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PLANNING AND NATURAL RESOURCES DEPARTMENT

Planning
Community Development
Administrative Operations

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Kern County Planning Commission
Kern County Administrative Center
1115 Truxtun Avenue
Bakersfield, CA 93301

General Plan Update Workshop #6 – Overview of the Kern County General Plan Noise and Safety Elements
(Fiscal Impact: None) All S.D.s

INTRODUCTION

Today marks the sixth in this series of scheduled Kern County General Plan Update interactive workshops. The purpose of tonight's workshop is to present your Commission with information which may be utilized in preparation of the upcoming General Plan Update. Additionally, this workshop will serve as a forum for the Planning and Natural Resource Department to receive feedback from community residents, agencies, and other interested stakeholders as to potential content for the General Plan Update. The topics for tonight's discussion include an overview of the required noise and safety elements.

NOISE ELEMENT

The 2004 General Plan states; "the preservation and enhancement of the acoustical environment relates directly to the quality of life that can be achieved in the County's communities." By recognizing existing sources of noise pollution, taking reasonable steps to mitigate future impacts, and preventing additional substantial sources of noise, the County can achieve a quieter environment and a more comfortable and calming community. Noise has been linked directly to human health and, aside from general annoyance, excessive noise is a source of discomfort, interferes with sleep and disrupts communication and relaxation.

Noise Scales and Definitions

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibration object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds and is typically described as any unwanted or objectionable sound. The standard unit of measurement of the loudness of sound is the decibel (dB). The perceived loudness of sounds is dependent upon factors, including sound pressure level and frequency content. Within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels (dBA). The A-weighted decibel scale (dBA) performs this compensation by discriminating against sound frequencies in a manner approximating the sensitivity of the human ear. The A-weighted sound level of traffic and other long-term noise-producing activities within and around a community varies considerably with time. Measurements of this varying noise level are accomplished by recording values of the A-weighted level during representative periods during the day.

Decibels are based on the logarithmic scale; two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase in 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound, and twice as loud as a 60 dBA sound. Everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Examples of various sound levels in different environments are shown in Attachment 1 of this Staff Report, Sound Levels and Human Response.

The effects of noise on people can be placed in three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted; the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

In most situations, a 3 dBA change in sound pressure level is considered a "just detectable" difference. A 6 dBA change (either louder or quieter) is readily noticeable and a 10 dBA change is a doubling (if louder) or a halving (if quieter) of the subjective loudness. Sound from a small localized source (approximating a "point" source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates or drops-off at a rate of 6 dBA for each doubling of the distance (6 dBA/DD). The movement of the vehicles makes the source of the sound appear to emanate from a line (line source) rather than a point when viewed over some time interval. Since the change in surface area of a cylinder only increases by two times for each doubling of the radius instead of the four times associated with spheres, the change in sound level is 3-dBA per doubling of distance. Numerous methods have been developed to measure sound over a period of time. These methods include: (1) the community

noise equivalent level (CNEL); (2) the equivalent sound level (L_{eq}); and (3) the day/night average sound level (L_{dn}). These methods and additional noise related terminology is described below.

Community Noise Equivalent Level (CNEL)

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}). CNEL is a 24-hour, time-weighted, energy-average noise level based on dBA that measures the overall noise during an entire day. Noise that occurs during certain sensitive time periods is penalized for occurring at these times by adding decibels to its L_{eq} measurement. The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with the community response to noise.

Equivalent Sound Level (L_{eq})

The equivalent sound level (L_{eq}) is a measure of the steady state, A-weighted sound level containing the same total energy as a time varying signal over a particular time period (e.g., one-hour, eight-hour school day, nighttime, or a full 24-hour day). Because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing L_{eq}.

Conceptually, L_{eq} may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level with its normal peaks and valleys. It is important to recognize that the two signals (the constant one and the time-varying one) would sound very different from each other if compared in real life. Variations in the "average" sound level suggested by L_{eq} are not an arithmetic value, but a logarithmic ("energy-averaged") sound level. Thus, loud events clearly dominate any noise environment described by L_{eq}.

