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The Legislative Aspect of Noise in The Republic of Kosovo and Human Health

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Abstract

In the truest definition of the word, noise is an obnoxious sound to the human ear, and noise in the home is an obnoxious sound and dangerous to one's health. Any vibration picked up by the human ear and brought on by any tool or activity utilized by humans is referred to be a source of noise. Noise is described as a detrimental sound in regulatory terms (in the EU according to Directives, in Kosovo according to the Noise Law) as well as an environmental sound that is produced by explicitly declared human activity. The side effects of these noises can be harmful to human health. Therefore, in such a setting, loud noises can result in a range of unfavorable feelings, including rage, dislike of things, discontent, helplessness, disability, sadness, anxiety, restlessness, exhaustion, and damage to the hearing organs, which can elevate blood pressure, among others. Unwanted sound is characterized as having a low pitch, whereas hazardous sound has a high pitch. The ecosystem in Kosovo and the entire world continues to be severely harmed by noise. Millions of individuals worldwide, particularly in big cities and nations with developed industries, are subjected to intolerable noise limits set by regulatory organizations. Although noise pollution and health protection are subject to regulation by regulatory bodies, Kosovo and many other nations might benefit from the implementation of these laws.

Keywords: Environmental, human health, sound, and regulating pollution from noise.

1. INTRODUCTION

There is no physical distinction between sound and noise when we discuss noise and its definition [4], [5]. Based on physical sound properties, noise cannot be identified. A common definition of noise is acoustic energy that has a negative impact on physical and mental well-being as well as social or material values. Many sounds that people hear in their daily environments are unpleasant or unwelcome. The degree to which a sound disturbs people frequently depends not only on the type of sound but also on how we respond to it (e.g., music).

There are sounds that constantly affect us by making us anxious, such as those produced by metal clanging; friction between various materials, and other similar sounds, therefore sound need not be loud to disturb us. These human worries frequently depend on when we hear the sound (night or day). In addition to disturbing and hurting people, sound (or "twang") can also harm or even start the disintegration of physical structures. Three areas of interest for sound as a physical phenomena predominate in engineering [1]:

→ Sound as a means of communication (speaking, music, warning, etc.),
→ Sound as a tool in medicine (diagnostic-ultrasound methods, etc.),
→ Sound like noise (psychological, sociological, etc.).

Types of noise pollution can be:
→ Noise from natural sources (lightning, storm, wind, water noise, etc.)
→ Man-made noise

In daily life, noise is intended to be man-made (artificially manufactured) sound because natural noises typically have no lasting effects.

2. MATERIALS AND METHODS

The amount of energy emitted by the source overall per unit of time is measured by the sound power amplitude. It is typically stated in octaves or thirds of octaves [2]. Since the noise source typically does not emit sound equally in all directions, focus and direction are important considerations. The frequency of the sound affects orientation [5]. Below the auditory range (audible at 20Hz), infrared sounds can be heard if they are intense enough. For example: Dizziness, instability, lack of concentration, and frequency resonance in various physiological organs can be brought on by lightning, volcanic eruptions, aircraft, rockets, air conditioning, thermostats, and more.

Rarely can infrared spectrum noise occur alone (without auditory noise or other vibrations in the vibration spectrum), it typically has small amplitude, and it typically has little long-term impact on people. If ultrasound is present at a level greater than 100 dB [10, 11], symptoms such as headaches, nausea, tiredness, irritability, delayed reflexes, fever, pale skin, and others may result.

Low-frequency oscillations known as vibrations frequently occur with infrared (such as electric drills), in which case they are transmitted by direct contact. Large frequency variations during vibrations can harm internal organs as well as bones, muscles, and blood vessels. Long-term exposure to vibrations that fluctuate (oscillate) can result in the so-called "Vibration disease," which manifests as joint and muscle pain, numbness in the fingers, and, in extreme cases, muscle atrophy.

