Chapter 11: Noise Element

I. Introduction

Noise levels can have a significant impact on quality of life. Excessive levels of noise result in increased neighborhood annoyance, dissatisfaction, and in some cases, health and safety hazards. Due to Los Angeles County's geographic, environmental, and cultural diversity, the levels and types of noise issues vary significantly. The purpose of the Noise Element is to reduce and limit the exposure of the general public to excessive noise levels. The Noise Element sets the goals and policy direction for the management of noise in the unincorporated areas.

II. Background

Sound is the result of a sound source inducing vibration in the air. The vibration produces alternating bands of relatively dense and sparse particles in the air, spreading outward from the source. The result of the movement of the particles is a fluctuation in the normal atmosphere pressure, or sound waves. These waves radiate in all directions from the source and may be reflected and scattered or, like other wave actions, may turn corners. When the source stops vibrating, the sound waves disappear, almost instantaneously, and the sound ceases. The ear is extremely sensitive to sound pressure fluctuations, which are converted into auditory sensations.

Sound may be described by three variables: amplitude, frequency, and time pattern. For more information on sound descriptors, please refer to Appendix G.

Noise Measurement

Noise is often described in qualitative terms, and individuals differ greatly on what noises are considered pleasant or annoying. The community noise metrics used in the Noise Element are either Community Noise Equivalent Level (CNEL) or Day-Night Average Level (Ldn). CNEL and Ldn are the metrics used to describe annoyance due to noise and to establish land use planning criteria regarding noise.

Community Noise Equivalent Level (CNEL)

CNEL is the average equivalent A-weighted sound level during a 24-hour day that is obtained after the addition of five decibels to sound levels in the evening, from 7 p.m. to 10 p.m., and after the addition of 10 decibels to sound levels in the evening, from 10 p.m. to 7 a.m. The CNEL metric is currently used by the California Aeronautics Code for the evaluation of noise impacts at airports. Local compliance with the state airport standard requires that community noise levels be expressed in CNEL.

Day-Night Average Level (Ldn)

Ldn is the average equivalent A-weighted sound level during a 24-hour day that is obtained after the addition of 10 decibels to sound levels in the evening, after 10 p.m. and before 7 a.m. The Ldn represents a simplification of CNEL.

For more information on basic levels of noise measurement, please refer to Appendix G.

Noise Environment

The typical community noise environment is made up of background or “ambient noise,” and higher, “intrusive” levels of noise. In the unincorporated areas, the major sources of noise come from transportation systems, such as commercial and private airports, rail and bus networks, and the regional freeway and highway system. Other major sources of noise have historically been identified with industrial uses, such as manufacturing plants.

Effects of Noise

Noise by definition is unwanted sound. It is an intrusion on one’s sense of privacy. Noise can be an emotional strain and a source of great frustration when the noise is beyond a person’s control. Noise may interfere with a broad range of human activities, the overall effect of which is to cause annoyance.

The potential effects of noise on humans include the following:

- Hearing loss;
- Non-auditory physiological response;
- Communication interference;
- Performance interference;
- Sleep disturbance;
- Subjective response; and
- Community response.

Hearing Loss

Exposure to sufficient levels of noise for long periods of time can produce temporary or permanent loss of hearing. Noise levels have been identified as protective of the hearing of the general population from significant damage due to environmental noise. Environmental noise differs from workplace noise in that it is generally intermittent, covers 365 days per year rather than 250 work days, and covers 24 hours per day rather than 8 hours. Taking these factors into account, the U.S. Environmental Protection Agency (EPA) has identified an environmental noise level of Leq (24) = 70 dB to protect 96 percent of the general population from a hearing loss of greater than 5 dB at 4000 Hz.

Non-Auditory Physiological Response

Excessive exposure to noise may contribute to the development and aggravation of stress-related conditions, such as high blood pressure, coronary diseases, ulcers, colitis, and migraine headaches. U.S.EPA studies suggest the possibility of adverse health outcomes associated with environmental noise and underscore the need for additional research. Although it is reasonable to view annoyance as a symptom or sign of noise-induced stress, no direct test of this relationship has been made.

Communication Interference

The indirect effects of speech interference are:

- Disturbance of normal domestic or educational activities;

- Creation of an undesirable living environment;
- Safety hazards; and
- A source of extreme annoyance.

The appropriate noise levels to prevent outdoor speech interference (oral communication) for the outdoors, depends on the voice level and communication distance. For example, at a distance of two meters from the speaker with a normal voice (70 dB) the sound level that would allow communication with 95 percent intelligibility is 60 dB. Indoors, an Ldn of 50 dB permits virtually100 percent intelligibility. For older populations and people with hearing problems, the background noise would be lower.

