APPENDIX F
NOISE BACKGROUND

Characteristics of Sound/Noise

Noise is defined as unwanted or objectionable sound (CSUMB, 2008). Measurement of sound involves determining three variables: 1) magnitude; 2) frequency; and 3) parameters in time (duration) (EPA, 1974). The magnitude of variations in air pressure associated with sound waves results in the quality commonly referred to as loudness. Human ears respond to a very wide range of sound pressures and it is customary to express sound pressure level in decibels (dB) which are logarithmic (1, 10, 100…) ratios when comparing sound pressures to a reference pressure. A doubling of sound energy is equivalent to an increase of 3 dB. According to the Department of Transportation, Federal Highway Administration, noise level increases of less than 3 dB are not generally perceptible to the average human ear.

Sound level diminishes as distance from the source increases (attenuation). For a "point" source of sound in free space, the sound level will drop 6 dB each time the distance from the source is doubled. A stream of vehicles on a busy highway represents a "line" source of sound and the attenuation rate is only about 3 dB for each doubling of distance (Santa Barbara County, 2009).

The duration of noise and the time period over which it occurs are important factors in determining the human response to sound. Annoyance due to noise is associated with how often noise is present and how long it persists. One approach to quantifying time-varying noise levels is to calculate the Energy Equivalent Sound Level (Leq) for the time period of interest. The Leq represents a sound level which, if continuous would contain the same total acoustical energy as the actual time-varying noise, which occurs during the observation period.

In a residential or other noise sensitive environment, noise is more disturbing at night than during the day. Thus, noise indices have been developed to account for the differences in intrusiveness between daytime and nighttime noise. The Community Noise Level Equivalent (CNEL) and the Day-Night Average Level (DNL or Ldn) are such indices. CNEL and Ldn values result from the averaging of hourly Leqs for a 24-hour period, with a weighting factor applied to the nighttime Leq values (and the evening values for CNEL). The CNEL penalizes noise levels during the night (10 p.m. to 7 a.m.) by adding 10 dB to account for the increased sensitivity of people to noise after dark. Evening noise levels (7 p.m. to 10 p.m.) are "penalized" by adding 5 dB to the CNEL. The Ldn also penalizes nighttime noise levels by adding 10 dB, but does not penalize evening levels. These two indices are generally equivalent.

Human Response to Noise

Human response to noise is dependent not only on the magnitude but also on the characteristic of the sound, or the sound frequency distribution. Generally, the human ear is more susceptible to higher frequency than lower frequency sounds. Human response to noise is also dependent on the time of day, location and other factors. For example, a person sleeping at home might react differently to the sound of a car horn than to the same sound while driving during the day. The regulatory process has attempted to account for these factors by developing overall noise ratings such as CNEL and Ldn which incorporate penalties for noise occurring at night. Figure 3.3.11-1 provides a scale showing typical noise levels encountered in common daily activities.

According to the San Luis Obispo County General Plan Noise Element (Brown & Buntin, 1992), noise effects are generally considered based on their effect on surrounding land uses and nearby sensitive receptors. Sensitive receptors, as defined by the General Plan, include residential developments, schools, health care and nursing facilities, churches, entertainment venues, libraries/museums, hotels, business offices, and outdoor sports and recreational facilities

Sound Level (dBA)	Typical Outdoor Noise Source	Typical Indoor Noise Sources	Typical Human Response/Effects
140	Carrier Jet takeoff (50 ft)		--Threshold for Pain--
130	Siren (100 ft) Live Rock Band		---Hearing Damage---
120	Jet takeoff (200 ft) Auto horn (3 ft)		
110	Chain Saw Snow Mobile		---Deafening---
100	Lawn Mower (3 ft) Motorcycle (50 ft)		
90	Heavy Duty Truck (50 ft)	Food Blender (3 ft)	---Very Loud---
80	Busy Urban Street, Daytime	Garbage Disposal (3 ft)	
70	Automobile (50 ft)	Vacuum Cleaner (9 ft)	---Loud---
60	Small plane at ¾ mile	Conversation (3 ft)	
50	Quiet Residential Daytime	Dishwasher Rinse (10 ft)	---Moderate---

Sound Level (dBA)	Typical Outdoor Noise Source	Typical Indoor Noise Sources	Typical Human Response/Effects
40	Quiet Residential Nighttime	Quiet Home Indoors	---Quiet---
30	Slight Rustling of Leaves	Soft Whisper (15 ft)	---Very Quiet---
20		Broadcasting Studio	
10		Breathing	--Barely Audible--
0			--Threshold of Hearing--
Modified from City of Carpinteria, 2007			

Figure 3.3.11-1 Typical Human Responses to Noise

References

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