Table 1. The sound intensity measured in Decibels (dB) [11]

Intensity sound	**Decibel (dB)**
Sound threshold (10-12 W/m2)	0
Whisper to yourself	10 dB
Hearing threshold	16 dB
Whispering	20 dB
Quiet house	25 - 35
Library	30 dB
Bedroom	35 dB
Background in a private office	35 – 40
Labor office	50 dB
The usual conversation in 1m	60 dB
The human voice in 1 m	55 – 60
Inside the car	70 dB Normal (legal limit)
The average radio or TV	70 - 90
City streets	80 dB Loud
Camion	80 - 90
Siren, buzzer, police nozzle	90 Possible consequences on human health
Car siren	95 dB Damages after 8h
Screams (1.5 m)	100 dB Very loud voice
Car (truck) without muffler	100 dB Damages after 2h
Rock band or orchestra out loud	100 - 120 - Hazard to human health
Large industrial compressors	110 - Hazard!

Within the constraints of the precision of the instrument and the method of measurement, acoustic noise quantities such as sound pressure (p), velocity (v), intensity (I), and others can be calculated.

There are many different measuring tools available for the measurement of these acoustic values, ranging from straightforward meters and sound phenomenon indicators to composite frequency and level analyzers. So, it is possible to practically measure properly and theoretically analyzes all-acoustic magnitudes, including the effective value of sound pressure, intensity, frequency, and the temporal function of sound pressure.

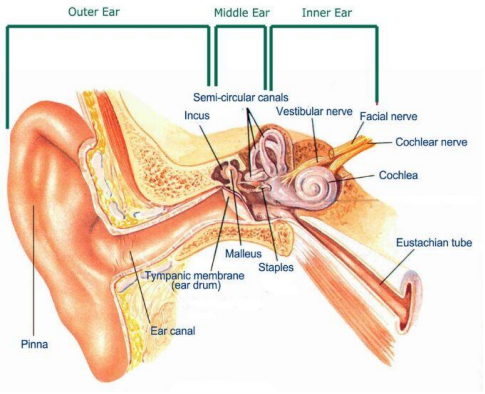
The human hearing system is primarily responsible for the acoustic magnitudes and noise sensitivity stated above (ear). Intensity as a physical quantity equates to power as a subjective quantity, whereas frequency corresponds to sound, and the ear bears these physical changes and transmits them with various auditory sensations to which man reacts in various ways [6]. The decibel (dB), which stands for intensity or pressure, is the unit for objectively measuring sound power.

The decibel measures the physical magnitude of sound, but depending on our hearing system's sensitivity and frequency range, our ears actually accept this magnitude and recreate it as auditory stimuli. Only a frequency of 1000 Hz, which is proportionately between the pain and hearing thresholds, has the ability to stimulate the ear.

However, for other frequencies of the listening range, the sensitivity is altered such that it is removed for frequencies between 16 Hz and 20,000 Hz.

Figure 1

Anatomy of the human ear



Unfortunately, the suppression of the sound that operates in the ear does not simply correspond to the sound that the ear hears and that is subjectively felt in the brain. It responds to sound with a variety of sound suppressions at various frequencies while maintaining the same subjective sensitivity to sound. Deep and high tones require more sound pressure to provide the same effect and volume of sound. In contrast, a tiny quantity of sound pressure is all that is required to generate the same level of sound intensity in the frequency range between 1000 and 4000 Hz [12], [13]. Noise distribution in urban areas:

a) Noise in the workplace
→ Noise generated by the device on which the employee works directly
→ Noise from other devices
→ Noise from so-called non-production sources, e.g., for ventilation and air (air conditioning) equipment, and sounds from the environment, e.g., traffic.
b) Noise in the environment
→ Traffic noise
→ Noise heard from industry
→ Road noise of different origins (cafeterias, sports fields, etc.)
→ Noise in households (from electrical and electronic equipment, from neighboring housing, etc.)

The entire living environment, including residential structures and workplaces, is measured for noise. The acoustic testing of various building materials, structures, and halls is done in the construction business using noise measuring equipment. Noise levels in manufacturing areas are measured in industry (facilities). In a home neighborhood as well as on the street, noise testing is crucial. Based on the testing results, it is possible to assess the harm and lessen the adverse consequences of noise exposure for a person in habitations or at work [3]. For screening reasons, sound level meters give instantaneous noise measurements (Figure 2). A sound level meter aids in locating noisy places during an initial walk around where full-shift noise dosimetry should be carried out [4].

