COMPARATIVE STUDY OF SOUND POLLUTION IN MINING CARRIERS OF SURFACE JILT AND BERBESTI

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ABSTRACT: Noise pollution is a topical issue worldwide, along with atmospheric pollution and waste management. The technical evolution also brought with it an important source of noise pollution. Noise is considered a "by-product of technological metabolism", which is the most important discomfort factor for the population. EU law requires authorities to inform the public about the impact of noise pollution and to consult with them on the measures they intend to take to limit noise pollution. In this way, citizens can see what are the real improvements brought about by the noise management measures and will be able to speak to the elected representatives if necessary.

KEY WORDS: pollutants, parameters, noise level monitoring

1. INTRODUCTION

The anthropic activities specific to the surface mining quarries and the machines used for these activities are:
- works of opening and preparing the deposits
- exploitation works
- transport and haulage works
- refurbishment and rendering works in the natural circuit of the affected surfaces.

Vibrations are dynamic phenomena that can be encountered in all daily activities and everything around us [3]. There are vibrations at the heartbeat, sporting activities, walks, rocking the trees, earthquakes from buildings to earthquakes, musical instruments, machines and machines used in industry, etc. Vibrations can be unwanted movements that produce noises or high mechanical demands. The vibrations have negative effects on the environment, people, cars and buildings. We define vibration as mechanical oscillations of solid bodies that are transmitted directly to the human body, of frequencies, amplitudes of different accelerations and speeds, continuous or discontinuous products of fixed machines, means of transport, etc., during the exercise of professional activity. The vibrations are transmitted to the entire body of the worker through the lower limbs (when the worker stands on a shaking surface) and of the spinal region (when the worker is in the sitting position). The reception of vibrations is made according to their frequency.

Vibrations, depending on the cause that produces or sustains the movement, can be classified as follows:

a) free vibrations caused by an initial impact or displacement;

b) forced vibrations, products of external forces or kinetic excitations;

c) parametric vibrations - due to the variation, produced by an external cause, of a parameter of the system;

d) self-excited vibrations - produced by a mechanism inherent in the system, by the conversion of an energy obtained from a constant energy source over time.

In order to be able to control the level of the vibrations, it is necessary to know their frequency and amplitude. These elements have negative effects on the good operation of the machines and the machines affecting the degree of wear and the precision of work. Exceeding the maximum permissible limits of vibration has negative influences on human

health. They can lead to reduced work productivity but also to certain medical conditions such as injuries to parts of the body, pain, etc.

2. SOURCES OF PHONIC POLLUTION AND VIBRATION PROTECTION

Coal mining in Jilt and Berbesti surface mining quarries is done using rotary excavators. Coal and tailings are transported using belt conveyors of different capacities. Belt conveyors used in quarries can be stationary or non-stationary. Welding of the sterile material is carried out with the help of welding machines [4].

The category of **fixed sources** includes high-capacity, continuous-acting machines for excavating, transporting and dumping mining:

- excavators with rotor type ERc 1400 and EsRc 470;
- welding machines type A2Rs 6500.90;
- stacking machines, T.2053;
- removing machines, T.2052;
- conveyor belts.

In the category of **mobile sources** are included: bulldozers, dumpers, bucket loader, compactor, excavator, tractor, etc.

The noise emissions from mobile sources in the analyzed area appear as a result of the following activities:

- supply of material and spare parts at the work point on the technological flow with automotive means;
- pickling the tops of the hills by "continuous flow extraction technology with classic machines and car transport" to achieve working conditions for rotor excavators.

Employed personnel will generally be most exposed to the action of noise and vibration. Knowing the level of exposure to noise is important because in addition to the effects mentioned above, noise has the effects of decreasing work capacity, decreasing accuracy and efficiency of movements, increasing the energy costs required to perform a given physical effort.

Also, noise is an important cause of the frequency and number of work accidents increase by preventing the perception of sound signals, decreasing and distracting attention, disturbances of balance, visual disturbances (attenuation of the perception of colors and shapes).

Noise can produce two types of adverse effects on exposed personnel:

- optical effects (specific);
- extra-otic (non-specific) effects.

Specific effects from the auditory analyzer level consist of the deafness and the professional hearing loss, conditions that are in most countries in the first three places in the hierarchy of professional diseases.

The professional hearing loss represents the permanent decrease of the hearing threshold at the frequency of 4000 Hz with over 30 dB, after applying the presbyopia correction. Professional deafness represents the permanent decrease of the threshold at conventional frequencies (500, 1000, 2000Hz) with over 25dB inclusive, after applying the presbyopia correction.

