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MONITORING OF NOISE PRODUCED BY BANDCONVEYORS FROM THE MINING UNIT OF CAREER ROSIA

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Abstract

In this paper we intend to make a noise monitoring, produced by bandconveyors, monitorization necessary for finding solutions to combat noise. The main sources of noise pollution are tracked excavators with rotor and bandconveyors. For the urban areas and forested areas the tracked excavators with rotor is not a source of noise pollution. They represent a source of noise just inside the career, because of the way adjacent extraction steps, which is a natural barrier against the propagation of noise. The bandconveyor T111 from the Career Rosia of Jiu, which is transporting excavated material represents a source of noise pollution for residents of the village of Rosia of Jiu due to he`s close location. Exposure to noise for long-term can cause adverse effects on health.

Key words: *pollution, noise control, noise attenuation.*

INTRODUCTION

Opening of the Mining Unit of Career Rosia began in April 1973, and it is the largest career in Romania and also from the South-Eastern Europe by volume of geological reserves of lignite. Mining Unit of Career Rosia has toughest hydrogeologic conditions in Romania.

The Mining Unit of Career Rosia is making part of the coal basin of northwestern Oltenia managed by Trading Company Oltenia Energy Complex - SA, located in the interfluve between the river Jilţ and the river Jiu regularized and developed on a third of the surface in the Jiu valley and the rest is in the hilly part (Stanci, Stanci, Dumitrescu, 2011).

Exploitation perimeter of the Mining Unit of Career Rosia is located on the territory of the administrative city Rovinari and administrative territories of the communes Farcasesti and Bălteni and is part of the mining basin Rovinari part of the mining area Motru-Jilţ-Rovinari, located in northern Oltenia.

In Romania there is a tendency, which also manifests itself in the world: the increase in noise and vibration generation - whose sources appear with impetuous development of all branches of the economy and transportation.

One of the main objectives of modernization of production capacities of mining coal basin of Oltenia is reduction of noise and dust emissions.

THEORETICAL CONSIDERATIONS

Noise pollution is an important component of environmental pollution, both by harmful character and he is present in all day to day activities of modern life. The noise pollution is a major problem for all economically developed countries or developing countries. Noise pollution is a continue aggression, determined by different noises made by machinery, industrial equipment or domestic, inside or outside buildings, noise favored by the placement and their constructive isolation.

One of the disturbing factors of the environment, that influence the environment in which it operates and human life is the noise which is associated and identified in generally by noise pollution.

Source of pollution, by noise, include:

Use of motorized vehicles to transport workers, materials and equipment to and from career;

Use of mobile machinery and stationary inside of careers, they typically include the tracked excavators with rotor, cross-pit spreader and bandconveyors.

Potential noise receptors typically include mine workers, people outside the open pit limits.

Choice of methods to combat noise is conditioned to the combined between noise sources, the propagation medium (path) of acoustic energy and receivers. In the noise control methods should be incorporated parts of this system, it distinguished: methods of noise control at source, methods of the control of noise on pathways and methods to combat noise at the receiver.

When crossing propagation environment, the acoustic waves lose some of the energy originally contained due to the following physical causes: internal friction of environmental particles which particles enters in oscillation (viscosity), thermal conductivity of the environment, radiation heat and energy of intermolecular exchange.

Attenuation due to viscosity is expressed by a coefficient dependent on the characteristics of the environment but and the frequency of the sound.

$$A_{\vartheta} = \frac{4\pi^2}{\lambda^2} \cdot \frac{2}{3} \cdot \frac{\eta}{Z_s} \qquad (1)$$

where:

λ - wave length of the given sound

η – dynamic viscosity of the environment

$Z_s = \text{-}1\rho \cdot c$ – specific impedance of environment.

In case of bandconveyors sound wavelengths remain unchanged; which varies is the characteristics of the environment due to temperature variations.

Sound attenuation due to thermal conductivity is expressed by the corresponding coefficient of attenuation (expression given by Herzfeld and Rice).

$$A_T = \frac{4\pi^2}{\lambda^2} \cdot \frac{c_T}{2Z_s} \cdot \frac{\gamma\text{-}1}{\gamma C_V} \qquad (2)$$

where, in addition to the variables in the expression (1) appear:

c_T – coefficient of thermal conductivity of air

γ - adiabatic coefficient

CV – specific heat at constant volume of environment

Acoustic wave attenuation is achieved by increasing energy level of the gas molecules by putting them in motion of vibration. This variation of the energy depends on the number of degrees of freedom of the molecules, so energy loss increases from monatomic to the polyatomic molecules. Like global effect of sound attenuation in air, Beranek gives the following formula for the additional attenuation:

$$A_S = 7{,}4\left(\frac{f_m^2 \cdot r}{\Phi}\right) \cdot 10^{-8} \quad [\text{dB}] \qquad (3)$$

where:

fm – is the geometric average of the frequency band in which the sound is emitted (Hz)

r – the distance of point of registration to the source (m)

Φ – the relative humidity of the environment (%).

