

STUDY OF HEARING LOSS IN THE DIESEL POWER PLANT SILAE WORKERS IN PALU CITY

*(KAJIAN KEHILANGAN PENDENGARAN DI LOJI JANAKUASA TENAGA
DIESEL SILAE DI BANDAR PALU)*

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Abstract

Industrial hearing loss was ranked first in the list of occupational diseases worldwide, 7% of the western population and 21% in the developing world. Continuous exposure to noise will result in persistent and unrecoverable hearing loss. Measurement results in parking area, office space and engine room at diesel power plant Silae using Sound Level Meter are known noise level between 71.6 dB-95.869 dB. This study aims to assess the hearing loss of workers in the Silae power plant. This research is quantitative with Cross Sectional design. Sampling was done in total sampling. The results showed that from 66 respondents, there were 27 respondents had hearing loss. Years of service more than 10 years ($p = 0.00$), duration of exposure more than 8 hours ($p = 0.003$) and use of personal protective equipment ($p = 0.002$) related to hearing loss. Basically use of personal protective equipment is an appropriate preventive measure in reducing the frequency of noise exposure, but it should be noted the type of personal protective equipment and how to use it. As a recommendation, workers' awareness raising in the proper use of personal protective equipment is required, particularly workers at the highest noise level. Tighter surveillance and the provision of standard personal protective equipment can be the first step in raising worker awareness.

Keywords: hearing loss, years of service, exposure time, personal protective equipment

Abstrak

Kehilangan pendengaran industri menduduki tempat pertama dalam senarai penyakit pekerjaan di seluruh dunia, 7% penduduk barat dan 21% di dunia membangun. Pendedahan berterusan terhadap bunyi bising akan mengakibatkan kehilangan pendengaran yang berterusan dan tidak dapat dipulihkan. Hasil pengukuran di kawasan parkir, ruang pejabat dan bilik enjin di loji janakuasa tenaga diesel Silae menggunakan Sound Level Meter diketahui tahap bunyi antara 71.6 dB-95.869 dB. Kajian ini bertujuan menilai kehilangan pendengaran pekerja di loji janakuasa tenaga diesel Silae. Kajian ini adalah kuantitatif dengan reka bentuk Cross Sectional. Persampelan dilakukan secara persampelan. Keputusan menunjukkan bahawa dari 66 responden, terdapat 27 responden mengalami kehilangan pendengaran. Tahun perkhidmatan lebih daripada 10 tahun ($p = 0,00$), tempoh pendedahan lebih daripada 8 jam ($p = 0,003$) dan penggunaan peralatan pelindung diri ($p = 0,002$) yang berkaitan dengan kehilangan pendengaran. Pada dasarnya penggunaan peralatan pelindung diri adalah langkah pencegahan yang sesuai untuk

mengurangkan frekuensi pendengaran bunyi, tetapi harus diperhatikan jenis peralatan pelindung diri dan cara menggunakannya. Sebagai cadangan, peningkatan kesedaran pekerja dalam penggunaan peralatan pelindung diri yang diperlukan, khususnya pekerja pada tahap bunyi bisung tertinggi. Pengawasan yang lebih ketat dan penyediaan peralatan perlindungan peribadi yang berpiawai boleh menjadi langkah pertama dalam meningkatkan kesedaran pekerja.

Kata kunci: *Kehilangan pendengaran, tahun perkhidmatan, masa pendedahan, peralatan pelindung diri*

INTRODUCTION

Increased utilization of technology in the industrial world has a significant impact on the optimization of production processes. However, the use of this technology also has other impacts on occupational health and safety. The workplace must be able to guarantee the security and health of all employees (Mohammadi, 2014).

Noise in workplace can cause hearing loss and other disorders. The emergence of health syndroms such as deafness due to noise occurs slowly for months to years. This is often not realized by the suffered, so that when the patient begins to complain of hearing loss is usually already in an irreversible stage. Noise factors in the workplace can lead to the emergences of other potential risks such as stress disorders, pulse acceleration, increased blood pressure, emotional feelings, communication disorders and lowered of work motivation (Kunto, 2008).

Deafness occurring in industry has been ranked first in the list of occupational diseases in the United States and Europe. With a prevalence of 7% of the western population and 21% in developing countries. In America about 9 million employees are exposed to noise with intensity above 85 dBA and about 8 million have Hearing loss (ILO, 2014).

Silae Diesel Power Plant is one of the most influential power plants in supplying electricity in Palu City area. Utilization of Silae Diesel Power Plant if not managed properly can be a potential source of hazard for workers, especially operational and maintenance officers in engine room of diesel power plants that have great potential hearing loss.

There are several variables that affect hearing loss, such as duration of service, duration of exposure and use of personal protective equipment to workers. Duration of service more than 10 years is thought to be one of the determinants of hearing loss. Likewise the duration of exposure is considered a determinant variable. The duration of exposure is calculated in hours, workers are not allowed to be exposed to noise above 85db for 8 hours a day, if exposed to noise during that time then workers will potentially get a hearing loss. Use of personal protective equipment is also one of the variables to be considered in occurrence of hearing loss. The use of personal protective equipment is an attempt to minimize the accidents at work severity. The type of personal protective equipment to be used should be adjusted to the type of work and risk in the area. To protect the ear from noise in use ear muff and ear plug, this has been done by the workers in Diesel Power Plant Silae, this has been done by the workers in Silae, but they are use it not qualified to standard operating procedure. Sometimes, a worker also ignored to use ear muff continuously when they work in the machine area.

