7A Noise and Vibration - Glossary

7A.1 What Is Noise and Vibration?

Noise is often defined as unwanted sound, but technically noise is the perception of a series of compressions and rarefactions of the air above and below normal atmospheric pressure.

Vibration refers to the oscillating movement of any object. Noise is the term used to describe the vibration of air particles and the term vibration is usually used for the vibration of solid objects. Noise can lead to vibration of objects, and vibration transmitted through the ground can radiate from a surface into the air and be perceived as noise when it is referred to as ground-borne noise.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

7A.2 How To Measure and Describe Noise?

Noise is measured using a ‘sound level’ meter, designed to meet internationally recognised performance standards, which measures the Sound Pressure Level (SPL or L_0). The SPL is the sound level received in the environment and is distinguished from the Sound Power level (SWL or L_w) which is the sound energy produced by a source.

Audible sound pressure is measured in Pascals (Pa) and can vary from the threshold of hearing at about 20\mu Pa to the threshold of pain at 200 Pa (a range of 10^7 Pa). Because this is such a large range a logarithmic scale is used to measure sound pressure levels using a unit called the decibel (dB).

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in A-weighted decibels (dBA). The A-weighting scale is designed to match the average frequency response of human hearing and enables comparison of the intensity of noise with different frequency characteristics. Other scales such as dBC and dBLin are used to measure other features of noise, so for example dBLin (linear weighted dB) is typically used to measure the level of airblast caused by an explosion (see Section 7A.5).

To demonstrate how this scale works, the following points give an indication of how noise levels are perceived by an average person:

- 0 dBA represents the threshold of human hearing (for a young person with ears in good condition);
- 35 dBA is a typical quiet rural environment;
- 50 dBA represents average conversation;
- 70 dBA represents typical street noise, local traffic etc;
- 90 dBA represents the noise inside an industrial premises or factory; and
- 140 dBA represents the threshold of pain – the point at which permanent hearing damage may occur.

The human ear perceives changes in environmental noise levels as follows:

- differences in noise levels of less than 2-3 dBA are generally imperceptible;
- differences in noise levels of around 5 dBA are considered to be clearly evident; and
- differences in noise levels of around 10 dBA are generally perceived to be a doubling (or halving) of the perceived loudness of the noise.

7A.3 Statistical Noise Descriptors

As environmental noise levels tend to vary over time statistical noise descriptors are usually used to describe levels of environmental noise. Common parameters include:

- \( L_{A10,T} \) – The A-weighted sound pressure level exceeded for 10% of the measurement period T;
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7A.4 Other Noise Descriptors

In standard noise monitoring practice the following terms are used to describe the audibility of noise:

- **Inaudible / Not Audible** – the noise cannot be heard, or is masked by extraneous noise sources not associated with the source. An ‘inaudible’ noise will typically be 10dB or more below the measured LA90 background noise level;

- **Barely Audible** – the noise is difficult to define, or is masked by extraneous noise sources not associated with the source. A ‘barely audible’ noise may be 5 - 7 dB below the measured LA90 or LAeq noise level, depending on the nature of the source (constant or intermittent);

- **Just Audible** – the noise can be defined but other extraneous sources are present in the measurement;
- **Audible** – the noise can be easily defined; and
- **Dominant** – the noise is ‘louder’ than all other noise sources.

The temporal characteristics of noise can be described as:

- **Continuous** – the noise is constantly audible for the duration of the noise measurement eg an air-conditioner running continuously;
- **Intermittent** – the noise is audible but stops and starts at regular intervals eg cars passing by on a road;
- **Infrequent** – the noise is audible, but does not occur regularly eg occasional aircraft flying overhead; and
- **Impulsive** – sounds that significantly exceed the background sound pressure level for a very short duration, such as gun shots, hammer blows, explosions.

### 7A.5 Noise and Vibration from Blasting

Blasting is a particular source of impulsive acoustic effect and can cause both noise and vibration.

Noise is caused by the blast of air pressure radiating out from the blast and is commonly referred to as airblast or airblast overpressure. It is measured in decibels using the linear weighting scale dB (Lin), also referred to as dBZ and levels can typically reach 160 dBLin near the source.

Blasting also causes vibration through the ground and can affect structures causing cosmetic or structural damage and disturbance for people. Vibration is usually measured by the Peak Particle Velocity (PPV); that is the highest particle velocity which is recorded during a particular vibration event over the three dimensions. PPV can reach up to 1 000 mm/second near the source.

The level of airblast noise and vibration will depend on the size of the explosion and the distance to the measurement location. The size is usually represented by the Maximum Instantaneous Charge (MIC), that is the explosive charge mass (kg) detonated per delay (8 millisecond interval).