00 p.m. no truck operations occurred within the project site. Between the hours of 1:00 p.m. and 2:00 p.m. WJVA staff measured a total of thirteen (13) individual project-related events. Events were considered to be trucks entering the site, exiting the site, or audible movements occurring within the site. Each individual truck accessing the site resulted in two (2) or three (3) individual events. The 13 measured events were associated with a total of five (5) trucks that accessed the site between 1:00 p.m. and 2:00 p.m.

The measured hourly  $L_{eq}$  for the hour of 12:00 p.m. to 1:00 p.m. was 58.3 dB. The measured hourly  $L_{eq}$  for the hour of 1:00 p.m. to 2:00 p.m. was 59.9 dB. Therefore, the second hour of noise monitoring, with 13 project-site events, resulted in an increase in overall noise by approximately 1.6 dB over the first hour, when no events occurred. Although it is not possible to directly attribute all of the increased noise levels to the truck events nor is it possible to assume that the background/residual noise levels in the absence of truck events would be the same between any two given monitoring periods (hours), the data does indicate that the second hour of noise monitoring, with the 13 truck events, is comparable to the first hour where no truck events occurred at the project site. Therefore, it is reasonable to assume that project-site truck movements do not significantly contribute to the existing, overall noise exposure (as defined by the  $L_{eq}$ ) in the project vicinity.

Although increasing the number of trucks from the existing 50 daily trucks to the proposed 70 daily trucks would not typically be expected to result in any significant or noticeable increase in overall noise exposure (as defined by the  $L_{eq}$ ), because the applicant proposes to extend truck parking closer to the existing residential land uses than that of current operations, WJVA estimates an increase of approximately 1-2 dB could occur as a result of the expanded utilized parking area (depending on which portion of the project site is being utilized during any given hour of the day).

In regards to the City's maximum ( $L_{\max}$ ) noise level standards described in Table I,  $L_{\max}$  noise levels observed during the 13 measured events were in the range of 63-73 dB. As the proposed project would move trailer parking operations closer to existing residential land uses,  $L_{\max}$  levels could be expected to be in the range of 75-85 dB, when operations occur in close proximity to the residential land uses. Such levels would exceed the City's daytime  $L_{\max}$  standard of 70 dB and nighttime  $L_{\max}$  standard of 60 dB.

Additionally, in order to quantify on-site truck movement noise exposure in terms of the  $L_{dn}$ , individual truck movement SEL (sound exposure level) values must be determined. The SEL is a measure of the total energy of a noise event, including consideration of event duration. The SEL is not actually heard, but is a derived value used for the calculation of energy-based noise exposure metrics such as the  $L_{dn}$ . The average measured truck event movement SEL collected by WJVA was 78.1 dB.

Based upon truck events observed by WJVA, a total of 70 trucks per day utilizing the site would result in approximately 182 truck movement events. For the purpose of this analysis, it was assumed that truck movements could occur at any hour of the day, and could be evenly distributed over a 24-hour day.

Truck movement noise exposure may be quantified in terms of the  $L_{dn}$  using the following formula:

$$L_{dn} = SEL + 10 \log N_{eq} - 49.4$$

where,

*SEL is the average SEL for a truck movement,  $N_{eq}$  is the equivalent number of truck movements in a typical 24-hour period determined by adding 10 times the number of nighttime events (10 p.m. - 7 a.m.) to the actual number of daytime events (7 a.m. - 7 p.m.), and 49.4 is a time constant equal to 10 log the number of seconds in the day.*

Applying the above described assumptions and standard rates of noise attenuation from a noise source, the resulting noise exposure at the closest noise-sensitive land uses derived from on-site truck movements would be approximately 59.5 dB  $L_{dn}$ . This noise level is below the City's 65 dB  $L_{dn}$  noise level standard.

### **Idling Refrigeration Units:**

WJVA staff conducted reference noise level measurements of operating/idling refrigeration trailer units at the Producers Dairy main facility on January 23, 2017. WJVA measured noise levels of a Thermo King SB 210 refrigeration trailer and a Carrier X4 7300 refrigeration trailer. Both units have a high-speed and a low-speed setting. According the fleet manager, the units cycle on and off over time. The fleet manager indicated that typically, the high-speed setting will occur when a unit is turned off after an extended period of non-operation. Additionally, in the summer

months when exterior ambient temperatures are higher, the high-speed setting occurs more frequently than in cooler months. When the units cycle off, they remain off for a minimum time period of twenty (20) minutes.

Noise level measurements were conducted at a reference distance of approximately ten (10) feet from the operating units. High-speed setting noise levels ranged from approximately 80-83 dB at a distance of ten feet and low speed setting noise levels ranged from approximately 73-76 dB at a distance of ten feet. According to the project applicant, trailers would be parked with the rear of the trailer facing the proposed CMU wall (and residential land uses), with the refrigeration unit facing toward the north, away from residential land uses. Assuming multiple trailers could be in operation simultaneously, the resulting noise levels associated with idling refrigeration trailers along the southern project boundary would be expected to be in the range of 75-85 dB during warmer months if the units remained on for longer periods of time. Such levels would exceed the City's noise level standards.

