

NOISE MEASUREMENT

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Abstract

In the near future, noise will pose a serious danger to the quality of human life because of its rapid rise. Throughout the last 30 years, noise pollution has been on the rise, particularly in metropolitan areas. Due to a rise in noise pollution, there are a number of negative impacts on the human environment. There are three ways in which noise affects the human body: directly affecting the auditory system, indirectly affecting non-auditory physiological processes, and indirectly affecting psychological systems.

Keywords

Automobiles, Contamination, Environment, Noise levels, Pollutant

1. INTRODUCTION

Industrial activities or Automobiles generates pollution as a byproduct. In order to entirely eradicate the pollutant, it is almost impossible but may be regulated or minimized. Pollutants may be tolerated to varying degrees depending on their chemical composition. In order to ensure that the level of pollution does not continue to rise, it is vital to know the amount by which the legal limit has been surpassed. The pollutant must be measured in order to determine the extent of contamination. Because our auditory system is unable to detect gradual changes in noise levels, measurements are even more critical in the case of noise pollution.

For better living of the life in metropolitan region, noise pollution is a serious issue. Noise is a problem that affects everyone and is expected to be a big concern over the next twenty years. When it comes to noise we need to know where it comes from, how it affects us, and how we can measure it, as well as the dangers it poses to our health.

2. NOISE

The Latin word "Nausea" is the source of the term "noise." As a matter of law, it may be described as a continuous stream of excessive, infuriating noise.

"Noise is an undesired sound," say Vitals.

"Noise is an undesirable sound that increases tiredness and, under certain industrial situations, causes hearing," says Harrel.

3. NOISE MEASUREMENT

The characteristics of a noise field must be established in order to find the best ways of controlling it. In most cases, it is only feasible to quantify noise at specific spots in a noisy environment. To get an accurate picture of how noise is dispersed in the environment, a large number of measurements are needed.

The root-mean-square value of noise may be measured using a weighted logarithmic scale for air noise measurements.

A decibel (dB) reading on a sound-level meter is termed a sound level, and this instrument is called a sound-level meter.

In order to determine whether or not sound levels have been detrimental to health and welfare or have exceeded locally accepted legal limitations, it might be difficult to quantify them. According to the objective of the measurement and the precision required, a broad variety of measuring procedures and sound level descriptors are recommended by various professionals.

2.1 Sound measuring Devices

The easiest way to characterize noise is to measure the linear pressure level at the source in db. An adjustment may be made to the measured sound level in order to obtain a signal value that approximates the response of the human ear. The A weighting system is the most often utilized of the several weighting systems.[11] Since many standards are based on it and most noise meters can directly record dB(A) values, the dB(A) unit is nearly generally used for ambient noise assessment.

The degree of complexity and accuracy of noise monitoring instruments varies depending on the parameters being monitored. Sound level meters are classified into four categories by international standards. These are some of the things:

Type 0: Accuracy to the maximum degree that is possible in a lab

Type1: Precision

Type 2: To Put It another Way (Field use)

Type3: Lowest survey precision.

2.2 Measurement of Sound Level

The rms value of a sound's frequency content is measured with a sound level meter. For pure tones, an approximation to human hearing's degree of sensitivity to loudness was used to calibrate the decibel scale of the sound level meter, which was originally designed for this purpose.[12]

Logarithmic attenuation, frequency response (weighting) networks, and an indicating meter with a logarithmic scale are all components of a standard sound level meter. [13]Electrical signals generated by microphones when sound is present are weighed for frequency content by weighting networks before being displayed on a meter.

As a field instrument, sound level meters are typically battery-operated and self-contained. It is dependable, transportable, battery-stable, and small. The input impedance is high enough to minimize burden on microphones with high impedance. Most analyzers can be driven by this because of its low output impedance and high output level.

3. NATURAL FACTORS IN NOISE

Sound:

Acousticians describe sound as a feeling in the ear caused by changes in air pressure or vibrations. It's possible that one individual is more sensitive to a certain frequency than another. A logarithmic scale means that when two sources of 70 decibel (A) sound are combined together, the sound intensity is not 140 dB (A) but only 73 dB (A). When we say (A), we're talking about a weighting scale that mimics how we hear better at higher frequencies than lower ones.

