

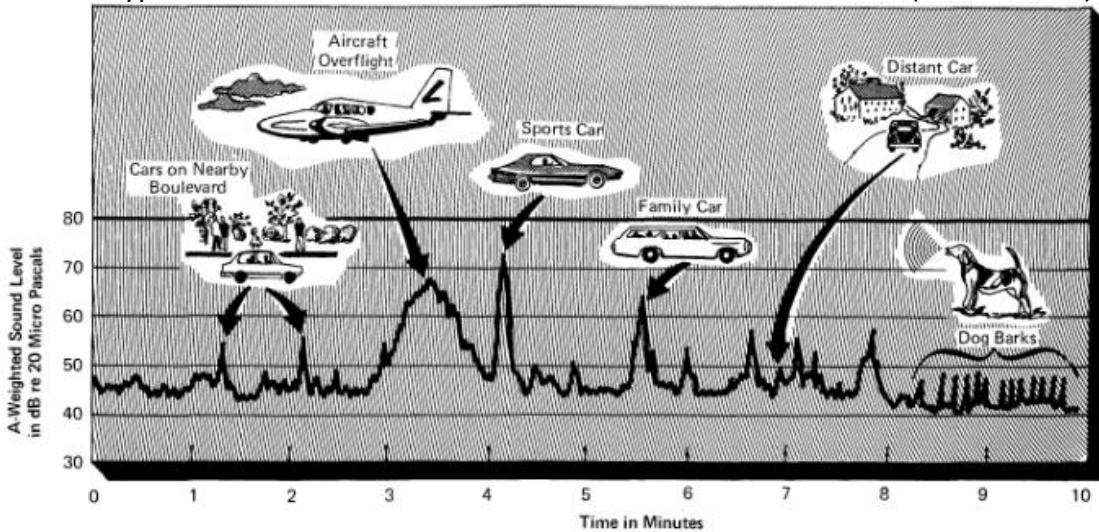


# The Basics of Noise Metrics

**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: EPA<sup>1</sup>)

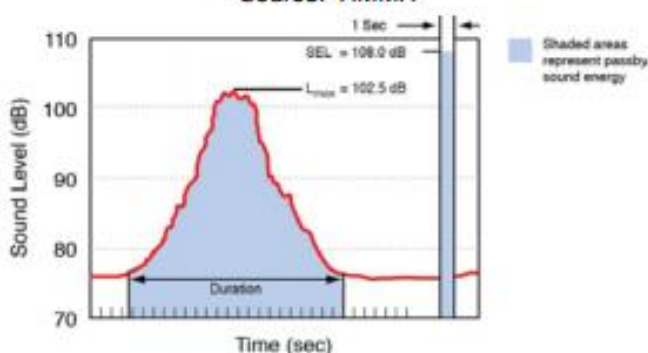


## Single event noise metrics

- **L<sub>max</sub>**: 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<sub>max</sub>.

### Graphical Depiction of Sound Exposure Level

Source: HMMH



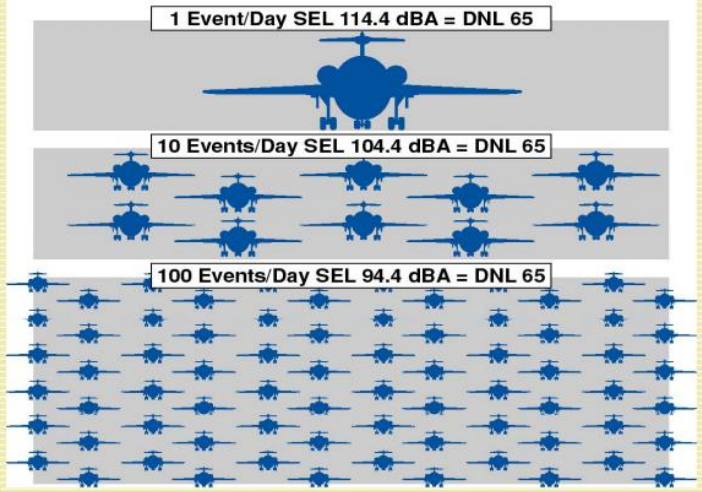
## Average noise metrics

- **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<sub>dn</sub>**
  - 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.<sup>1</sup>

<sup>1</sup> [https://www.faa.gov/airports/environmental/environmental\\_desk\\_ref/media/desk-ref-chap17.pdf](https://www.faa.gov/airports/environmental/environmental_desk_ref/media/desk-ref-chap17.pdf)

## Different DNL 65 Environments

Identical DNL Levels



Source: SFO Round Table<sup>2</sup>

**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**<sup>3</sup>. 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 <sub>ax, fast</sub> [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	-

<sup>2</sup> SFO Community Round Table, Noise 101, Jul 2013

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