## **NOISE MITIGATION**

### **Exterior Noise Exposure:**

As described above, the project applicant proposes the construction of a 12-foot CMU sound wall along the southern portion of the project site. The proposed sound wall will extend toward the north, until the site entry locations on both the east and west side of the project site.

A computer model was used to determine the effectiveness of the proposed 12-foot CMU sound wall along the southern project boundary. The model calculates sound wall insertion loss (noise reduction) based upon the distance from the source to the wall, the distance from wall to the receptor, and the relative heights of the sources and receptors. A semi-truck is typically assumed to have an effective source height of 8 feet above the pavement. However, for a typical refrigeration trailer unit, the source height is considered to be approximately 12 feet above the pavement. A typical receptor is assumed to have a height of 5 feet above ground level.

Based upon the above-described assumptions and method of analysis, it was determined that a 12-foot sound wall would reduce typical truck movement event noise levels by approximately 8-11 dB and refrigeration unit noise levels by approximately 5-8 dB.

Taking into account the above-described project-related noise levels, as well as the noise level reduction that would be expected as a result of the proposed 12-foot CMU sound wall, refrigeration unit noise levels would be expected to be approximately 64-77 dB at the closest existing residential land uses to the south of the project site. Such levels exceed the City's applicable noise level standards, as defined by the  $L_{max}$ . Please note, this assumes multiple refrigeration units in operation simultaneously along the southern boundary of the project site, near the closest existing residential land uses, and is considered a worst-case assessment of project-related noise levels.

In order to maintain compliance with the City's applicable noise level standards, the applicant should not utilize the project area south of the site entrances for truck movements between the hours of 10:00 p.m. to 7:00 a.m. or for operating idling refrigeration trailer units at any time during the day. The applicant may, however, utilize the project area north of the project site entrance at any hour of the day for truck movements as well the usage of idling refrigeration trailers. The parking area south of the site entrances should only be used for truck movements between daytime hours of 7:00 a.m. to 10:00 p.m.

### **Interior Noise Exposure:**

The City of Fresno interior noise level standard is 45 dB  $L_{dn}$ . With the proposed 12-foot CMU sound wall in place, the project-related noise exposure would be expected to be in the range of 49-52 dB  $L_{dn}$ . This means that the closest homes to the project site would need to be capable of providing a minimum outdoor-to-indoor noise level reduction (NLR) of approximately 7 dB (52-45=7).

A specific analysis of interior noise levels was not performed. However, it may be assumed that residential construction will reduce exterior noise levels by a minimum of 25 dB if windows and doors are closed and a minimum of 15 dB if windows and doors are open. This will be sufficient for compliance with the City's 45 dB  $L_{dn}$  interior standard.

## **VIBRATION**

The dominant sources of man-made vibration are sonic booms, blasting, pile driving, pavement breaking, demolition, diesel locomotives, and rail-car coupling. None of these sources are anticipated from the project site. Typical vibration levels at distances of 25 feet and 100 feet are summarized by Table IV. Vibration levels caused by project-related truck movements would be considered "barely perceptible", as defined by Table II, at nearby residential land uses.

<b>TABLE IV</b>		
<b>TYPICAL VIBRATION LEVELS</b>		
	<b>PPV (in/sec)</b>	
<b>Equipment</b>	<b>@ 25'</b>	<b>@ 100'</b>
Bulldozer (Large)	0.09	0.011
Bulldozer (Small)	0.003	0.0004
<b>Loaded Truck</b>	<b>0.08</b>	<b>0.01</b>
Jackhammer	0.04	0.005
Vibratory Roller	0.2	0.03
Source: <i>Caltrans</i>		



## CONCLUSIONS AND RECOMMENDATIONS

The proposed Producers Dairy Parking lot project located at 450 E. Belmont Avenue in Fresno will comply with applicable City of Fresno exterior and interior noise level requirements, and would not result in an increase of 3 dB or greater above existing ambient noise levels, provided that the following noise mitigation measures are included in the proposed project design and operations.

1. The applicant should build the proposed 12-foot CMU sound wall along the southern boundary of the project site. The sound wall should extend toward the north to the extent of the project access locations on the east and west sides of the project site, as shown in Figure 1.
2. The applicant should not utilize the project site area south of the project access locations for the purpose of storing operational refrigeration trailer units at any time.
3. The applicant should not utilize the project site area south of the project access locations for vehicle movements or operations between the hours of 10:00 p.m. and 7:00 a.m.

The conclusions of this acoustical analysis are based upon the best information known to WJV Acoustics, Inc. (WJVA) at the time the analysis was prepared concerning the proposed site plan, project operational details (including equipment type used on-site), sound wall location(s) and hours of operation. Any significant changes to these factors will require a reevaluation of the findings of this report. Additionally, any significant future changes in equipment technology, noise regulations or other factors beyond WJVA's control may result in long-term noise results different from those described by this analysis.