High levels of noise reduce the number of conversations and their content, quality, and fidelity. Children have a relative lack of knowledge of language that makes them less able to "hear" speech when some of the cues are lost. Repeated exposure to high levels of noise in "critical periods of development" might affect conceptual development and the acquisition of speech, language, and language-related skills, such as reading and listening.

Performance Interference

In general, noise is more likely to reduce the accuracy than the total quantity of work, and it affects complex tasks more than simpler ones. As noise levels increase, both reaction times and numbers of errors increase. For some simple tasks, noise may enhance performance (when distracting cues are dropped out). Factors to consider on how noise affects work performance include: the characteristics of noise; characteristics of the task; aspects of performance considered important; and individual differences.

Noise levels most likely to be detrimental to performance are:

- Continuous noise levels above 90 dB; and
- Levels less than 90 dB, if they have predominantly high frequency components, are intermittent, unexpected, or uncontrollable.

According to the U.S. EPA, field studies demonstrate that high noise levels have been corroborated with poor performance on reading tests and auditory discrimination problems.

Sleep Disturbance

Sleep disturbance is one of the major causes of annoyance due to noise. Long-term or chronic sleep disturbance may lead to health disorders. In general, the higher the noise level, the greater the probability of a response. For example, a study found that there was a 5 percent probability of subjects being awakened by peak levels of 40 dB and a 30 percent probability at 70 dB. If the number of sound peaks increases, an individual will take longer to fall asleep, even if the average sound level decreases. However, continuous or very frequent noise throughout the night, even as high as 95 dB, appears to cause little change in the average duration of the sleep stages, since such stages are disturbed more by peaks than by high continuous levels alone.

Subjective Response

Excessive noise exposure can result in a variety of psychological responses or symptoms in an individual. The physical attributes of noise that can affect an individual's subjective response include apparent loudness or intensity, spectral shape, presence of discrete frequency components,

abruptness or impulsiveness, intermittency, duration, and temporal variations. Other factors include the time of day, the activity interfered with, the ability to control the source and the information content, and personal factors.

Sounds of two KHz or higher are generally the most annoying and disruptive, although noises that are abrupt, intermittent, or fluctuate with time can be very annoying as well. In general, the louder the noise, the more annoying it is likely to be.

Community Response

Community response to noise is usually studied through social surveys. These studies attempt to predict, on an aggregate basis, the degree of annoyance or other effects that can be expected by the community at varying noise levels. Community response to noise is based on statistical averages, since it is known that response to noise varies greatly among individuals.

The most stable indicator of annoyance is the percentage of exposed persons who rate themselves as being highly annoyed. According to the U.S. EPA, there is a relationship between annoyance, complaints, and community reaction as a function of day-night sound levels. Approximately 17 percent of the population will be highly annoyed at an Ldn of 55 dB, and over 40 percent of the population will be highly annoyed if the Ldn exceeds 70 dB, which is the maximum safe level that the U.S. EPA has identified to protect against the risk of hearing loss. The relationship between noise and annoyance is based largely on the results of surveys around airports. These estimates have been criticized because aircraft noise is not present in many urban areas. In addition, complaints occur at a much lower rate than annoyance, and generally do not become evident until the noise levels are very high. For example, at an Ldn of 70 dB, approximately 10 percent of the population can be expected to complain, while 25 to 40 percent of the population will be annoyed.

Table 11.1 lists disturbances from excessive noise that range from minor sleep annoyance to potential hearing loss. Schools and hospitals, and other land uses that house sensitive receptors, or those at high risk of being affected by high noise levels, are considered noise-sensitive uses. In addition to the effects on human physiology and behavior, excessive noise impacts other species. For example, birds living in noisier environments tend to sing louder at night.

Table 11.1: Sources and Effects of Common Noise

dB	Effects	Observation	Source
130	Hearing loss	Pain threshold	Hard rock band Thunder
120		Deafening	
110			Jet take-off
100			Loud auto horn at 10 ft.
90		Very loud	Noisy city street
85			
80			School cafeteria
75			

70	Physiological effects	Loud	Vacuum cleaner at 10 ft.
65			
60	Interference with speech		Normal speech at 3 ft.
55			
50	Sleep interruption	Moderately loud	Average office Dishwasher in next room
45			
40	Sleep disturbance		Soft radio music Quiet residential area
35			
30		Faint	Interior of average residence
20			Average whisper at 6 ft.
10			Rustle of leaves in wind
5		Very faint	Human breathing
0	Audibility threshold		

Source: Compilation of scientific and academic literature, generated by FHWA and U.S. EPA.