This attenuation is added to the produced attenuation according to the distance from the receiver to the source of sound (Enescu, Magheţi, Sârbu, 1998).

RESULTS AND DISCUSSIONS

Noises produced by machinery and mining installations are often uncomfortable for environment (Bratu, 2002). Sources of noise in Mining Unit of Career Rosia equipped with technology in continuous flow can be:

- driving motor and drive the rotor excavators, cross-pit spreader and tractor in motion
- engines bulldozers, loaders and dumpers which acting in career
- bandconveyors

Due to the type of construction and operation of bandconveyors, we have a source of structural noise - rolling noise. Rolling noise is the result of roughness or irregularities from the contact of the rolling surfaces. Spectral composition of rolling noise is broadband. Roller bearings used in the construction of bandconveyors are the elements with periodic motion that make apear tonal components.

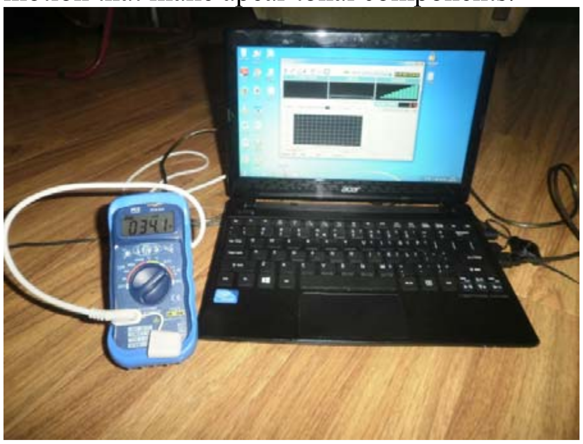


Figure 1 - The digital measuring device 4 in 1

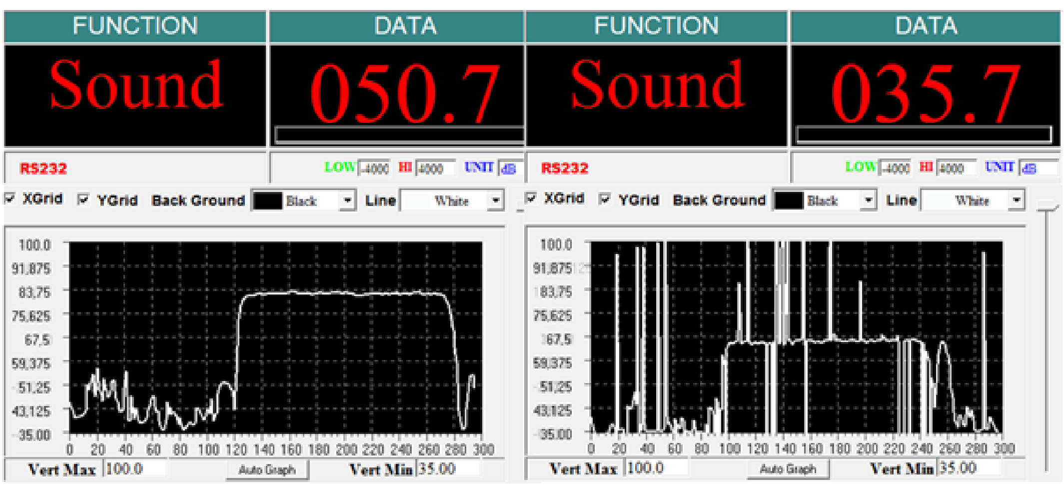
The bandconveyors T111 is a source of noise pollution in the Mining Unit of Career Rosia which is located to a distance of 15-20 m from the first house in the village Rosia of Jiu. In order to find solutions to combat noise pollution produced by the bandconveyors we conducted noise monitoring for a period of 30 days.

In order to monitor noise we used digital measuring device 4 in 1 PVE-222 (figure 1).

The digital measuring device 4 in 1 with multiple functions for the environment has been designed to combine the measurement of the sound level, light, humidity and temperature.

