

Logan Community Advisory
Committee Meeting
July 26, 2007

Noise 101
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What is Noise?

- Noise is unwanted sound
- Noise is temporary
- Annoyance is subjective

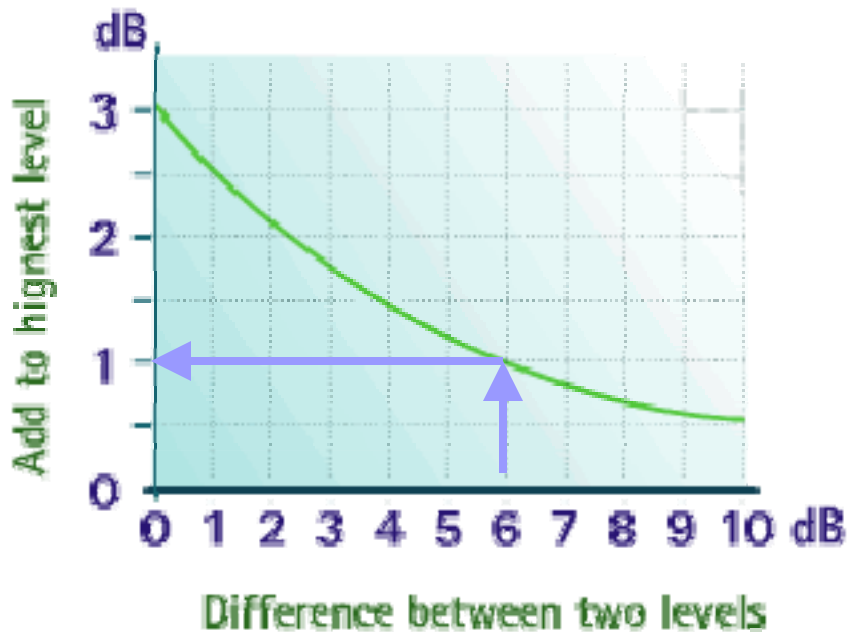
Decibels

- Decibels (dB) are the common unit of measurement for sound.
- The decibel scale is logarithmic, not linear
 - Smallest detectable change = 1 dB
 - 3 dB is readily noticeable in a lab environment, but harder to detect in the field
 - 10 dB seems twice as loud
- The human ear can detect a range from zero to more than 140 decibels, or across a range of 10^{14} sound pressure units



Decibel Math

Addition

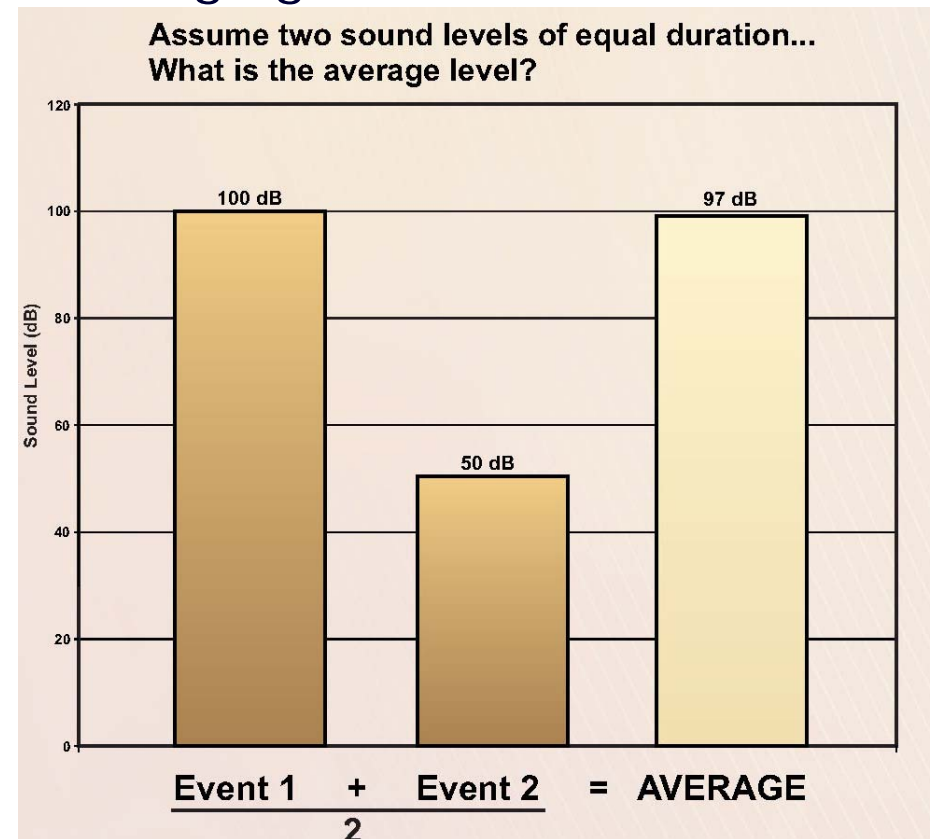


Example:

$$80\text{dB} + 74\text{dB} = 81\text{dB}$$



Averaging



Example:

$$100\text{dB} \text{ and } 50\text{dB} \text{ average to } 97\text{dB}$$

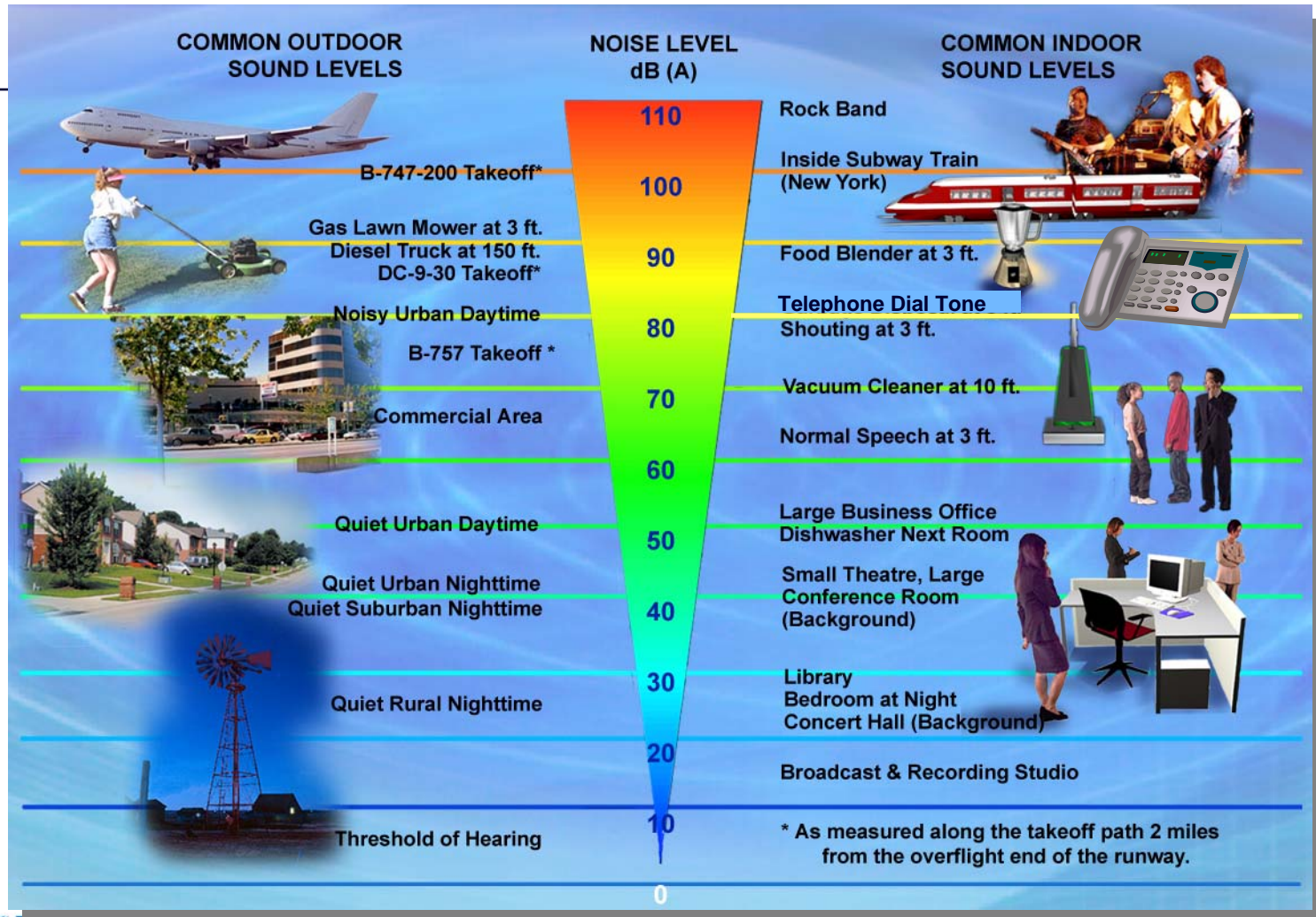


“Rules of Thumb”