Community Attitudes Toward Noise Impacts

Countywide outreach efforts for the General Plan reveal that both urban and rural communities experience neighborhood disturbances, such as barking dogs, leaf blowers, garbage trucks, buses, back-up alarms, permanent amplified noise (i.e., PA systems),and motorcycles. Urban residential areas seemed to be affected by commercial and industrial spillover noise, such as trucks making late night deliveries at neighborhood shopping centers. Virtually all communities objected to noise generated by freeways and major arterials. All communities reacted to aircraft noise to some extent, with the strongest reaction from those whose homes and businesses lie beneath the flight path of major airports.

In compliance with the County Noise Ordinance, the Los Angeles County Department of Public Health (DPH) has performed noise complaint assessments and surveys from 1996 through 1999. During this period, DPH responded to a total of 111 noise complaints under its statutory authority. It should be noted, however, that the quantification of complaints should not be used solely as a definitive expression of community response.

Regulatory Framework

The following section outlines federal, state and county noise-level standards.

Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Promulgating noise emission standards for interstate commerce;
- Assisting state and local abatement efforts; and
- Promoting noise education and research.

The Office of Noise Abatement and Control (ONAC) was initially tasked with implementing the Noise Control Act. However, the ONAC has since been eliminated, leaving the development of federal noise policies and programs to other federal agencies and inter-agency committees. For example, the Occupational Safety and Health Administration (OSHA) agency prohibits exposure of workers to excessive sound levels. The U.S. Department of Transportation (DOT) assumed a significant role in noise control through its various operating agencies, such as with the Federal Aviation Administration (FAA), which regulates noise generated by aircraft and airports. Surface transportation system noise is regulated by a host of agencies, including the Federal Transit Administration (FTA), which requires that all rail systems receiving federal funding be constructed and operated in accordance with its regulations and specifications. The Federal Railroad Administration (FRA) sets forth and enforces safety standards, including noise emissions within railroad locomotive cabs. Transit noise is regulated by the FTA, while freeways that are part of the interstate highway system are regulated by the Federal Highway Administration (FHWA). The FHWA has adopted and promulgated noise abatement criteria for highway construction projects. The federal government encourages local jurisdictions to use their land use regulatory authority to site new development to minimize potential noise impacts. For information on federal guidelines for acceptable environmental noise levels, please refer to Appendix G.

State Regulations

A major source of excessive noise is airports. Title 21 of the California Code of Regulations establishes the maximum acceptable level of aircraft noise in proximity to residences, schools, hospitals, and places of assembly at 65 dB CNEL. The County's Airport Land Use Plan was adopted by the Airport Land Use Commission (ALUC) in 1991 and contains noise contours based on the state standards for all public use airports within Los Angeles County. Figure 11.1 shows these noise contours, and includes updated noise contour data where available. The County's Airport Land Use Plan can be found on the Los Angeles County Department of Regional Planning's web site, located at http://planning.lacounty.gov/ALUC.

Figure 11.1: Airport Noise Contours Map

Additional state regulatory codes that relate to noise abatement include:

- Uniform Building Code: Title 24 of the California Code of Regulations requires certain noise insulation measures to be used in the design of all new residential construction other than detached, single family dwellings;
- Vehicle Code: Establishes maximum noise levels for motor vehicles; and
- California Code of Regulations: Establishes maximum acceptable levels of aircraft noise.

The California Department of Health Service's Office of Noise Control (ONC), established in 1973, was instrumental in developing regulatory tools to control and abate noise for use by local agencies. One significant model is the Land Use Compatibility for Community Noise Environments Matrix, which allows a local jurisdiction to clearly delineate the compatibility of sensitive uses with various incremental levels of noise. The County has adapted this matrix to develop the County's exterior noise standards, as seen in Table 11.2.

County Regulations

The County maintains the health and welfare of its residents with respect to noise through nuisance abatement ordinances and land use planning. The County Noise Control Ordinance, Title 12 of the County Code, was adopted by the Los Angeles County Board of Supervisors in 1977 "…to control unnecessary, excessive, and annoying noise and vibration.…" It declares that the purpose of the County policy is to "…maintain quiet in those areas which exhibit low noise levels and to implement programs aimed at reducing noise in those areas within the county where noise levels are above acceptable values." (Section 12.08.010 of the County Code).

On August 14, 2001, the Board of Supervisors approved an ordinance amending Title 12 of the County Code to prohibit loud, unnecessary, and unusual noise that disturbs the peace and/or quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitivity residing in the area. Regulations can include requirements for sound barriers, mitigation measures to reduce excessive noise, or the placement and orientation of buildings, and can specify the compatibility of different uses with varying noise levels, as shown in Table 11.2. For more information on noise barrier strategies, please see Appendix G.

