

4.12 NOISE

This section describes ambient noise levels in the environs of LLNL with emphasis on community noise levels in areas where the community may be exposed. Regulations and guidelines related to community noise issues are discussed in Section 4.12.1. Regional noise sources, including those associated with LLNL, are described in Section 4.12.2. Finally, Section 4.12.3 presents the results of local field surveys.

4.12.1 Regulatory Framework

Noise-related criteria and guidelines have been promulgated at the Federal, state, and local level. Various Federal agencies have been delegated responsibility to set noise control standards. Uniform noise control standards have been set by these agencies for equipment such as aircraft and airports, interstate motor carriers and railroads, medium and heavy-duty trucks, motorcycles and mopeds, and portable air compressors. With the exception of federally assisted housing projects, however, community exposures are regulated at either the state or local level, and emphasis is placed on these programs.

4.12.1.1 *State of California*

The State of California has issued land use compatibility criteria for noise elements of local general plans. These guidelines outline the compatibility of various land uses based upon existing community noise levels. They are often adopted by city and county agencies for land use planning purposes and include specific exterior noise exposure standards for commercial, industrial, office, professional, and public recreation land uses. The State of California has also issued community noise equivalent level (CNEL) standards for new multiple-dwelling construction to provide adequate interior protection from exterior noise sources. These standards require a level of protection be incorporated to limit interior noise levels attributable to exterior sources to a level not to exceed 45 A-weighted decibels (dB[A])¹ in any habitable room with windows closed. These standards apply to hotels, motels, and dwellings other than detached single-family structures with windows closed, and are included here to provide a standard for comparison, although not specifically applicable.

4.12.1.2 *Local Noise Ordinances*

City of Livermore and Alameda County

The city of Livermore, within the noise element of the general plan, provides acceptable noise levels for certain land uses, based on state guidelines (Table 4.12.1.2-1), and identifies local noise problems and noise-sensitive areas within the city. It further establishes goals to be achieved in noise abatement and identifies a basic framework for implementing a noise-control program. Several elements of the city general plan are currently being updated. In the update, the city identifies noise levels compatible with various land uses to guide future mitigation of noise

¹ Sound is often expressed using the decibel (dB) scale. The decibel scale is a nonlinear scale of measurement that simplifies presentation data that have a wide range of variation, but its values cannot be added together without conversion; i.e., 1 dB + 1 dB does not equal 2 dB. The A-weighted decibel (dB[A]) scale is an instrument response that mimics the human ear at moderate sound pressure levels. The CNEL represents a time-weighted, 24-hour average noise level based on the A-weighted decibel scale. "Time-weighted" refers to the fact that noise that occurs during certain sensitive times is weighted more heavily in calculations. This scale includes a 5-decibel upward adjustment for sounds occurring in the evening (defined as 7 p.m. to 10 p.m.) and a 10-decibel upward adjustment for sounds occurring in the late evening and early morning (defined as 10 p.m. to 7 a.m.).

issues. The city also addresses noise considerations in its municipal code noise ordinance. This ordinance is intended to reduce and restrict certain noise-generating activities within its jurisdiction and provides methods for addressing noise problems, but it does not contain explicit noise level limits.

The Alameda County general plan noise element is similar to that of the city of Livermore. Noise criteria are also included in the East (Alameda) County Area Plan (ECAP). The goals contained in these two plans are generally more stringent than those set in the city's noise ordinance. In addition, the ECAP addresses potential impacts of proposed activities, characterized by a net increase in dB(A). The County's noise element also sets limits on the allowable amount of noise (maximum decibels) that can be heard from one property to another to protect certain noise-sensitive land uses (City of Livermore and LSA 2002).

TABLE 4.12.1.2–1.—City of Livermore Land-Use Compatibility for Community Noise Environments, Day-Night Average Levels^a

Land Use	Normally Acceptable Levels (dB[A])	
	City	County
Residential – low density	< 60	50 – 60
Residential – multi-family, and transient lodging	< 65	50 – 65
School, library, church, playground, park	< 70	50 – 70
Golf course, water recreation	< 75	50 – 75
Office building	< 70	-
Industrial, manufacturing, agricultural	< 75	-

Source: City of Livermore and LSA 2002.

^a The *Day-Night Average Level* is a time-weighted average noise level wherein the individual “pockets” of noise that occur during late evening through early morning (10 p.m. to 7 a.m.) are multiplied by 10 (i.e., given a 10-decibel upward adjustment) to account for the fact that certain noises would be more objectionable and the community is more sensitive to noises that occur during these times.

dB(A) = A-weighted decibels.