For a correct presentation of the different aspects related to the noise produced by different installations or machines, three levels of observation must be considered:

- noise at the source;
- near field noise;
- noise in the far field.

Each of the three levels of observation corresponds to its own characteristics.

In case of noise at the source, the study of each equipment is done separately and is supposed to be placed in the open field. This phase of the study allows to know the intrinsic characteristics of the source, regardless of its working environment.

If, in the case of the first two levels of observation, the acoustic characteristics are closely related to the nature of the machines and their arrangement, the noise in the distant field, that is to say several hundred meters from the source, depends to a large extent on

additional external factors such as: wave absorption acoustic by the soil, phenomenon called "soil effect", air absorption, pressure dependence, temperature, relative humidity, spectral noise component, terrain topography; vegetation.

In general terms, the impact of ambient noise and vibration may vary within wide limits, depending on the distance to the inhabited areas or certain buildings sensitive to noise and vibration. In addition, the perception of an impact that is likely to cause discomfort (ie, at a level where noise or vibration may interrupt the normal course of daily activities) is highly subjective, varying to a large extent, depending on the personal perception of each receiver. In this regard, a permanent communication will be considered with the residents of the surrounding areas and with the authorities involved in order to improve the practices of noise and vibration management.

Regarding the activity of the mobile machinery on the site, as it is carried out in open spaces, no arrangements are necessary to attenuate and reduce the level of noise and vibration than the specific ones for the regulation and good functioning of the engines [1,2].

For the calculation of the noise level resulting from the machines and means of transport the following relation can be used:

$$L_p = L_w - 10log(r^2) - 8 \quad (1)$$

Lp - noise level

Lw - acoustic power

r - distance from the source of noise (used in the case of propagating noise from a point source on a flat ground).

Based on the data regarding the acoustic power and the relation mentioned above, provided in the Guide on the development, analysis and evaluation of strategic noise maps, one can determine the noise levels resulting from the used machines and means of transport, at different distances from the source of noise.

3. NOISE LEVEL RESULTED FROM THE EQUIPMENT USED FOR PERFORMING DIFFERENT CATEGORIES OF WORK

In the Berbesti mining quarry the noise level resulting from the equipment used for coal extraction/transport is presented in table number 1.

Table 1

Distance to noise source (m)	Bulldozer	Excavator	Loader	Dumper	Compactor	Tractor	STAS 10009/2017
50	73 dB	75 dB	70 dB	65 dB	64 dB	68 dB	65 dB
100	67 dB	69 dB	64 dB	59 dB	57 dB	62 dB	
200	61 dB	63 dB	58 dB	53 dB	51 dB	56 dB	

From the analysis of this table it is observed that each time the distance from the noise source doubles, the acoustic pressure level. decreases by 6 dB. From the presented data it results that the noise pollution has significant effects only in the vicinity of the sources working in the career, not affecting the neighboring local communities.

Only the activity of car transport, when the vehicles pass through localities can produce disturbing noises.

Regarding the activity of excavation, transport and wastewater equipment, on the site, since it is carried out in open spaces, no arrangements are necessary to attenuate and reduce the level of noise and vibration than the specific ones of good maintenance and operation [5].

Regarding the fixed sources, the noise levels are presented in table number 2.

Table 2

Nr. crt.	Monitoring point	Measured value (dB)	STAS 10009/2017
1	Access road T 703	52	65 dB
2	Access road T 704	62	
3	Access road to coal depot	58	
4	Headquarters platform	59	

Noise level resulting from the excavation, transport and haulage activity at the inhabited boundary, located at a distance of approximately 200 m (the minimum distance between the inhabited area and the area of technological flows) and determined with the relation,
$L_p = L_w - 10log(r^2) - 8$, is presented in table no.3.

4. CONCLUSIONS

Considering the distance between the working areas of the machines to the nearest receiver (inhabited limit) and the terrain topography it can be appreciated that the sound levels will be less than 65 dB (A) (maximum value allowed by STAS 10009/2017).

Table 3

Equipment	The acoustic power Lw – dB (A)	Distant from Noise source (m)	Level noise (dB)
rotor excavator	115-125	100	67-77
		200	61-71
conveyor belt	85-90	100	37-42
		200	31-36
welding machine	119	100	71
		200	75

The management of the potential categories of impact generated by noise and vibration on the personnel of the career and of the inhabitants of the neighboring communities, represents a key factor in the design, the planning and the implementation of any modern mining activities, because these can affect the health and the work capacity of the workers, as well as the comfort to the inhabitants of the near human settlements and in the situations in which vibrations occur - the physical integrity of some potentially sensitive constructions.

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