- 3 dB is just noticeable to most people
- Adding two like sounds adds 3 dB increase
- Double or half the airport operations = +/- 3 dB
- 10 dB sounds twice as loud or twice as quiet
- Double or half the distance equates to 6 dB
- Using DNL, 1 night flight=10 day flights



Comparative Noise Levels (dB)





Noise Metrics

- Lmax - Maximum noise level
- SEL - Sound Exposure Level
- Leq - Equivalent sound level
- DNL - Day-Night average sound Level



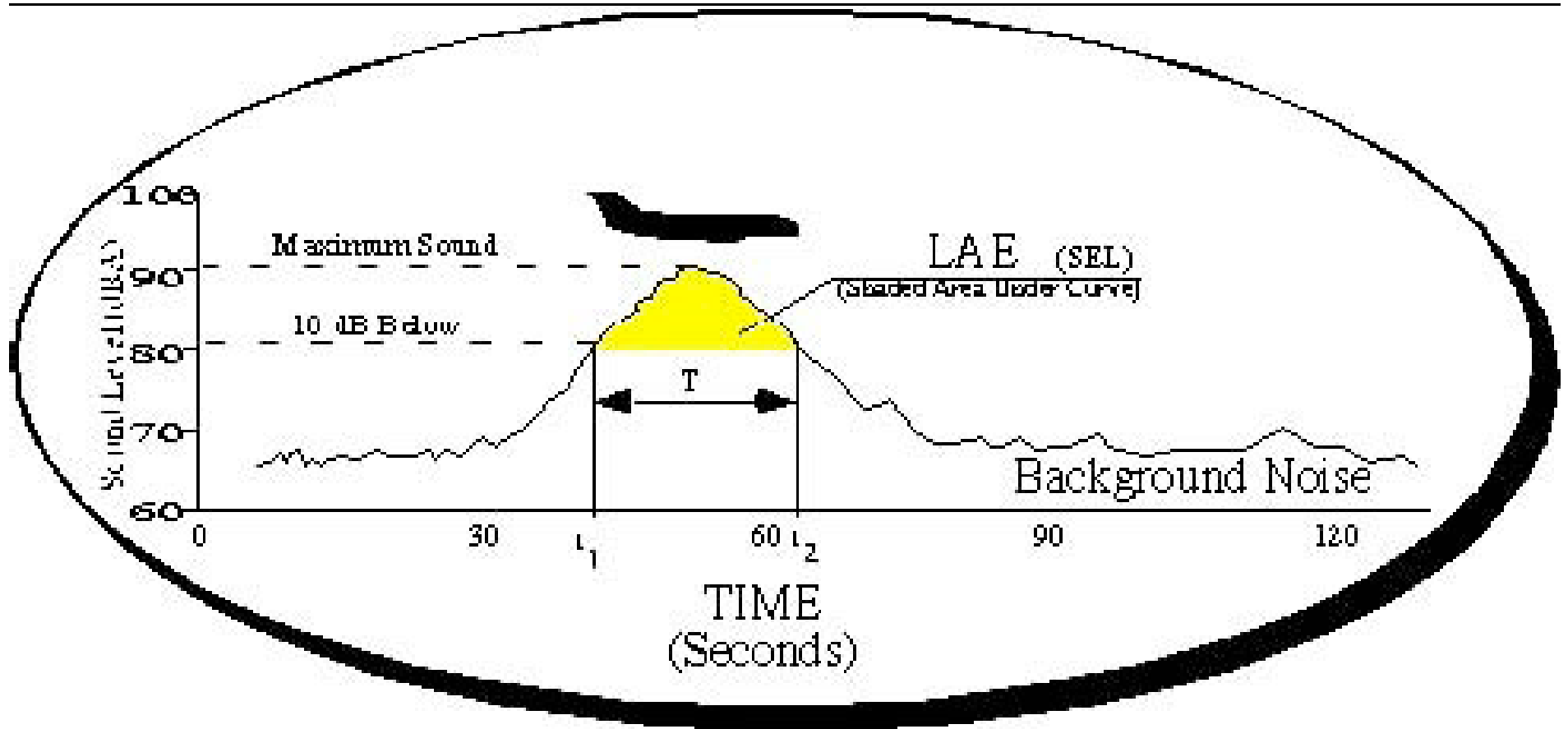
SEL

Sound Exposure Level

- SEL is a measure of the physical energy of the noise event compressed into 1 second. It takes into account both intensity and duration.
- SEL is typically used to compare noise events of varying durations and intensities.