City of Tracy and San Joaquin County

The city of Tracy's noise control ordinance was established to reduce and restrict certain noise-generating activities and provide methods for addressing noise problems. Unlike Livermore, however, it provides explicit noise level limits for various zoning types (Table 4.12.1.2–2) and requirements for exemptions to the ordinance. San Joaquin County has adopted a noise ordinance and guidelines for noise levels associated with various land uses within its unincorporated territory. The ordinance sets noise limits for various land uses, summarized as follows:

- No sound may exceed 65 decibels day-night average level at property lines that abut parks, schools, hospitals, rest homes, homes for the care of the aged and infirmed, or areas developed or zoned as residential.
- The sound within commercial-manufacturing zones must not exceed 75 decibels day-night average level at property lines of the property being developed.

TABLE 4.12.1.2–2.—City of Tracy Sound Level Limits for Base District Zones

Base District Zone	Sound Level (dB[A])
Residential districts	55
Commercial districts	65
Industrial districts (light and heavy)	75
Agricultural	75
Aggregate mineral overlay zone	75

Source: City of Tracy 2002.

dB(A) = A-weighted decibels.

For comparative purposes, typical indoor and outdoor noise levels generated by various activities are listed in Table 4.12.1.2–3.

TABLE 4.12.1.2–3.—Typical Sound Levels

Noise Source	Sound Level (dB[A])
Near jet engine	140
Accelerating motorcycle at a few feet away	110
Pile driver; noisy urban street/heavy city traffic	100
Ambulance siren; food blender	95
Pneumatic drill; vacuum cleaner	80
Near freeway auto traffic	70
Suburban street	55
Light traffic; soft radio music in apartment	50
Average residence without stereo playing	40
Soft whisper	30

Source: City of Livermore and LSA 2002.

dB(A) = A-weighted decibels.

4.12.2 Environmental Setting and Existing Noise Sources

This section provides a description of local noise sources and sources attributable to LLNL and presents the results of local noise monitoring surveys.

4.12.2.1 Local Noise Sources

Noise sources local to Livermore include the following (City of Livermore and LSA 2002):

- **Construction Activity**—Construction generally comprises discrete steps, including demolishing, excavating, grading, and building, resulting in intermittent noise levels generally higher than background. Each of these steps involves different equipment and, consequently, its own noise characteristics. Typical noise levels can reach 90 decibels or more at 50 feet during the noisiest construction phases. Mitigation is typically required to reduce the impact of construction activity noise on the surrounding community. The city of Livermore requires that all construction vehicles or equipment be equipped with properly operating and maintained mufflers. For certain equipment, hours of operation are restricted to between 7 a.m. and 8 p.m.
- **Equipment**—The variety of machinery or equipment that generates noise during operation includes heating, ventilating, and air-conditioning equipment, cooling towers, motors, pumps, fans, generators, air compressors, jackhammers, and loudspeakers.
- **Vehicular Traffic**—Traffic noise varies depending on factors such as traffic volume, vehicle mix (percentage of cars and trucks), and average traffic speed. Major regional roadway noise

sources include I-580, Highway 84, Livermore Avenue, First Street, and other arterial and collector roadways throughout the city.

- **Rail Operations**—The Union Pacific and Southern Pacific rail lines, located just north of the Livermore Site, produce noise from whistles, engines, and wheels and ground-borne vibration.
- **Aircraft Operations**—The Livermore Airport, located south of I-580 just within the western boundary of the city of Livermore, provides a variety of services to small and large noncommercial aircraft. It is a source of intermittent noise associated with takeoffs, landings, taxiing, and support vehicles. Aircraft overflights, however, currently contribute little to the ambient noise levels in Livermore.

Local noise sources in the Site 300 environs include off-road vehicles using the Carnegie State Vehicular Recreation Area south of Site 300, vehicular traffic along Corral Hollow Road, and occasional aircraft flybys. The city of Tracy Municipal Airport is somewhat distant and a relatively minor source of noise.

4.12.2.2 *Noise Sources Associated with Lawrence Livermore National Laboratory Activities*

Noise sources at LLNL are, for the most part, common to other local industrial/commercial settings, although on a somewhat larger scale. Construction and demolition activities are similar, however, because of the size of the site, perimeter buffer zone, and intervening roads. The contribution of these activities to noise levels offsite is small. The contribution of mobile noise sources associated with heavy-duty trucks and employee vehicles is greater, due to the relatively large number of shipments of materials and waste to and from the site and the large employment base; i.e., compared with other area businesses. Occasionally, noise may also be heard from the pistol and rifle firing range located at Site 300. These activities are not in conflict with land use compatibility guidelines.

LLNL is unique in the category of impulse (short-blast) noise associated with explosives research testing. High explosive tests are conducted regularly (daily and/or weekly) at both the Livermore Site, in the High Explosives Application Facility (HEAF), Building 191; and at Site 300, within the Contained Firing Facility and on open firing tables.

