THE EFFECT OF EXCESSIVE OF NOISE EXPOSURE ON HEARING IMPAIRMENT AMONG CRUSHING STONE WORKERS

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ABSTRACT

The purposes of this study were to evaluate noise exposure and its effect on hearing ability of the exposed workers. Noise exposure among stone crushing workers was measured by using sound level meter at the workplace areas. The hearing impairment of workers was evaluated by audiometer. There were thirteen sampling points at the crushed stone operations for monitoring noise using a sound level meter. The result revealed that there were 9 sampling points that the noise level was exceeded the Thailand occupational health safety and environment standards at 90 dB (A) for eight working hours. They were 96.3 dB (A) Leq at stone delivery truck parking area (near stone feeding area) 4, 105.7 dB(A) Leq at stone feeding area 4, 101.4 dB(A) Leq at stone feeding area 5, 102.9 dB(A) Leq at vibrating screen 4, 109.1 dB(A) Leq at vibrating screen, 99.1 dB(A) Leq at rest area near stone feeding area 7, 100.5 dB(A) Leq at stone feeding area 7, 99.8 dB(A) Leq at vibrating screen 7 and 95.0 dB(A) Leq at hopper 7. The audiometric data revealed that there were 34 workers suffered from hearing loss and 51 workers showed normal hearing ability. In the hearing impairment group, there were hearing loss in slight level (n=12), moderate level (n=10) and severe level (n=5). This industry already has selection and use of hearing protection devices and periodic audiometric evaluation for the workers. Therefore, the hearing conservation program including engineering and administrative controls such as using sound absorption materials, modifying work rotation system should be conducted in the stone feeder, jaw crusher area and vibrating screen.

Keywords: Noise effect, Hearing loss, Crushing stone, Hearing impairment, Audiometry

1. Introduction

Stone crushing is necessary for building roads, bridges, buildings and almost everything we need in our modern life. Major concerns in stone crushing are accidents and injuries, hearing loss, dust-related lung diseases. Noise-induced hearing loss (NIHL) has long been recognized as the primary and most direct health effect of excessive noise exposure (1). Noise exposure can cause several risks for the health and safety of workers. Crushing stone workers have a high risk of hearing loss due to excessive noise levels at the workplace environment. Noise, an unwanted sound, causes serious psychological, physiological and social effects. Noise is able to induce learned helplessness, increase arousal, alter the choice of task strategy, and decrease attention to the task (2). Frequent exposure to high level of noise can cause severe stress on the auditory and nervous system (3).

Hearing loss due to noise will gradually occurred in this situation which make both employees and employers lack of awareness and caution about the dangers of noise. In order to reduce health risk and prevent workers from hearing loss, we have to assess the risk. It helps us understand the nature of hazards, how our employees could be harmed and how we can prevent that from happening. Therefore, in this study we aimed to evaluate noise exposure and its effect on hearing ability of the exposed workers and try to find the suitable way to protect the stone crushing workers from excessive noise level in the next step.

2. Equipment and methods

This descriptive cross-sectional study was done in stone crushing plant in northeast of Thailand.

2.1. Equipments

The sound level meter type RION, NL-21, Serial No.: 00110045, Microphone UC-52 was measured according to the standard IEC 61672-1:2002 Class 2, JIS C 1509-1:2005 Class 2.Noise exposure among stone crushing workers was measured using personal noise dosimeters at the workers. The hearing impairment of workers was evaluated by audiometer.

2.2. Procedure

2.2.1 Monitored noise at workplace area by using a sound level meter at 13 sampling points at the crushed stone operations. After that analysed the data and compared with the standard.

2.2.2 Evaluated the hearing impairment of workers who work in all areas of company. After that analyzed the data and compared with the standard.

2.2.3 Analyzed all data in 2.2.1 and 2.2.2 then gave the recommendation for prevention the stone crushing workers from excessive noise exposure to the company.