Day/Night Average Sound Level (L_{dn})

The day/night average sound level (L_{dn}) is based upon the average noise level for a 24-hour period at a given location. It was adopted by the U.S. Environmental Protection Agency (EPA) for the evaluation of community noise exposure. The L_{dn} is calculated by averaging the L_{eq} measurements for each hour of the day at a given location after penalizing the sleeping hours (from 10:00 p.m. to 7:00 a.m.) by 10 dBA to take into account the increased sensitivity of people to noises that occur at night. The sound level exceeded over a specified time frame can be expressed as L_n (i.e., L_{90}, L_{50}, L_{10}, etc.). L_{50} equals the level exceeded 50 percent of the time, $L_{10,}$ ten percent of the time, etc.

Maximum Sound Level (L_{max})

The maximum sound level (L_{max}) measured over during a particular time period.

Noise (Exposure) Contours

Noise (exposure) contours illustrate (typically a line drawn on a diagram/map) a noise source indicating constant levels of noise exposure. CNEL contours are frequently utilized to describe a community's exposure to noise.

Sound Propagation and Attenuation

For purposes of sound propagation, noise sources may be classified as point sources or line sources. Point sources usually are localized, such as a piece of machinery, and at a distance, sound from such sources will propagate in a spherical pattern. Sound levels from point sources will attenuate or drop-off at the rate of 6 dB for each doubling of distance. Sound from line sources, such as a highway, propagates in a cylindrical pattern. Sound from line sources will attenuate at a rate of 3 dB per doubling of distance.

Additionally, sound levels also may be attenuated by air and ground absorption, and from shielding by natural or manmade obstacles in the sound path. Noise barriers (walls or earth berms) are features that are commonly constructed to interrupt noise propagation and reduce noise levels. Wind and atmospheric temperature inversions also influence sound propagation.

Vibration Characteristics

Vibration is a unique form of noise. It is unique because its energy is carried through structures and the earth, whereas, noise is simply carried through the air. Thus, vibration is generally felt rather than heard. Some vibration effects can be caused by noise; e.g., the rattling of windows from truck pass-bys. This phenomenon is related to the coupling of the acoustic energy at frequencies that are close to the resonant frequency of the material being vibrated. Typically, ground-borne vibration generated by man-made activities attenuates rapidly as distance from the source of the vibration increases. Vibration, which spreads through the ground rapidly, diminishes in amplitude with distance from the source. The ground motion caused by vibration is measured as particle velocity in inches per second and, in the U.S. is referenced as vibration decibels (VdB).

The vibration velocity level threshold of perception for humans is approximately 65 VdB. A vibration velocity of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. Sources within buildings such as operation of mechanical equipment, movement of people or the slamming of doors causes most perceptible indoor vibration. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel wheeled trains and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is barely perceptible. The range of interest is from approximately 50 VdB, which is the typically background vibration velocity, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings.

Purpose of the Noise Element

The Noise Element is a mandatory element of the General Plan (California Government Code Section 65302 (f)). The State, recognizing the effects of noise upon people's health and well being, required that local jurisdictions prepare statement of policy indicating their intentions regarding noise and noise sources, establish desired maximum noise levels

according to land use categories, set standards from noise emission from transportation facilities and fixed-point sources, and prepare a program for implementation of noise control measures.

The major purposes of the Kern County Noise Element are to: (1) establish reasonable standards for maximum desired noise levels in Kern County, and; (2) develop an implementation program which could effectively deal with the noise problem. Considerable research has been done to determine the effects of various sound pressure levels on human health and on the successful performance of various human activities. It is known that noises of 120 dB(A) and higher will cause ear pain in most people; much lower levels may have permanent adverse effects on hearing.

Per Government Code 65302(f):

(1) A noise element shall identify and appraise noise problems in the community. The noise element shall analyze and quantify, to the extent practicable, as determined by the legislative body, current and projected noise levels for all of the following sources:

    (A) Highways and freeways.
    (B) Primary arterials and major local streets.
    (C) Passenger and freight online railroad operations and ground rapid transit systems.
    (D) Commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation.
    (E) Local industrial plants, including, but not limited to, railroad classification yards.
    (F) Other ground stationary noise sources, including, but not limited to, military installations, identified by local agencies as contributing to the community noise environment.