Because this type of source is unique, it is not considered within local agency land use compatibility guidelines. LLNL has evaluated this type of noise and, in an effort to limit nuisance to nearby residents and preclude damage to property, imposes a maximum allowable sound pressure level of 126 decibels, not to be exceeded in nearby populated areas. This value is considerably lower than some known damage thresholds and is considered to be well within the safe limit for both humans and structures in residential areas (LLNL 1991a). LLNL uses “blast forecasting” for open air detonations at Site 300. Blast forecasting considers explosive type and detonation characteristics together with various sound-wave propagation factors such as atmospheric attenuation, local topography, ground surface roughness, and monitored meteorological conditions to predict the magnitude and location of impulse noise levels. Blast forecasting is used to determine the maximum explosive weight that can be detonated without an irritant effect on the nearest populated areas; i.e., maintains sound levels within the self-imposed 126-decibel limit. Prior to tests on the open firing tables, LLNL also launches a weather balloon to obtain more detailed input data for the predictive noise-modeling program.

At the Livermore Site, explosive tests are conducted within the HEAF Building and, although these may at times be audible offsite, the insulating properties limit noise levels in nearby populated areas to a small fraction of the self-imposed 126-decibel limit.

4.12.3 Noise Monitoring Surveys

A field survey was conducted in January 2003 to characterize typical daily maximum noise levels in the vicinity of the Livermore Site (Sculley 2003). Measurements were taken for 1-hour periods using standard sound-level meters during the heart of the morning and evening commute. The monitors were placed at eight locations surrounding and just outside the Livermore Site perimeter, in regions of maximum activity (intersections and site entrance and exit locations) shown in Figure 4.12.3-1. Results of the survey, listed in Table 4.12.3-1, indicated that, as expected, vehicular traffic was the dominant noise source at most monitored locations. Rail operations and light aircraft overflights were minor contributors. The only recognizable noise sources from site activities within LLNL were some heavy equipment backup warning beepers, which were detectable during low traffic intervals at the monitoring sites on Patterson Pass Road. All levels were within the acceptable range established by the city of Livermore and Alameda County.

In addition to the 1-hour monitoring activity, additional measurements were taken to characterize the variations in noise over a 24-hour period. These measurements were taken along Vasco Road, approximately 1,000 feet south of Patterson Pass Road. The results indicated noise levels typical of suburban and near-freeway streets, with highest levels occurring during periods corresponding to peak traffic hours (Figure 4.12.3-2).

In 1991, a less extensive field survey, consisting of 5 perimeter locations and 10- to 15-minute collection periods, was conducted in the vicinity of Site 300 to document weekday ambient noise levels. The study showed ambient noise levels along Corral Hollow Road/Tesla Road ranging from 56 to 66 dB(A) equivalent continuous sound level (L_{eq})², which is typical of traffic noises associated with suburban street to near-freeway traffic (Table 4.12.3-2). At the time of the survey, no noticeable noise was being generated at the Site 300 firing range or the Carnegie State Vehicular Recreation Area. Higher ambient noise levels would be expected at the monitoring sites along Corral Hollow Road/Tesla Road during weekend periods when the Carnegie State Vehicular Recreation Area has the greatest off-highway vehicle activity.

² The *Equivalent-Continuous Sound Level* (L_{eq}) is an energy-averaged noise level for the indicated time.

TABLE 4.12.3-1.—Results of Ambient Noise Measurements Around Livermore Site^a

	Locations ^b	Date	Start and End Times ^c		1-Hour L _{eq} ^d (dB[A])
1	Patterson Pass Rd: 16 ft from near traffic lane	Jan. 9, 2003	7:00 - 4:30	8:00 a.m. - 5:30 p.m.	70.5 68.5
2	Patterson Pass Rd: 19 ft from near traffic lane	Jan. 9, 2003	7:00 - 4:30	8:00 a.m. - 5:30 p.m.	68.1 63.7
3	Greenville Rd: 6.8 ft from near traffic lane	Jan. 7, 2003	7:15 - 4:30	8:15 a.m. - 5:30 p.m.	73.0 74.0
4	Vasco Rd: 17 ft from near traffic lane	Jan. 8, 2003	7:00 - 4:30	8:00 a.m. - 5:30 p.m.	70.2 68.6
		Jan. 9, 2003 ^e	7:00 - 4:30	8:00 a.m. - 5:30 p.m.	70.2
5	Vasco Rd: 32 ft from near traffic lane	Jan. 10, 2003	7:15 - 4:30	8:15 a.m. - 5:30 p.m.	73.2 66.5
6	Vasco Rd: 43 ft from near traffic lane	Jan. 10, 2003	7:15 - 4:30	8:15 a.m. - 5:30 p.m.	73.4 69.3
7	Greenville Rd: 21 ft from near traffic lane	Jan. 7, 2003	7:00 - 4:30	8:00 a.m. - 5:30 p.m.	72.2 73.5
8	Greenville Rd: 11 ft from near traffic lane	Jan. 8, 2003	7:00 - 4:30	8:00 a.m. - 5:30 p.m.	72.3 72.6

Source: Sculley 2003.