A Typical Noise Event



Leq

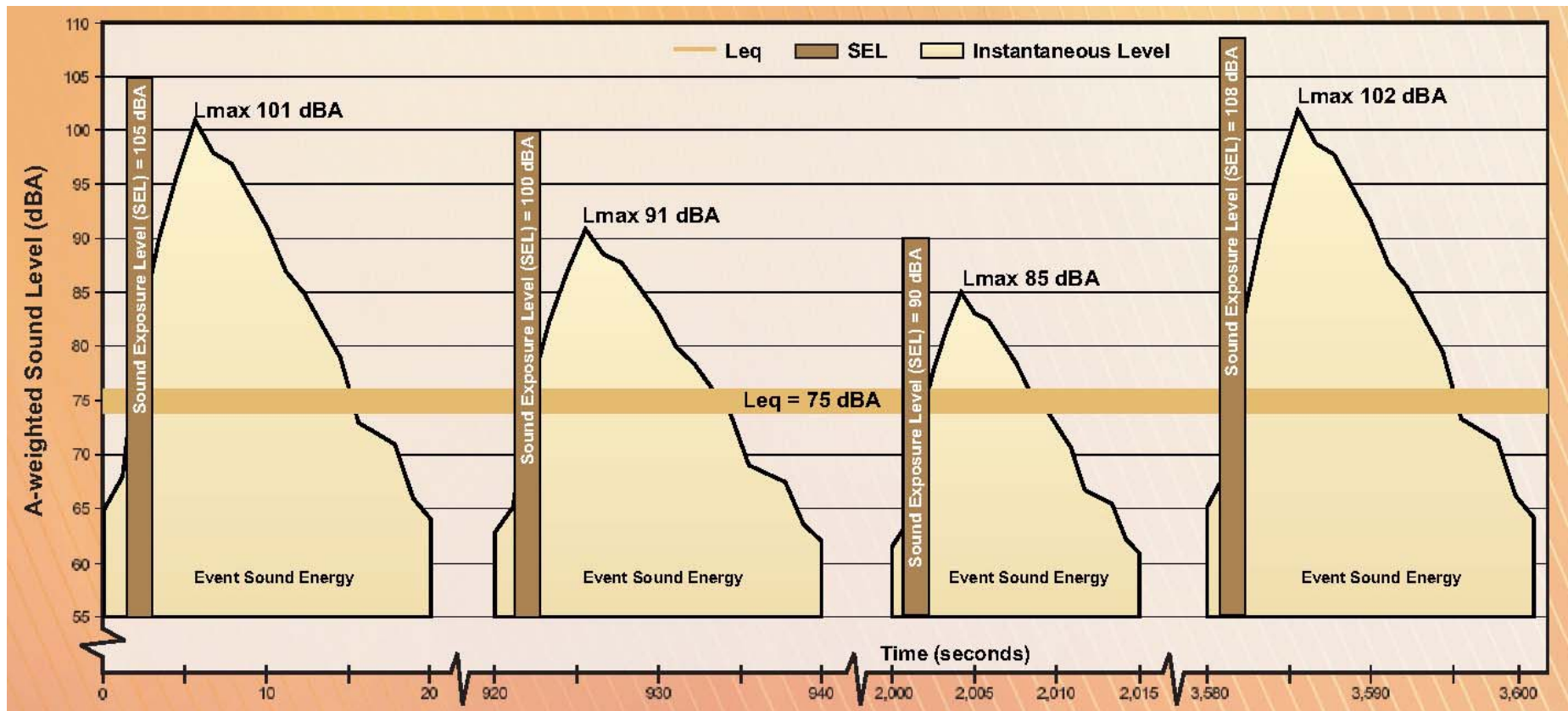
Equivalent Sound Level

- Leq is the steady A-weighted sound level over any specified period.
- Leq is used to identify the average sound level over a given period of time.