(2) Noise contours shall be shown for all of these sources and stated in terms of community noise equivalent level (CNEL) or day-night average level (Ldn). The noise contours shall be prepared on the basis of noise monitoring or following generally accepted noise modeling techniques for the various sources identified in paragraphs (1) to (6), inclusive.

(3) The noise contours shall be used as a guide for establishing a pattern of land uses in the land use element that minimizes the exposure of community residents to excessive noise.

(4) The noise element must include implementation measures and possible solutions to existing and foreseeable noise issues. Further, the policies and standards must be sufficient to serve as a guideline for compliance with sound transmission control requirements.

The Governor's Office of Planning and Research 2015 draft General Plan Update Guidelines states; "The purpose of the noise element is to ensure that a local planning

area limits the exposure of the community to excessive noise levels in noise-sensitive areas and at noise-sensitive times of day. The noise element should cover the issues and sources of noise relevant to the local planning area. The element should utilize the most accurate and up-to-date information available to reflect the noise environment, stationary sources of noise, predicted levels of noise, and the impacts of noise on local residents. It should be as detailed as necessary to describe the local situation and offer solutions to local noise issues."

As part of this update process, it is Staff's intent to review our existing major noise sources to ensure areas of considerable noise pollution are adequately identified within our planning documents. Additionally, Staff will be evaluating how noise impacts are not only measured, but mitigated through the planning process to ensure the establishment of reasonable standards for maximum desired noise levels in Kern County.

SAFETY ELEMENT (Hazards)

According to the Governor's Office of Planning and Research 2015 Draft *General Plan Update Guidelines*, the aim of the safety element is to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from fires, floods, droughts, earthquakes, landslides, as well as other hazards and climate change impacts. Other locally relevant safety issues, such as airport land use, emergency response, hazardous materials spills, and crime reduction, may also be included. Some local jurisdictions have chosen to incorporate their hazardous waste management plans into their safety elements. The safety element overlaps topics mandated in the land use, conservation, and open space elements as development plans must adequately account for public safety considerations and open space for public health and ecological benefits often incorporate areas of increased hazard risk.

Per Government Code 65302(g), a safety element is for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence; liquefaction; and other seismic hazards identified pursuant to Chapter 7.8 (commencing with Section 2690) of Division 2 of the Public Resources Code, and other geologic hazards known to the legislative body; flooding; and wildland and urban fires.

The Safety Element shall include mapping of known seismic and other geologic hazards. It address evacuation routes, military installations, peak load water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards. As California confronts climate change impacts, effective planning measures should include comprehensive hazard mitigation and emergency response strategies that account for heightened frequency and magnitude of wildfires, floods, droughts, extreme heat, and coastal storm damage.

Since the 2004 General Plan was adopted two key pieces of legislation that have been adopted pertaining to the Safety Element. The first was Assembly Bill (AB) 3065 (Kehoe, 2004) General Plan: Safety Element – which revised safety element requirements for State responsibility areas and very high fire hazard severity zones. It required the safety element be submitted to the State Board of Forestry and Fire

Protection and to local agencies that provide fire protection to territory in the city or county. The second was Senate Bill (SB) 1241 (Kehoe, 2012) Land Use: General Plan: Safety Element: Fire Hazard Impacts See also AB 3065 (Kehoe, 2004), which revised safety element requirements for State responsibility areas and very high fire hazard severity zones and requires the safety element to take into account specified considerations, including the most recent version of the Office of Planning and Research's "Fire Hazard Planning" document.

As part of this General Plan Update process, Staff will comprehensively review the various required components of the Safety Element to ensure consistency with State law.

RECOMMENDATION

Therefore, IT IS RECOMMENDED your Commission (1) take public testimony; (2) receive and file this letter; (3) provide comments to Staff.