^a Monitoring was conducted using Larson-Davis Model 820 Type I sound level meters mounted on tripods, about 4 to 5 feet aboveground level. Instruments have a 110-decibel dynamic range with a noise floor of about 20 dB(A). Meters were programmed for slow response (8 samples per second, 1 second averaging), A-weighted setting. Weather protection for the body of the meter was provided as necessary using plastic bags or vinyl pouches.

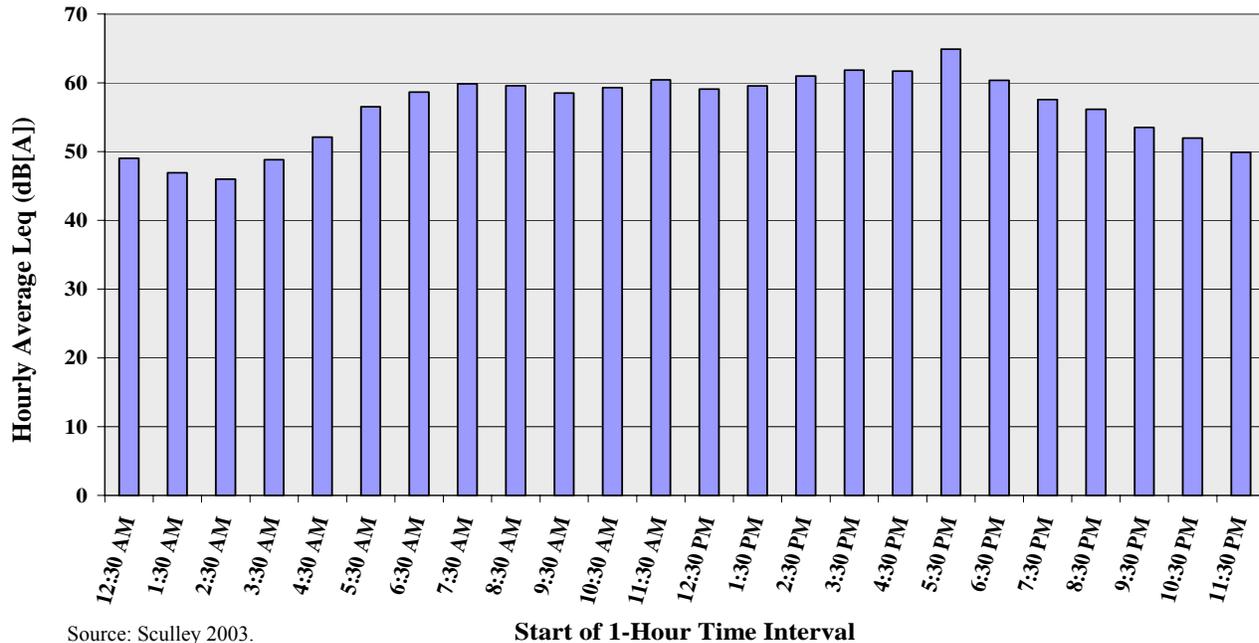
^b Locations are shown on Figure 4.12.3-1.

^c Meters were started and stopped manually, with 1-minute time histories and 15-minute interval histories collected; interval histories were synchronized to clock hours.

^d The *Equivalent-Continuous Sound Level* (L_{eq}) is an energy-averaged noise level for the indicated time.

^e Morning noise monitoring at Station # 4 was repeated on January 9, 2003.

dB(A) = A-weighted decibels



Source: Sculley 2003.

FIGURE 4.12.3-2.—Hourly Average Noise Levels Along South Vasco Road

TABLE 4.12.3–2.—Lawrence Livermore National Laboratory Site 300 Offsite Ambient Noise Measurement Results

Approximate Location	Time	L_{eq}^a (dB[A])	Description
Along eastern Site 300 boundary	11:15 - 11:30 AM	59	No dominant noise sources
Next to Corral Hollow Road			Ambient noise dominated by
0.75 mile west of I-580	9:05 - 9:20 AM	60	Earth-moving equipment (operating at Corral Hollow landfill, 0.5 mile from monitor)
2 miles east of I-580	9:35 - 9:50 AM	56	Overflying hawk
Across from Carnegie State Vehicular Recreational Area	12:50 - 1:05 PM	66	Wind and a few vehicles on roadway
Next to Tesla Road			Ambient noise dominated by
0.5 mile west of Alameda/San Joaquin County Line	1:15 - 1:30 PM	64	Wind and a few vehicles on roadway

^a The *Equivalent-Continuous Sound Level* (L_{eq}) is an energy-averaged noise level for the indicated time.
dB(A) = A-weighted decibels.