

Noise Measurement

Evaluating the Occupational
Environment

HSCI 466B

Spring 2008

Review of Noise

- Pressure waves in air
- Units of measurement dB
- Adding decibels
- Noise PEL, HCA, TLV
- Noise dose

Averaging Exposure

- L_{eq}
 - Constant noise level for period measured
- L_{avg}
 - Constant noise level for criterion period (e.g. 8 hours)
- Noise dose
 - Calculated to evaluate compliance with a guideline

Noise Dose

- Sum of time exposed over time allowed.

$$Dose = \sum \frac{\text{Time exposed}}{8hrs / 2^{\frac{L-C}{E}}} \times 100$$

Compare Dose and L avg

$$L_{avg} = 16.61 \log\left(\frac{D, \%}{100}\right) + 90 \text{dBA (PEL)}$$

$$L_{avg} = 10 \log\left(\frac{D, \%}{100}\right) + 85 \text{dBA (TLV)}$$

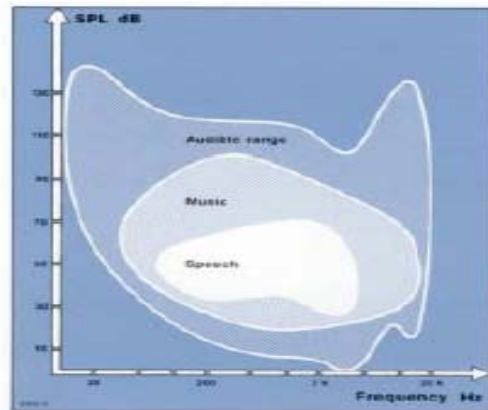
$$L_{eq} = 16.61 \log\left(\frac{D, \%}{12.5 \times t, \text{hours}}\right) + 90 \text{dBA (PEL)}$$

$$L_{eq} = 10 \log\left(\frac{D, \%}{12.5 \times t, \text{hours}}\right) + 85 \text{dBA (TLV)}$$

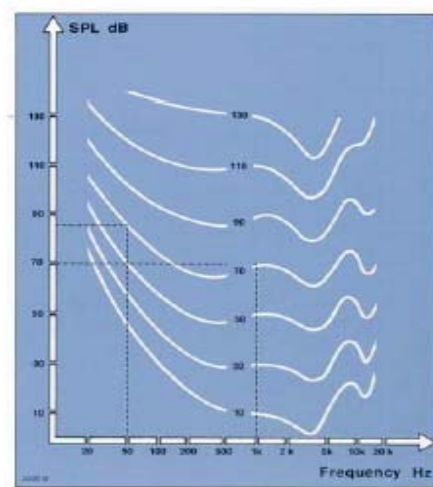
Noise calculation example

- Here is a scenario:
 - 2 hours of work, steady-state noise at 94.2 dBA
 - 2 hours of work, steady-state noise at 98.3 dBA
 - 4 hours of work, steady-state noise at 84 dBA
- Calculate dose, L_{avg} and L_{eq} for TLV and PEL.

How We Hear



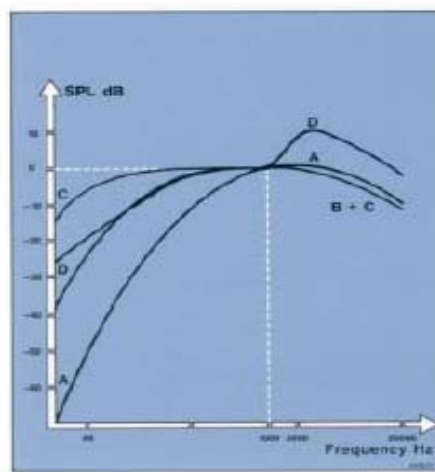
How We Hear



Sound Level Meter

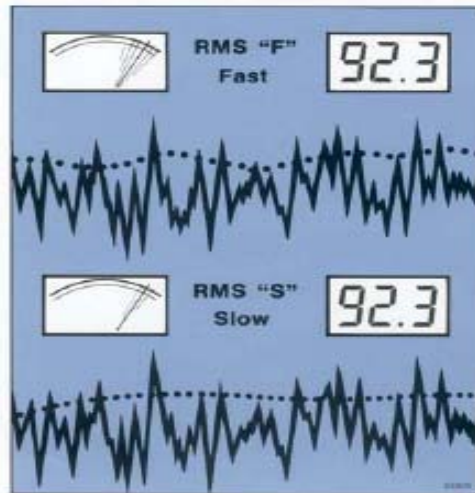
- Basic instrument
- Octave Band Filter
- Dosimeter