Sincerely,

LORELEI H. OVIATT, AICP, DIRECTOR
Kern County Planning and Natural Resources Department

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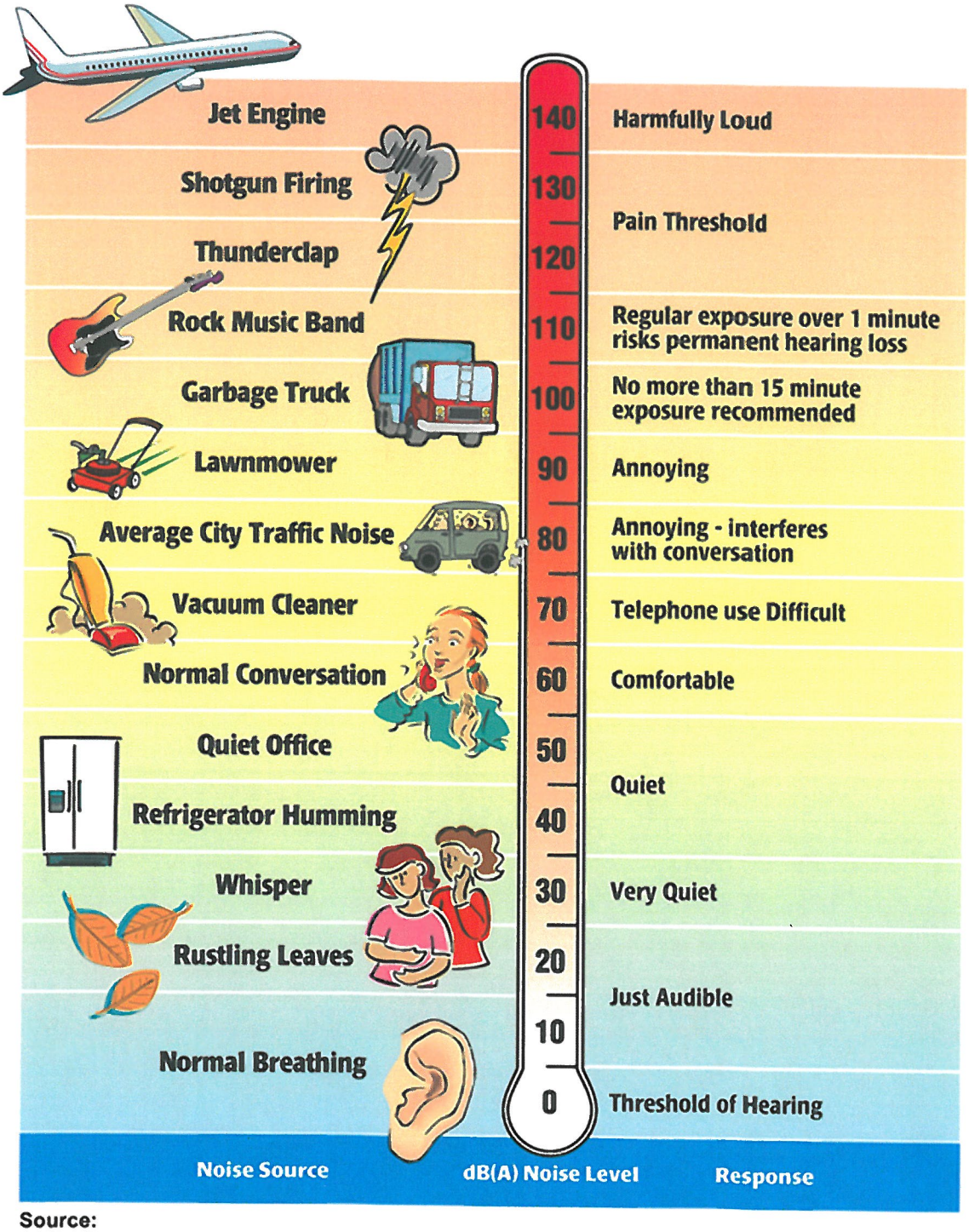
Attachment 1
Sound Levels and Human Response



Source:

Melville C. Branch and R. Dale Beland, *Outdoor Noise in the Metropolitan Environment*, 1970.

Environmental Protection Agency, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA/ONAC 550/9-74-004)*, March 1974.