Measurements were performed at different times of day ranging ambient temperature and the humidity.

The noise values where recorded at minimum temperature of 8.5°C near to the bandconveyor and at 10 m from it, graphs are shown in the Figure 2.



a) b)

Figure 2 - Values recoroded at temperature of 8.5°C a) near the bandconveyor and b) at 10 m of bandconveyor

For maximum temperature of 17.2°C noise values near of the bandconveyor and at 10 m from it, and the graphs are shown in the figure 3.

Measurements were performed in accordance with STAS existing, during the day, and were calculated using the relation (Stanci, 2012):

$$L_{equivalent} = L_{max} - \frac{1}{3}\left(L_{max} - L_{min}\right) \quad (4)$$

According to the equation (1), (2) and (3) change in sound attenuation depends on the temperature and humidity of the environment of propagation of the sound.

Moisture variation during the monitoring period was between 58.5% and 63.5%, which leads according with relation (3) to noise attenuation between 0.55 dB and 0.59 dB.

Attenuation due to temperature change is significant, with values between 7.74 dB at a temperature of 17.2°C and 19.7 dB at a temperature of 8.5°C at a distance of 10 m from the bandconveyor T111.

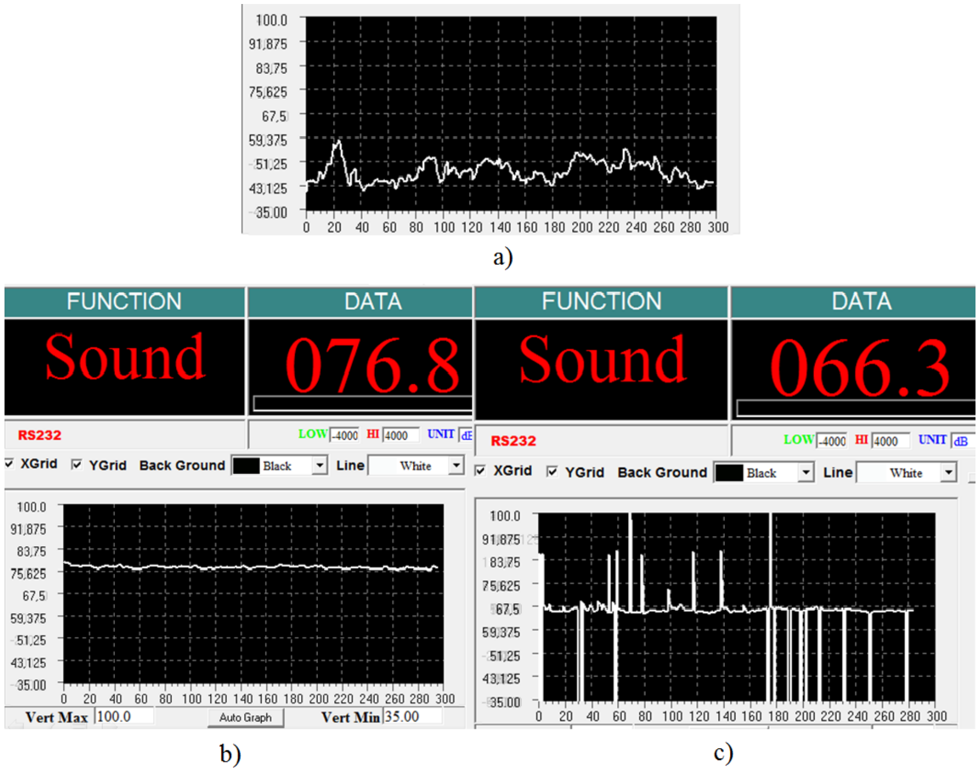


Figure 3 - Values recorded at a temperature of 17.2°C a) before starting work b) near the bandconveyor and c) at 10 m from the bandconveyor

CONCLUSIONS

Noise emission from bandconveyors, passing through village Rosia of Jiu, transporting the material extracted, are producing perturbations in this area.

The value recommended to allowable noise limits, to limit functional urban areas considered as noise sources from adjacent areas (industrial premises) is 65 dB and it is exceeded. The same is with acceptable limits of noise near protected buildings (houses, hotels, hostels, guest houses) which is 55 dB, the first house in the village of Rosia of Jiu is located just 15-20 m of bandconveyor T111.

In result of the monitoring was found that noise limits are exceeding maximum allowable, this endangering the health of the habitants of the village Rosia of Jiu.

Using the data record we can perform calculations for sizing the acoustic isolation and sound absorbing panels to reduce structural noise.

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