Sound level meters are useful for:

→ Spot-checking of noise.
→ Determining a worker's noise.
→ Identifying and evaluating individual noise sources.
→ Evaluating the suitability of HPDs for the actual noise level in an area etc.

Figure 2

Sound Level Meter

Depending on the type of noise and the measurement method, there are various ways to measure it. In a rush to find the noise sources, measurements are made on both sides of the sources.

The maximum sound levels are simultaneously read on both sides. Sonometer is the name of the instrument used to measure noise (sono = sound).It is primarily found 8 meters from the central source, at a height of 1 meter. The sonometer is positioned 7 m to the left and right of the exhaust pipe when stopping cars are tested [8], [10].

The level of noise should be monitored and evaluated before the proper technology safeguards and medical treatments are implemented. The cost to investors of implementing technological noise control measures is tied to the promotion of material losses that have a direct impact on the economy, social situation, and policy. [11], [12].

a) In different workplaces, schools, and hospitals

→ There is an upper allowable limit of the noise level at which the human body will not suffer permanent damage.
→ When a person is exposed to noise at work time it leads to transient changes (decreased ear sensitivity, increased heart rate, increased blood pressure).
→ If exposure to noise does not follow after a normal period of rest, then the consequences are permanent and seriously damage health.

b) Outside the workplace

→ People are psychologically sensitive to noise during the holidays, which is especially sensitive at night due to the impact on sleep.
→ The biggest and so far, most unresolved problem is the proximity to roads and holiday homes.
→ There are several legislative measures regulating noise, among others and means of transport, that are difficult to apply, but most of these regulations remain only on paper.
→ Noise sources and propagation
→ Sound comes from the noise source.

→ Noise also has the characteristics defined at its source: spatial, temporal, and acoustic.
→ The movement of sound in trajectories is related to its propagation that is determined for each case separately.
→ The sound receiver is the ear.

Hearing loss begins at high frequencies at an intensity of 80 dB, and at low and middle frequencies at an intensity of 90 dB. These are the maximum noise levels that should be tolerated by employees at work.

According to what was previously stated, it is expected that the worker is only exposed to noise during working hours and that he relaxes in a calm setting after work. On a daily basis, we experience noise levels of up to 35 dB in apartments and up to 45 dB on the street (this type of noise depends on many factors such as noise during the day or at night, e.g. Noise during the day does not exceed 60-70 dB, in schools up to 40 dB, and hospitals 30 dB).

Specific guidelines on allowable intensity are established by noise protection rules and regulations, which differ from country to country. Noise is typically an unpleasant sound. What is noise for most, for an individual may not be understood as such and vice versa?

The negative outcome is not solely attributable to the distinction between these two phenomena. Regardless of whether it qualifies as sound or noise, hearing loss will result if the volume surpasses specified sound thresholds.

However, if the speech is heard as noise below this threshold, it may have negative effects on his health since it works as an unwelcome obstruction. There won't be any bad effects on our health if sound that is below a particular threshold is not considered noisy but rather desirable.

Physically speaking, the reference sound volume at a pressure of 20 micro Pascals (0.02 mPa) corresponds to the same pitch as the noise level represented in decibels [7]. However, it has been noted that depending on how this value varies, it might have various affects on people. Consequently, the time characteristic must be considered while discussing noise.

The average noise height observed over the time interval at which the real heights are tallied and measured can be determined by adding together all of the high current sound levels, obtaining them with enough density, and dividing them by their number. The power per unit area that a wave carries is what is referred to as intensity. Power is the rate at which a wave transfers energy. I=P/A, where P is the power through area A, is the formula for the intensity. W/m^2 is the SI unit for I.

The following equation relates a sound wave's intensity to its amplitude squared: I= (Δp) 2/ 2vw.

Here, Δp is the pressure variation or pressure amplitude, expressed in Pascals (Pa) or Newtons per square meter (N/m2).

It is half the difference between the maximum and minimum pressures in the sound wave. (To differentiate pressure from power, which is represented by the capital P above, we use a lower-case p.)