HOUR	NOISE LEVEL (dB)
8:00 AM	40.3
9:00 AM	44.7
10:00 AM	38.2
11:00 AM	47.6
12:00 PM	41.1
1:00 PM	80.4
2:00 PM	55.0
3:00 PM	49.5
AVERAGE Leq₈	71.4



Metric comparisons



DNL

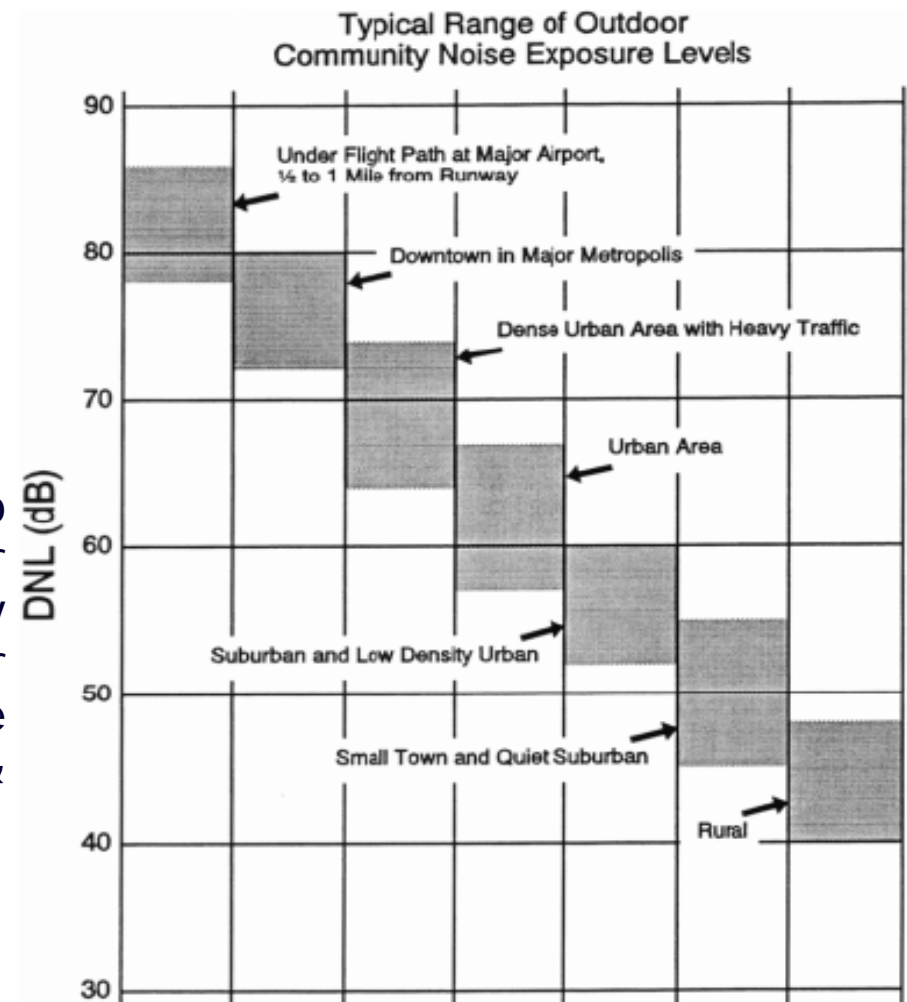
Day-Night Average Sound Level

- DNL is a 24-hour time-averaged sound exposure level with a 10 dB nighttime (10p-7a) weighting.
- $DNL = \frac{\text{Total Daytime Sound Energy} + 10 \times \text{Total Nighttime Sound Energy}}{\text{Time (in seconds)}}$
- DNL was selected by the EPA as the best metric to correlate with health and welfare
- All Federal agencies have adopted DNL as the metric for airport noise analysis.



Typical DNL Levels

- FAA has identified 65 DNL as the level where residential areas become incompatible with aircraft noise. A change of 1.5 DNL at 65 DNL is considered a “significant” change. (Other reportable changes are 3 DNL at levels of 60-65 DNL and 5 DNL at 45-60 DNL levels.)
- 65 DNL would be like listening to 70 dB (a vacuum cleaner), for 7hrs & 35 minutes during the day with 0 dB for the rest of the 24 hr period. 45 DNL would be like listening to the vacuum for 4min & 33 secs.



Integrated Noise Model (INM) and Noise Contours

- The required tool for calculation of aircraft noise contours in studies seeking to make noise mitigation eligible for Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) funding.

Ingredients – INM

- **Airport information - runways, temperature, airport altitude**
- **Where aircraft fly - flight tracks (definitions and usage)**
- **What aircraft are flown - fleet mix data**
- **How often they fly - operations levels – day/night (night=10dB penalty with DNL)**
- **What engines are used - hush kit information**
- **Where they fly from - runway usage**
- **When they fly - time-of-day characteristics**
- **How they are flown - climb/descent profiles**
- **Where they fly to - performance data**
- **Output includes Noise contours connecting points of equal noise exposure (typically 65, 70, 75 DNL), Tabular information, Noise levels at specific locations (grid point analysis)**