Preliminary studies find that the noise intensity on the engine area of the power plant exceeds the threshold value (> 85 dB), to communicate within a distance of ≤ 1 meters inside the engine area they should shout at each other. Field evidence showed, a workers on generator engines area tend have an hearing loss. Based on this problem, the researcher interested to conduct a study related employee hearing loss in power plant diesel Silae by measuring the variables of duration of service, duration of exposure and use of personal protective equipment behavior.

METHODS

This study is an analytic research with cross sectional design. The study was conducted by measuring noise in parking area, office and machine area using sound level meter. these measurements were performed to obtain the average noise level in each areas. The population in this research is all workers in Diesel Power Plant Silae as many as 66 workers, samples of research drawn in total sampling and data analysis using chi-square test.

RESULT

Respondent Characteristics

Table 1. Respondent Characteristics of Diesel Power Plant Silae Workers

	Frequency	Percentage (%)
Age (Years)		
26-30	28	42.4
31-35	7	10.6
36-40	12	18.2
41-55	19	28.8
Duration of Service (Years)		
≥ 10	28	42.4
< 10	36	57.6
Duration of Exposure (Hours)		
≥ 8	37	56.7
< 8	29	43.3
Personal Protective Equipment		
Not Uses	36	54.5
Uses	30	45.5
Hearing Loss		
Yes	27	40.9
No	39	59.1

Table 1 describe the highest age group was 25-30 years, amounted to 28 people (42.4%), while the lowest age group 31-35 years was 7 people (10.6%). For the duration of service 36 people (42.4%) have worked more than 10 years, while 36 people (57.6%) worked less than 10 years. Duration of exposure 37 people (56.7%) workers exposed more than 8 hours a day and 29 people (43.3%) exposed less than 8 hours a day. For behavioral usage of APD, 36 people (54.5%) always use while 30 people (45.5%) do not use it. This table also describes the number of hearing loss to workers, 27 people (40.9%) worker have a loss hearing, and 39 (59.1%) workers did not experience the symptoms.

Hearing Loss Analysis

Table 2. Hearing Loss Analysis an Workers Diesels Power Plant Silae

	Hearing Loss				Total		<i>p value</i>
	Yes		No		n	%	
	n	%	N	%			
Duration of Service (Years)							
≥ 10	23	82.1	5	17.9	28	100	0.000
< 10	4	10.5	34	89.5	38	100	
Duration of Exposure (Hours)							
≥ 8	21	56.8	16	43.2	37	100	0.003
< 8	6	20.7	23	79.3	29	100	
Personal Protection Equipment							
Not Uses	21	58.3	15	41.7	36	100	0,002
Uses	6	20.0	24	80.0	30	100	

Table 2 describe that there is relationship between the tenure ≥ 10 years with hearing loss an workers ($p = 0.000 < p = 0.005$), based on data of 23 (82.1%) who have been working ≥ 10 years have hearing loss and only 5 people (17.9%) who are not disturbed. For the duration of exposure ≥ 8 hours in a day also associated with hearing loss ($p = 0.003 < p = 0.005$) as many as 21 (56.8%) workers have hearing loss and only 16 (43.2%) of them are not disturbed. Similarly, the use of Personal Protection Equipment was associated with hearing loss ($p = 0.002 < p = 0.005$) where of 29 workers with hearing loss, 21 (58.3%) among them were not used it.

DISCUSSION

The ear is one of the senses that support a person in communicating and able to respond to the sound in the range between 0-140 dB. The main effect of noise on health is hearing impairment, which causes progressive deafness and this effect has been known and generally accepted in the past. At first the effect of hearing noise is temporary and recovery occurs quickly after work leaves the noisy area. However, if working continuously in the noisy area there will be permanent and irreversible deafness (Tamsil Fauzi, 2011).

Communication disorders are usually caused by a masking effect (sound that covers unclear hearing) or noise clarity disorder. This interruption leads to disruption of the work, to the possibility of errors due to not hear the signal or alarm. This communication disorder indirectly endangers the safety of a person (Salawati, 2013).

Duration of Service and Hearing Loss At Diesel Power Plant Workers

The result of noise intensity measurement at three spot in Diesel Power Plant Building; is parking area, office space and machine room got noise intensity result between 71.6 dB – 95.869 dB, especially at machine room is extremely noisy. This value has exceeded the auditory threshold value for the duration exposure of 8 hours based on the provisions Regulation of the Man power Minister Number 13 in 2011.