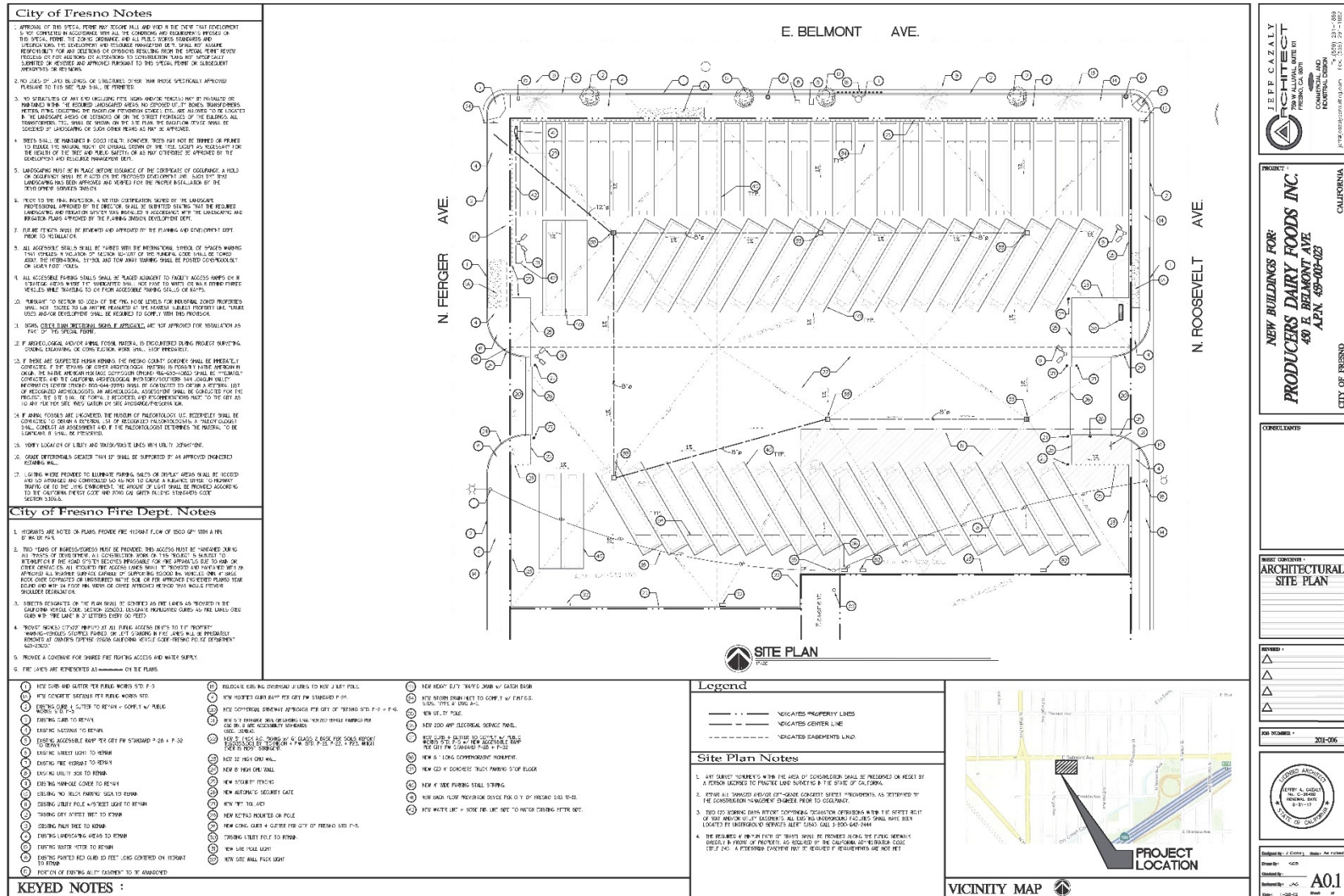
Respectfully submitted,



Walter J. Van Groningen  
President

WJV:wjv

FIGURE 1: PROJECT SITE PLAN



## APPENDIX A

### ACOUSTICAL TERMINOLOGY

<b>AMBIENT NOISE LEVEL:</b>	The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.
<b>CNEL:</b>	Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.
<b>DECIBEL, dB:</b>	A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
<b>DNL/<math>L_{dn}</math>:</b>	Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.
<b><math>L_{eq}</math>:</b>	Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. $L_{eq}$ is typically computed over 1, 8 and 24-hour sample periods.
<b>NOTE:</b>	The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while $L_{eq}$ represents the average noise exposure for a shorter time period, typically one hour.
<b><math>L_{max}</math>:</b>	The maximum noise level recorded during a noise event.
<b><math>L_n</math>:</b>	The sound level exceeded "n" percent of the time during a sample interval ( $L_{90}$ , $L_{50}$ , $L_{10}$ , etc.). For example, $L_{10}$ equals the level exceeded 10 percent of the time.

## **A-2**

### **ACOUSTICAL TERMINOLOGY**

#### **NOISE EXPOSURE CONTOURS:**

Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

#### **NOISE LEVEL REDUCTION (NLR):**

The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of “noise level reduction” combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

#### **SEL or SENEL:**

Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

#### **SOUND LEVEL:**

The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

#### **SOUND TRANSMISSION CLASS (STC):**

The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.