Auditory energy in the frequency ranges from 20,000Hz to below 20Hz, which is characteristic of the human auditory system, constitutes sound to listeners. The power of a source is defined by the rate of energy flow per unit area, and the intensity of sound at a given place in space is determined

by this rate. The decibel scale is often used to represent the intensity of sound on a logarithmic scale because of the vast dynamic range of sound pressure (dB). Pascal (Pa) is the unit of sound pressure, while dB is the unit of sound pressure level. A noise's impact is substantially influenced by the frequency at which the sound pressure oscillates. As a result, noise measurement relies on spectrum analysis.

When anything is moving or vibrating at a high rate, it produces a vibration that may be picked up by the auditory system. Sound is a vibration that can be heard by the ears. Only a longitudinal wave motion can carry sound through the air. As a result, it may be described as the mechanical energy of a vibrating item communicated by pressure waves over a medium to the ears of humans and other animals.

The distinction between sound and noise is vital to the human ear, although from a physical perspective there is no difference. An undesired sound is referred to as "noise" in this context. Noise may have a negative impact on people's health and well-being in some conditions, although this is not always the case. According to the consensus of specialists, the physical properties of sound cannot be used alone to characterize noise. As a result, noise is defined operationally as audible acoustic energy that has an unfavorable effect on people's physical and psychological health.

4. CHARACTERISTICS OF SOUND AND NOISE

Sound waves are made up of a series of compressions and refractions of an elastic medium like air. The frequency and speed of propagation determine the amplitude, frequency, and propagation velocity of these waves. There is an equation that links the speed of sound (c) to the frequency (f) and the wavelength (λ).

There is a mechanical energy flow that goes along with a sound wave, and a unit area normal to the propagation direction is known as a unit area of sound intensity (I). As a vector, sound intensity may be specified in any direction. Root mean square of the sound pressure (p), static mass density of the medium (r), and speed of sound (c) in the medium all contribute to the sound intensity in a free sound field.

A source's overall sound power is measured in Watts, which is the total sound energy emitted per unit time (W). Eq. 2's sound intensity (in Watts per square meter) is often assessed in this way (W/m^2). Sounds are described by means of time-varying sound pressure, $p(t)$. Compared to the magnitude of the atmospheric pressure, the temporal variations in sound pressure, caused by sound are extremely small. The values of sound pressure between 10^{-5} and $10^2 Pa$ (or Newton per square meter, N/m^2 , according to SI are important to the human ear. Logarithmic scales are often used to describe the value of this variable since it spans such a vast range. Ten times a logarithm (to base 10) of the ratio between a sound's amplitude and its corresponding acoustic intensity is the definition of sound intensity. A dB-value may be used to indicate any acoustic quantity linked to sound energy, such as power or mean square pressure. A reference value must be agreed upon in order to create an absolute level. So, the dB-value of the sound pressure level (L_p) relies on the mean squared sound pressure (p^2), which has an internationally acknowledged value of $210^{-5} N/m^2$ (commonly reported in micro pascals, 20 Pa). In terms of sound power level and sound intensity level, 10-12W and 10-12 W/m^2 are the usual reference levels, respectively.

Frequency of a wave: how many times per second a phase of compression and subsequent period of rarefaction occur in the same wave?

Receptor: Noise receptors are the places where noise is measured. These areas include homes, hotels, business buildings, and parks; they're all considered noise receptors.

Threshold of audibility: The threshold at which sounds can no longer be heard at all. Hearing is considered normal if it falls between the range of zero to twenty-five decibels (dB).

Pitch: To put it simply, it is the degree to which anything sounds loud or quiet. Objects vibrate at a pace that determines their pitch. The frequency is the rate at which the object vibrates. The higher the pitch, the greater is the frequency.

Intensity: The physical size of a sound is determined by its volume. The loudness of a sound is based on its subjective or perceived magnitude. The loudness of a sound is primarily determined by its intensity, frequency, and length. It is a sound's perception. Numerous methods exist for estimating loudness based on physical measures. Sound pressure levels are most easily measured

by using a filter or network of filters that replicates the auditory system's frequency response (weighting circuits in sound level meters). In addition, a variety of methods for estimating loudness have been devised. Sone is the unit of measure for loudness, whereas phon is the unit of measure for loudness level. At least at levels over 40 phon or 1 sone, there is a unique connection between sone and phon (ISO 131, 1979a).

5. CONCLUSION

The distinction between sound and noise is vital to the human ear, although from a physical perspective there is no difference. An undesired sound is referred to as "noise" in this context. Noise may have a negative impact on people's health and well-being in some conditions, although this is not always the case. According to the consensus of specialists, the physical properties of sound cannot be used alone to characterize noise. As a result, noise is defined operationally as audible acoustic energy that has an unfavorable effect on people's physical and psychological health.

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