Weighting Networks



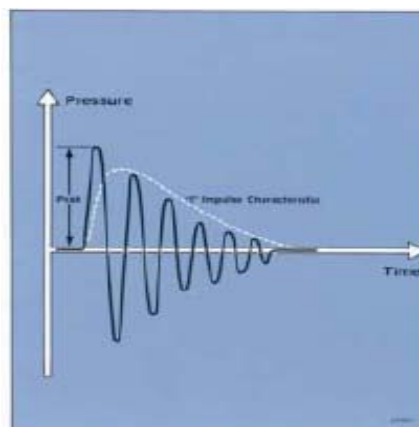
Fast and Slow Response

- Slow 1 sec
- Fast 125 msec

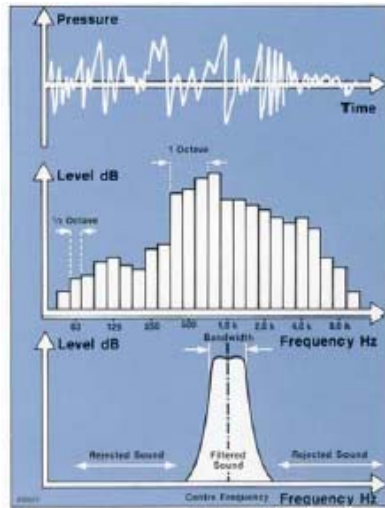


Impulse Meter

- 35 millisecond



Octave Band Filters



Types of Microphone

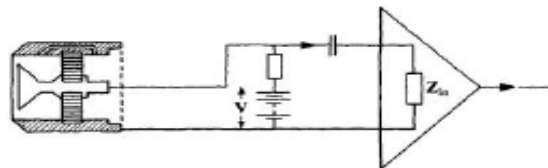
- Ceramic
- Condenser
 - Externally charged
 - Internally charged

Condenser Microphone



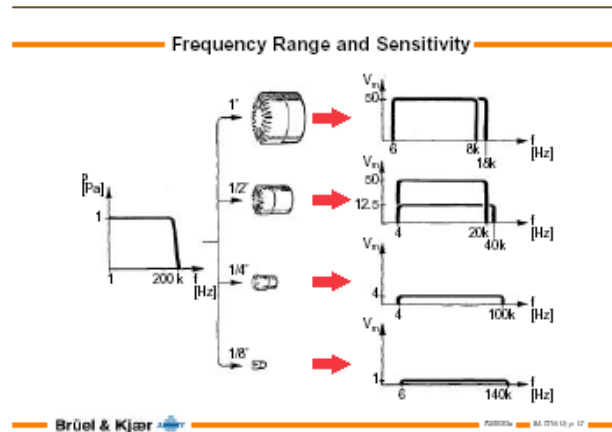
Condenser Microphone

Principle of Operation for
the Polarised Condenser Microphone

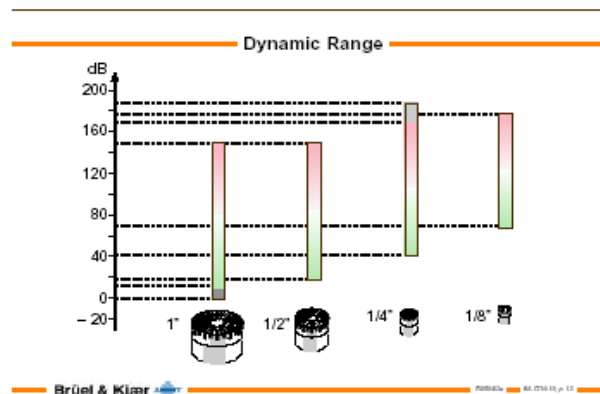


$$\left. \begin{array}{l} Q = CV \\ C = \epsilon \frac{A}{d} \end{array} \right\} \Rightarrow V = \frac{Q}{C} = \frac{Q}{\epsilon \frac{A}{d}} \Rightarrow \Delta V = \frac{Q}{\epsilon \frac{A}{d}} \Delta d$$

Condenser Microphone



Condenser Microphone



The Measurement Report

- A very important part of sound measurements is careful documentation of the measurements and results. A good measurement report should contain at least the following information:
 - A sketch of the measurement site showing applicable dimensions (e.g. size of room, machine dimensions), the location of the microphone and object being measured.
 - Standard(s) to which measurements are made.
 - Type and serial number of instruments used.
 - Method of calibration.
 - Weighting networks and detector responses used.

The Measurement Report

- Description of type of sound (e.g. impulsive, continuous, tones etc.)
- Background noise level.
- Environmental conditions (e.g. type of sound field, atmospheric conditions).
- Data on object being measured (e.g. machine type, load, speed etc.)
- Date when measurements were performed.

Noise Mapping