Based on the result of chi-square test, it is found that there is relationship with hearing loss complaint and tenure more than 10 years to the worker in Diesel Power Plant Silae. according to the measurement result as many as 23 people (82.1%) whose working period more than 10 years have hearing loss complaints. This is because during work in the power station they are exposed to noise but ignore it with the reasons have been accustomed, without them realize the value of the

threshold of hearing decreased. The longer their working periods are likely to be more exposed to noise in the work environment, and this is more and more dangerously for their hearing (Suma'ur, 2009).

Workers with less than 10 years working period as many as 4 people (10.5%) also experienced complaints of hearing loss. Although the respondents are classified as new workers but they are at risk of exposure to noise and complaints of hearing loss because sometimes workers ignore the intensity of existing noise and do not use Personal Protection Equipment when in the area of high noise such as the engine area. Low awareness of workers to use Personal Protection Equipment because they feel uncomfortable when using it.

The results above are in line with research Kurniawan (2012), that there is a relationship between the working period with the incidence of hearing loss perceived train drivers Solo Balapan. These results are also in line with WHO review (2015) that Excessive noise is increasingly encountered in many aspects of day-to-day life and among the many people exposed to noise at their place of work.

Duration of Exposure and Hearing Loss At Diesel Power Plant Workers

Duration of exposure is determined a working time. "working time" is defined as "any period during which the worker is working, at the employer's disposal and carrying out his activity or duties, in accordance with national laws and/or practice". "Rest period" is defined as "any period which is not working time". Generally, occupational scientists define "long working hours (LWH)" as working hours that is beyond normal weekly hours of work (Wagner, 2018).

Based on the results of *chi-square* test on the duration of exposure with hearing loss complaints obtained ($\alpha = 0.003 < \alpha 0.005$), this means that there is a relationship with the duration exposure of hearing loss at diesel power plant workers. Workers exposed over ≥ 8 hours according to the measurement results as many as 21 (56.9%) have complaints of hearing loss. However there are 6 (20.7%) workers exposed to noise less than 8 hours a day remain hearing impaired. This is may induced to the high noise value in the machine area which reaches 95.869 dB. at this noise level the maximum exposure allowed is 1 hour a day. Use of personal protection equipment like ear muff can reduce noise up to 10dB and use ear plug can reduce noise up to 25dB. Thus if workers use earmuff then maximum exposure can be extended to 4 hours, and if using earplug then maximum exposure can be extended to 8 hours. provided that the use of such ear protection devices is in accordance with standard operating procedures.

The results above in accordance with Suma'mur (2009) theory; suggests on a job not heavy or light, productivity began to decline after 4 hours of work. There are several studies that are in line with the results of this study, one of them Kurniawan (2012); that there is a relationship between the duration exposure in the railroad locomotive cabin a day with the hearing impairment to the train driver Solo Balapan. Other interesting studies recommend that in determining hearing loss should be considered as a risk factor for fatigue and mental distress which may lead to sick-leave. Fatigue is closely related to working time working environment condition (Kramer et.al., 2006).

Uses Personal Equipment Protection and Hearing Loss At Diesel Power Plant Workers

Personal Protection Equipment is the last alternative that is the completeness of all technical efforts of accident prevention. Personal Protection Equipment is diverse based on the organs that it protects, one of which is the organ of hearing. Hearing organs Protective Equipment often used to protect the ear from noise in the work environment in general there are two types of ear muff and ear plug.

Based on the results of chi-square test on the use of Personal Protection Equipment with hearing loss on workers obtained value $\alpha = 0.002$ ($\alpha < 0.05$), meaning there is a relationship of use

of Personal Protection Equipment with hearing loss. Based on the Table 2 workers who do not use Personal Protection Equipment during work experience hearing loss as many as 21 (58.3%), and workers who use it but still have hearing loss as much as 6 (20.0%). The difference in outcomes is because although the worker uses Personal Protection Equipment while working in a noisy area but the type of device used greatly affects the amount of reduced noise frequency, coupled with the way and compliance of the use of Personal Protection Equipment. Uncomfortable when using it, making the workers do not used consistently.

The high noise value especially in the machine area of 95.869 dB requires workers to use Personal Protection Equipment to reduce the frequency of noise, as the theory put forward by Tarwaka (2008), that Personal Protection Equipment is a set of safety tools used by workers to protect all or part of its body from the possibility of exposure potential workplace environmental hazards to occupational accidents and diseases.

The results above in accordance Mostaghaci et. al (2013), they are has documented a high incidence of noise-induced hearing loss in tile and ceramic workers that would put stress on the importance of using hearing protection devices. Other study Tetryanti, M AZ. (2014) found that workers who are inconsistent using hearing protection devices when they workplace have a tendency to get hearing loss when compared to workers who consistently wear it when working in noise areas that exceed Threshold Value.

CONCLUSION

Hearing loss to Diesel Power Plant Silae workers is associated with duration of service more than 10 years, time exposure more than 8 hours a day especially they are in the machine area and compliance of use personal protection equipment such as ear muff and ear plug. Basically the use of it is the most appropriate preventive effort in reducing the frequency of noise exposure, but note the type of equipment and how to use it. Further studies of this need to be done taking into consideration aspects of age, fatigue, work shifts and other factors including workers' anatomy.

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