

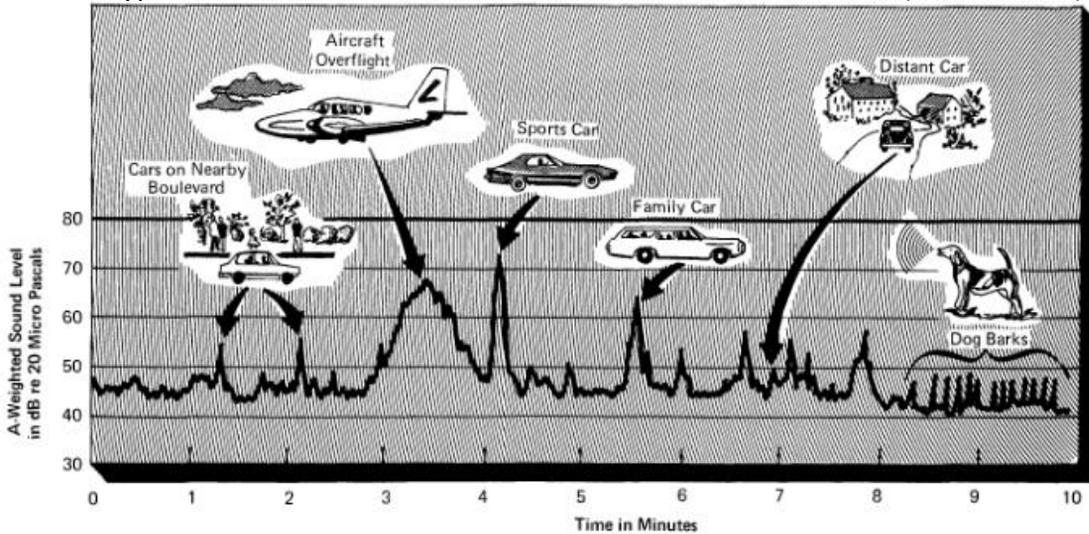


The Basics of Noise Metrics

Environmental sound is measured in dBA (Decibels, A-weighted), an international metric that is commonly used to assess environmental noise exposure

- Decibels (dB) measure the sound energy.
- The A-weighted scale adjusts the frequency content of the sound to approximate how noise is perceived on the human ear.
- As a rule of thumb, a **10 dB increase** is perceived as about **twice as loud**.

Typical Outdoor Sound Measured on a Quiet Suburban Street (Source: EPA¹)

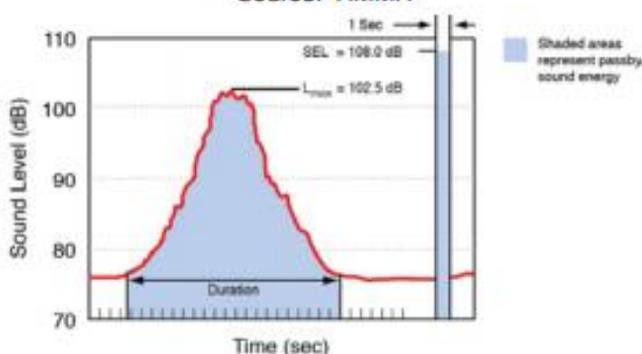


Single event noise metrics

- **L_{max}**: Maximum noise level of one noise event.
- **SEL** (Sound Exposure Level): total A-weighted energy of a noise event over its entire duration but compressed to one second. SEL will typically be higher than L_{max}.

Graphical Depiction of Sound Exposure Level

Source: HMMH



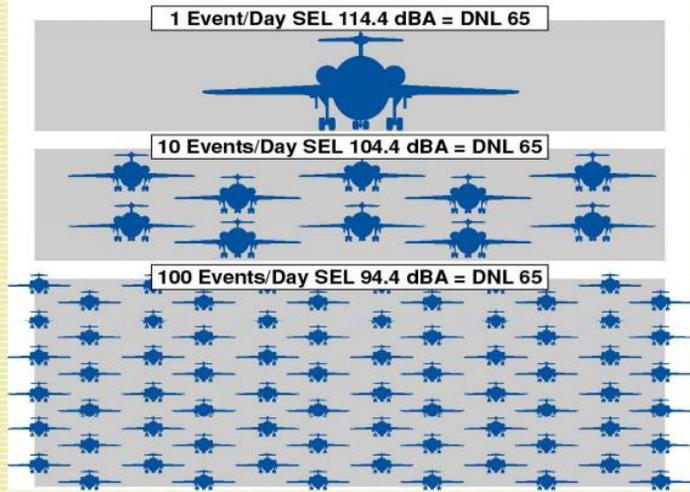
Average noise metrics

- **Leq** (Equivalent Noise Level): average sound level over a given time period.
- **LAeq** (also written as dBA Leq): same as Leq but A-weighted to approximate how the human ear would perceive the noise.
- **DNL** (Day-Night Average Sound Level) – also called **L_{dn}**
 - 24-hour time weighted energy average noise level
 - 10 dB penalty between 10pm to 7am to account for the higher sensitivity to noise at night due to lower background noise
- **CNEL** (Community Noise Equivalent Level): same as DNL but adds a 5 dB penalty between 7pm and 10pm. The FAA accepts the use of CNEL by California to assess noise effects.¹

¹ https://www.faa.gov/airports/environmental/environmental_desk_ref/media/desk-ref-chap17.pdf

Different DNL 65 Environments

Identical DNL Levels



Source: SFO Round Table²

SEL does not capture the repetitiveness of the sound exposure caused by many aircrafts flying over the same area. As shown on the left diagram, SEL decreases even though the number of aircrafts goes up.

WHO recommends that noise exposure does **not exceed 50 to 55 dB outdoors** and **30 to 35 dB indoors**³. Both values are **below the FAA noise threshold of 65 dB**.

World Health Organization - Guideline values for community noise in specific environments
(LAeq for "daytime" is 16 hours and LAeq "night-time" is 8 h)

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAm _{ax, fast} [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors Inside bedrooms	Speech intelligibility and moderate annoyance, daytime and evening	35	16	
	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoors	Sleep disturbance	30	sleeping-time	45
School, outdoor playground	Annoyance (external source)	55	during play	-

² SFO Community Round Table, Noise 101, Jul 2013

³WHO Guidelines for Community Noise, April 1999 <http://www.who.int/docstore/peh/noise/Commnoise4.htm>