Table 11.2: Los Angeles County Community Noise Criteria

			Level (dBA)				
Noise Zone	**Land Use of Receptor Property**	**Time**	**Std 1L5030 min/hr**	**Std 2L2515 min/hr**	**Std 3L8.35 min/hr**	**Std 4L1.71 min/hr**	**Std5L0 at no time**
I	Noise Sensitive	Anytime	45	50	55	60	65
II	Residential	10PM to 7AM	45	50	55	60	65
		7AM to 10PM	50	55	60	65	70
III	Commercial	10PM to 7AM	55	60	65	70	75
		7AM to 10PM	60	65	70	75	80
IV	Industrial	Anytime	70	75	80	85	90

Source: Section 12.08.390 of the Los Angeles County Code (a portion of the Noise Control Ordinance)

Noise Levels

Figure 11.2 shows the noise contours for major sources of noise. A discussion of current and projected levels for major sources of noise in the unincorporated areas can be found in Section 5.12 Noise and Vibration, and Appendix K of the General Plan Environmental Impact Report.

Figure 11.2: Noise Contours Map

III. Issues

Reducing Noise Impacts Through Planning

Since excessive noise affects quality of life, existing and future noise levels must be considered when making land use planning decisions to minimize exposure to excessive noise. Noise-sensitive uses, such as residences, hospitals, schools, childcare facilities, and places of assembly are especially vulnerable to excessive noises generated by airports, rail, freeways and primary arterials, heavy industry and warehousing facilities. As stated in the noise policies, planning for these noise-sensitive uses must include sufficient spatial separation or site design and construction to ensure compatibility with noise-generating uses.

Coordinated transportation and land use planning plays a critical role in the prevention and mitigation of excessive noise impacts. Federal and state laws, in many instances, preempt local laws from controlling certain sources by setting noise levels and operational procedures for aircraft, motor vehicles, and interstate carriers. Local governments can, whenever they have jurisdictional authority, address these noise problems through a combination of land use planning, building code and zoning regulations, and other policies where a noise abatement program is required.

As specified in Policy N 1.12, decisions on land adjacent to transportation facilities, such as the airports, freeways and other major highways, must consider both existing and future noise levels of these transportation facilities to assure the compatibility of proposed uses.

In addition, the condition of road surfaces and traffic congestion can contribute to vehicle noise. Local roadway design features, traffic management, and traffic calming techniques can minimize noise from traffic speed and frequent vehicle acceleration and deceleration, while innovative roadway paving material can further reduce traffic noise.

IV. Goals and Policies

Goal N 1: The reduction of excessive noise impacts.	
Topic	**Policy**
Reducing Noise Impacts	Policy N 1.1: Utilize land uses to buffer noise-sensitive uses from sources of adverse noise impacts.
	Policy N 1.2: Reduce exposure to noise impacts by promoting land use compatibility.
	Policy N 1.3: Minimize impacts to noise-sensitive land uses by ensuring adequate site design, acoustical construction, and use of barriers, berms, or additional engineering controls through Best Available Technologies (BAT).

	Policy N 1.4: Enhance and promote noise abatement programs in an effort to maintain acceptable levels of noise as defined by the Los Angeles County Exterior Noise Standards and other applicable noise standards.
	Policy N 1.5: Ensure compliance with the jurisdictions of State Noise Insulation Standards (Title 24, California Code of Regulations and Chapter 35 of the Uniform Building Code), such as noise insulation of new multifamily dwellings constructed within the 60 dB (CNEL or Ldn) noise exposure contours.
	Policy N 1.6: Ensure cumulative impacts related to noise do not exceed health-based safety margins.
	Policy N 1.7: Utilize traffic management and noise suppression techniques to minimize noise from traffic and transportation systems.
	Policy N 1.8: Minimize noise impacts to pedestrians and transit-riders in the design of transportation facilities and mobility networks.
	Policy N 1.9: Require construction of suitable noise attenuation barriers on noise sensitive uses that would be exposed to exterior noise levels of 65 dBA CNEL and above, when unavoidable impacts are identified.
	Policy N 1.10: Orient residential units away from major noise sources (in conjunction with applicable building codes).
	Policy N 1.11: Maximize buffer distances and design and orient sensitive receptor structures (hospitals, residential, etc.) to prevent noise and vibration transfer from commercial/light industrial uses.
	Policy N 1.12: Decisions on land adjacent to transportation facilities, such as the airports, freeways and other major highways, must consider both existing and future noise levels of these transportation facilities to assure the compatibility of proposed uses.

V. Noise Element Implementation Program

- Countywide Noise Assessment Survey/County Noise Ordinance Update
- Countywide Noise Mapping
- Noise Abatement Program

For descriptions of these programs, please refer to Chapter 16: General Plan Implementation Programs.