

Evaluation of Noise Measurements Performed in Mining Sites for Environmental Aspects

Cinar, I.¹ and Sensogut, C.^{2*}

¹Department of Mining Engineering, Selcuk University, 42079 Konya, Turkey

²Department of Mining Engineering, Dumlupinar University, 43100 Kutahya, Turkey

Received 16 March 2012;

Revised 21 July 2012;

Accepted 14 Aug. 2012

ABSTRACT: In this study, results of noise level measurements performed in 4 different mining sites are given. Noise level measurements performed in opencast mining site of Konya Ilgın Lignite Corporation (ILC), in Konya Eyak Mining quarry site and in Aydin Cine Feldspar ore dressing facility have been evaluated together with worker surveys. The noise level measurements performed in Manisa Soma Uyar Mining coal preparation facility have been evaluated in terms of machine-work performance. Thence, it has been pointed out that the increase in noise was due to machine faults. When the measurement results were considered, it is mandatory for the workers to use protective equipment. Workers working under high noise level would be affected physically, physiologically and psychologically. To prevent these harms, they should be encouraged to use earmuffs and plugs.

Key words: Noise propagation, Equivalent noise level, Occupational health, Machine work performance

INTRODUCTION

Sound is an objective concept and measurable as well as the presence of which does not change depending on the person. Sound is also a physical event that comes into existence with waves in which a source forms vibrations in air pressure and that stimulates the human sense of hearing (Sharland, 1972; Scott *et al.*, 2004). Noise, however, is a subjective concept and called “unpleasant, undesirable, disturbing sound”. For that very reason, if the sound is characterized as noise varies depending on the person. Yet, it is obvious that a high level of noise would be doubtlessly accepted as noise by everyone. Industrial noise is such a kind of noise. Besides, even if not being disturbed by high level of sounds, it is required to be controlled because of many harmful physiological and even psychological effects (Roy and Adhikari, 2007; Atakan, 2010). Many noise amounts in various industrial branches can be come across. However, if considered to be reached excessive noise levels during mining operations, in terms of being able to protect workers’ health, noise levels should be absolutely kept below the limit values. Since noise has inarguably too many effects on human health and affects labor-efficiency in workplaces; legal regulations have been

made and “Noise Regulations” (NR) have been carried out by Ministry of Labor and Social Security in Turkey. Based on European Parliament and Council Directive dated February 15, 2003 and issued 2003/10/EC, permissible noise levels in accordance with Noise Regulations, were determined as the duration of exposure to noise (Anon., 2003). Lastly, in parallel to Environmental Noise Management and Evaluation Directive dated June 25, 2002 and issued 2002/49/EC by Ministry of Environment and Forestry in Turkey, “Environmental Noise Evaluation and Management Regulations (ENEMR)” was carried out, published in official paper dated July 1st, 2005, issued 25862, and inured to the benefit. According to this regulation, Noise and Control Regulation that had been carried out since 1986, was legislated away (Anon., 2005).

MATERIALS & METHODS

High levels of noise are experienced in the course of mining operations. For that reason, studies have been carried out in four different sites to cover varying scopes of mining. Mining enterprises acting in the regions can be seen on the map in Fig.1.

*Corresponding author E-mail: sensogut@dpu.edu.tr

Ilgın Lignite Corporation (ILC), founded in 1989, is located 87 km northwest of Konya and 15 km north of Ilgın district center. The operation continues its work to provide solid fuel for the surrounding cities and counties, to cater the coal demands of factories particularly sugar mills and recycle the groundwater resources. However, there are some limitations for domestic coal used for heating by a regulation published by Ministry of Environment and Forestry in Turkey and valid from 01.04.2005 and for that reason, sales of coals for heating was terminated and coal dust demand of industry was catered.