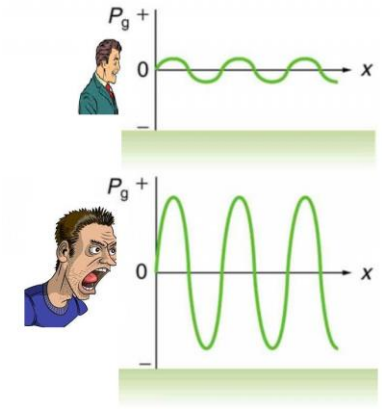
The energy of an oscillating air particle caused by a traveling sound wave is proportional to its amplitude squared (measured as kinetic energy, mv2/2).

In this equation, ρ is the material's density, expressed in kilograms per square meter, and v is the sound wave's velocity in the medium, expressed in meters per second. The pressure variation is proportional to the amplitude of the oscillation, and so I varies as (Δp)2 (Figure 3).

This relationship is consistent with the idea that a vibration is what causes the sound wave to occur; the louder the sound is produced, the more compressed the air is. Depending on how it is produced and how long it lasts, noise can take many various forms. The relationship between the noise's duration and pitch's temporal form may be seen. When the altitude remains constant over time, it becomes the simplest form (e.g., transformer noise). The difference depends on whether the pitch changes rhythmically or irregularly for all types of changing noise (at a slow pace or a fast pace).

Figure 3

Graphs of the gauge pressures in two sound waves of different intensities



The rhythm of the beats can be regular or erratic, slow or fast. The subjective sensitivity of noise that has been experienced by man is the foundation for the classification of noise according to the temporal form of its height. The man responds differently to noise that is consistent and differently to noise that changes [9]. In general, we might say that the noise spectrum consists of the current spectrum, which is the spectrum that is present right now.

As a result, the term "moment" refers to a very little period of time and is associated with the characteristics of the instrument used to measure the spectrum. The average value of the present spectra over a considerable amount of time is the mean spectrum. As a result, when we discuss the noise spectrum, we take into account that it evolves over time.

Three different spectrum types exist:

→ Discontinuous linear spectrum (detached), which contains only the basic periodic components.

→ Continuous spectrum, which contains all possible components in a certain frequency range.

→ Combined spectrum, which is a combination of the previous two spectra.

3. DISCUSSION

The Republic of Kosovo's Law No. 02/L-102 on Noise Protection is designed to lay out steps to prevent and lessen the effects of noise on the environment and human health. Kosovo-level strategic planning, the construction of noise maps, and the preparation of an action plan for taking steps to decrease noise exposure. This law's goal is to avoid, mitigate, or reduce adverse effects, including nuisance brought on by environmental noise exposure, on a priority basis. This law will serve as the foundation for the implementation of measures to minimize the noise released by significant sources, particularly those associated with the road, rail, air, outdoor and industrial equipment, mobile machinery, and other sources of noise pollution and environmental annoyance. Any noise that exceeds the permissible limit values, which will be established by a specific normative act, when regarded from the perspective of time and the location where the noise originates, including where people work and live, is considered to be hazardous to human health under this law.

4. CONCLUSIONS

Acoustic pollution, which creates unwelcome sounds, should be addressed to improve workplace comfort. A combined noise level that is 3 dB higher than the individual values of two noises of the same intensity is possible. The total noise level decreases, as the difference between the two distinct noise sources increases. The same type of noise might cause distinct reactions in different persons. Although hearing is a necessary skill for survival and interpersonal connection, not all noises are pleasant. Noise, which is the term used to describe unwanted sounds, typically results from human activities like traffic, industry, or housework. Particularly bad noise pollution is found in developing nations like our own. The noise that comes from vehicle traffic is the main cause of noise pollution, particularly in recent years.

In locations with high concentrations of traffic, daytime acoustic pressure levels can exceed 70 dB and even higher values. Noise at 90 dB has no discernible impact. Unprotected ears are not permitted for exposure above 115 dB since it could cause hearing loss. The noise level is notably higher during the spin phase since the washing machine turns between 80 and 70 dB louder and at a much faster rate. However, throughout the washing process, washing machines produce between 60 and 45 dB of noise. Human health is negatively impacted by increased noise pollution, and continual noise in the workplace is particularly detrimental. The most frequent impacts of noise on mental illness are disturbance and discomfort. We are bothered by noises when we are trying to relax or converse, as well as when we are working and doing other things.

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