3. Results

3.1. The results of noise level at workplace areas by using sound level meter

The stone crushing process in our study includes 5 main process systems, they are stone feeding, jaw crushing (primary crushing process), cone crushing (secondary crushing process), vibrating screening and hopper. Firstly, the raw materials (big size of stone) are initially crushed by jaw crusher into the smaller size; then the roughly crushed stone are transported into the cone crushing for further crushing; the fine crushed material get into vibrating screen to be divided into different sizes of stone according to the customer requirement; the divided stone were kept into hopper and waiting for delivery by truck to the customers.

Table 1: Results of noise level measurement at workplace area by using sound level meter.

No.	Sampling points	Sound Level (dBA)		
		L_{eq}	L_{min}	L_{max}
1	Rest area for workers (near stone feeding area 4)	86.2	85.9	87.5
2	Stone delivery truck parking area (near stone feeding 4)	96.3*	91.7*	98.0*
3	Stone feeding area 4	105.7*	104.9*	106.4*
4	Stone feeding area 5	101.9*	101.4*	102.4*
5	Vibrating screen 4	102.9*	102.3*	103.7*
6	Vibrating screen 5	101.9*	101.5*	102.4*
7	Hopper 4	87.7	87.5	88.1
8	Rest area of workers (near feeding stone area 7)	80.3	79.9	80.7
9	Stone delivery truck parking area (near stone feeding 7)	96.1*	88.3	101.1*
10	Stone feeding area 7	100.5*	99.4*	101.7*
11	Vibrating screen 7	99.8*	98.5*	102.0*
12	Hopper 7	95.0	94.4	95.4*
13	Office	51.8	50.5	53.4

*Refer to the noise level was exceeded the Thailand occupational health safety and environment standards at 90 dB (A) for eight working hours.

The result of noise level measurement was shown in Table 1. The result revealed that there were 9 of sampling points that the noise level was exceeded the Thailand occupational health safety and environment standards at 90 dB (A) for eight working hours. They were 96.3 dB (A) Leq at stone delivery truck parking area (near stone feeding area) 4, 105.7 dB(A) Leq at stone feeding area 4, 101.4 dB(A) Leq at stone feeding area 5, 102.9 dB(A) Leq at vibrating screen 4,

109.1 dB(A) Leq at vibrating screen, 99.1 dB(A) Leq at resting area near stone feeding 7, 100.5 dB(A) Leq at stone feeding area 7, 99.8 dB(A) Leq at vibrating screen 7 and 95.0 dB(A) Leq at hopper 7.

The noise level of other sampling points that exceeded the Thailand occupational health safety and environment standard at 85 dB(A) and needs to conduct Hearing Conservation Program were 86.2 dB(A) Leq at rest area for workers (near stone feeding area) 4, and 87.7 dB(A) Leq at the hopper area 4.

3.2. The results of hearing impairment of workers was evaluated by audiometer.

Noise-induced hearing loss (NIHL) is an irreversible sensory neural hearing loss associated with exposure to high levels of excessive noise. The hearing impairment of eighty five stone workers were evaluated by using an audiometer. Pure tone audiometric assessment was carried out for stone workers. The audiometric data revealed that there were 34 workers suffered from hearing loss and 51 workers showed normal hearing ability. In the hearing impairment group, there were hearing loss in slight level (n=12), moderate level (n=10) and severe level (n=5). The twenty-six of stone workers who suffered from hearing loss were worked at stone feeding area 4, 5, 7 and maintenance. The other 8 workers worked at office and as drivers. There were 11 workers who showed hearing loss at one ear and 23 workers who showed hearing loss at both ears.

4. Conclusions

The results indicated that the majority of stone workers who suffered from hearing loss work in the working area that have high level of noise and exceed the Thailand occupational health safety and environment standards at 90 dB (A) for eight working hours such as the stone feeding area and vibrating screen 4, 5 and 7. Although there are some worker in these working area showed the normal hearing ability, they need to protect from excessive noise exposure. This industry already has selection and use of hearing protection devices and periodic audiometric evaluation for the workers. However, most of them do not have awareness of hearing loss hazard. Thus they did not wear the hearing protective equipment. Therefore the motivation methods and effective promotion of using hearing protection devices need to be conducted. Moreover, the hearing conservation program including engineering and administrative controls such as using sound absorption materials, modifying work rotation system should be conducted in the stone feeding area, jaw crusher area and vibrating screen.

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