Eyak mining and Quarrying, founded in 1990, is located 30 km northwest of Konya in Omerler district. Operation continues its work on a 100 hectares licensed area of limestone massif. Polat Mining Feldspar Ore Preparation Plant provided service in order to cater the raw material needs of ceramic and ceramic sanitary factories within its own structure in 1991. Founded 3 km south of Aydin city Cine district center, on 75.000 m² land, the facility of crushing-screening, sizing and grinding performs its 200.000 tons/year capacity using "Alpine Technology" having the most advanced level on world's grinding and sizing processes. Founded in 2002, the plant is located 3 km south of Soma district in Manisa. In Uyar Mining Coal Plant, average 3000 tons of raw ore are extracted daily via underground mining method, 1200 tons of which are redounded in coal washery facility as concentrated. The capacity of coal washery facility is 250 tons/hour and 40 workers in total serve in 3 shifts in the facility. While noise measurement evaluations realized in lignite mill, quarries and ore preparation plant were for the occupational health, in coal preparation plants, they were carried out to evaluate the performance of

equipments. The effects of noise on occupational health were evaluated using the questionnaire prepared for the workers and the responses of the people who participated to this survey. Here, the workers' perspective on the subjective concept, noise, was tried to be determined. Noise level measurements were performed with AZ 8921 Digital sound level meter. The noise level data are recorded with the Handheld Meter's Data Logger Program.

While converting the recorded noise level taking a short time to equivalent noise level, the following relation was used (Anon., 1996; Pathak, 1996; Cinar & Sensogut, 2009);

$$L_{eq} = 10 \log \left(\frac{1}{n} \left(10^{L_1/10} + 10^{L_2/10} + \dots + 10^{L_n/10} \right) \right)$$

where n is the number of measurement, L_1 - L_n is the measurement values, dBA and L_{eq} is the equivalent noise level (a measure of the average sound pressure level during a period of time), dBA.

In order to determine how disturbing the noise for the workers, the amount of noise that workers in different sectors of mining exposed to was defined and how much they are disturbed by the noise is tried to be defined with questionnaires. Surveys were conducted with a total of 126 workers. Surveys on the workers. The questions asked to the workers in the questionnaire are as follows:

- use of personal protective equipment if any,
- experience,
- age,
- health problem in general if any,
- inspection time,

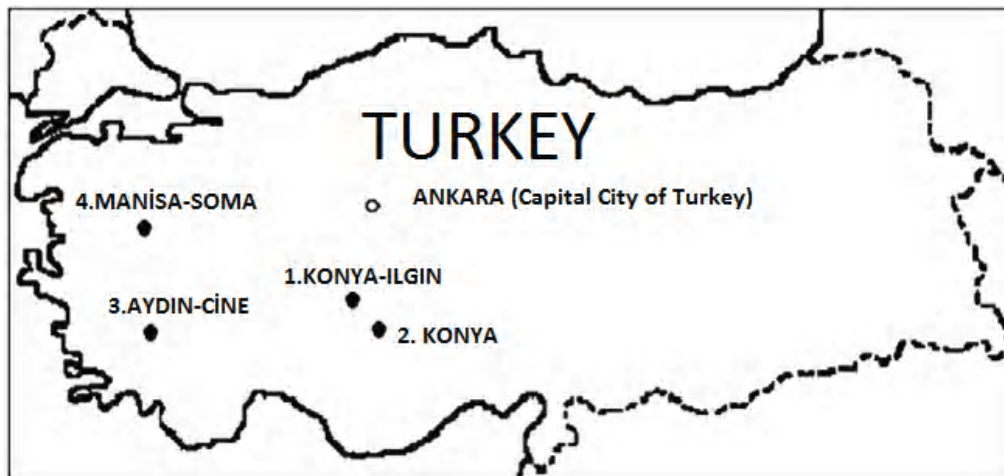


Fig. 1. The location of mining sites

- noise induced health problem if any,
- run time (year),
- habit of alcohol drinking or smoking if any.

The obtained measurement results and evaluations are given in Table 1.

The noise disturbance of workers was scored between 0-5 degrees and it was observed that discomfort was high for the workers in high noise levels. Workers were warned to use earplugs or earmuffs in the places where the discomfort level is high. Although the degree of discomfort of jaw crusher is expressed as “3” in Table 1a, for the noise levels above 90 dBA, the use of ear plugs is advised. The first symptoms of illness are generally either cough or

wheezing, as in the same way, if a machine starts breaking down it makes so much noise. For this purpose, noise measurements were practiced in Uyar Mining Coal Preparation Plant and the results were evaluated. First and second steps noise measurement results were presented in Table 2.

In the first stage, the noise level measurement was found quite high. First, the machines having more than 100 dBA noise level were determined. During the maintenance and repair work, weight booms of underground sieve and curved sieve changed; the hole losing oil in +10-18 mm. coal sieve was closed and the oil was changed. On the second phase of noise measurement after the maintenance and repair work, reduction of noise was measured as 4,9 dBA in

Table 1. Noise measurement results and evaluations

Measurement Locations	equivalent noise level, dBA	Degree of discomfort (0-5)	Use of personnel protective
Ilgin Lignite Plant			
Excavator (Komatsu PC 450 LC)	73,6	1	No
Truck (Fatih 220/26)	75,5	1	No
Truck (Mercedes)	70,1	0	No
Truck (Ford Cargo2524)	67,8	0	No
Grader (Volvo G 940)	72,6	2	No
Bulldozer (Komatsu D155A)	91,5	4	ear muff
Hydraulic hammer (Daewoo 290)	85,1	3	No
Eyak Mining and Quarrying Operation			
Jaw crusher	90,6	4	ear plugs
Sieve system	88,8	4	ear plugs
Tertiary crusher	89,4	4	ear plugs
Band facility	75,3	2	No
Polat Mining Feldspar Ore Preparation Plant			
Maintenance moment	71,4	2	No
Operator room	78,0	3	No
Jaw crusher	91,4	3	ear plugs
Cone crusher	92,7	4	ear plugs
Mill	89,6	4	ear plugs
Carrier band	79,7	4	ear plugs
Packaging	79,8	3	No

Table 2. Noise measurement results

Measurement Locations	Equivalent noise level, dBA		Measurement Locations	Equivalent noise level, dBA	
	I.stage	II.stage		I.stage	II.stage
Underground sieve	101,5	96,6	+10-18 mm. stone sieve	94,2	93,5
Double decker sieve	96,7	95,3	+10-18 mm. coal sieve	100,9	87,2
Curved sieve	107,6	99,1	+18 mm. coal sieve	91,4	91,8
Dewatering sieve	95,2	94,5	+18 stone sieve	99,0	98,5
+10-18 mm. coal washing sieve	95,0	96,0	-10 mm. coal sieve	96,8	95,2

underground sieve, 8.5 dBA in curved sieve and 12,9 dBA in +10-18 mm. coal sieve.

RESULTS & DISCUSSIONS

The noise level of working machine gives us information about its performance. Periodic noise measurements could be realized and compared with the normal noise level and in case of an increase in the level of noise, machine could be sent to the service. Thus, repair and maintenance costs could be less and large defects could be prevented with small changes. As a result, the operation plant would be able to go on working without a break. When the measurement results were considered, it is mandatory for the workers to use protective equipment. Workers working under high noise level would be affected physically, physiologically and psychologically. To prevent these harms, they should be encouraged to use earmuffs and plugs.

ACKNOWLEDGEMENT

Support given to achieve this work by the Scientific Research Found of Selcuk University is greatly acknowledged.

REFERENCES

- Anon, (1996). Acoustics-Attenuation of Sound during Propagation Outdoors-Part 2: A General Method of Calculation. ISO 9613-2.
- Anon, (2003). Noise Control Regulations of Turkey. Official Gazette, No.25325, 23.12.2003.
- Anon, (2005). Environmental Noise Evaluation and Management Regulations. Official Gazette, No.25862, 01.07.2005.
- Atakan, M. (2010). Determination of Noise Induced Hearing Lost in Mining: A Sample of Stone Crushing and Screening Plant. MsC Thesis, Osmangazi University, Eskisehir, p68.
- Cinar, I. and Sensogut, C. (2009). Evaluation of Environmental Factors Affecting Noise Propagation. Environmental Monitoring and Assessment, **153**, 377-382.
- Pathak, K. (1996). Modelling and Prediction of Environmental Noise Levels Near Mechanized Surface Mines and Quarries. PhD Thesis, Imperial College, London, October, p302.

Roy, S. and Adhikari, G. R. (2007). Worker Noise Exposures from Diesel and Electric Surface Coal Mining Machinery. Noise Control Eng. J., **55**, 434-437.

Scott, D. F., Grayson, R. L. and Edward, A. (2004). Disease and illness in U.S. mining, 1983-2001, Journal of Occupational & Environmental Medicine, **46 (12)**, 1272-1277.

Sharland, I. (1972). Woods Practical Guide to Noise Control. Woods of Colchester Ltd., May, England, p208.