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EVALUATION OF HEARING CONSERVATION PROGRAM IN PT PAITON OPERATION AND MAINTENANCE INDONESIA (PT POMI)

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Abstract

Introduction: The regulations related to hearing conservation programs are currently still theoretical and not practical. In the production process at PT POMI, there are several pieces of equipment that serve as sources of noise in the work area. Based on data from measurements of the work environment related to noise in the work area and noise exposure measurements on representative workers, the results indicate that the highest noise exposure at PT POMI is 97.9 dBA. Method: This research is a descriptive study that provides an overview of the implementation of the hearing conservation program. Data collection was conducted through observation, interviews, and literature review. The data obtained is then discussed by comparing it with existing regulations. Result: PT Paiton Operation and Maintenance Indonesia has implemented all elements of the hearing conservation program in accordance with the regulatory requirements of the Occupational Safety and Health Administration (OSHA) No. 1910.65 regarding Occupational Noise Exposure. Conclusion: PT POMI has implemented six elements of the hearing conservation program including noise exposure monitoring; engineering and administrative controls; audiometric test; hearing protection devices; training and education; and record keeping. However, the implementation of these elements has not been fully maximized.

Keywords: Hearing Loss, Hearing Conservation Program, Noise, Safety and Health

Introduction

Noise exposure in the workplace is one of the most common occupational hazards, responsible for approximately 16% of adult hearing loss worldwide. Workers experiencing hearing loss may face safety issues at work, exhibit high absenteeism rates, and even have an increased risk of work-related accidents. The prevalence of workplace noise and noise-induced hearing loss (NIHL) has rapidly increased due to the evolving work processes accompanying the current industrial revolution. In Southeast Asia, 109.4 million people suffer from moderate to severe hearing loss. In Indonesia, 16.8 percent of the population, or about 36 million people, experience hearing loss due to noise exposure, making Indonesia the country with the highest incidence of noise-induced hearing loss in Southeast Asia (1,2).

Continuous noise exposure above 70 dB can lead to cumulative hearing loss, while noise levels exceeding 120 dB can cause immediate hearing damage. Noise-induced hearing loss (NIHL) results from damage to the cochlear hair cells, particularly the outer hair cells in the basal region. Damage can occur through various mechanisms, and in mammals, damaged hair cells cannot regenerate, making NIHL permanent once these cells are destroyed. Tinnitus is the conscious perception of sound without

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any external auditory stimulus, often experienced as ringing or buzzing. It is typically self-reported and subjective. Hearing impairment occurs in about 60% of individuals with tinnitus, indicating a pathophysiological process following exposure to harmful noise. The variability between tinnitus and hearing loss in individuals exposed to noise may be due to differences in the susceptibility of cochlear and central components to the duration and intensity of noise exposure (1,3).

The Occupational Safety and Health Administration (OSHA) mandates that companies establish a hearing conservation program if the average noise exposure in the workplace exceeds 85 dBA. Such a program requires regular noise level assessments, free annual hearing examinations, comprehensive training, and ensuring that workers have access to adequate and free hearing protection (4). A study on companies implementing hearing conservation programs indicated a reduction in workplace accidents, occupational diseases, and lost work time due to accidents. Other research has shown that long-term noise exposure can contribute to stress-related diseases, particularly cardiovascular conditions. If a worker suffers from noise-induced hearing loss (NIHL), the damage is permanent and may require medical intervention or surgery for treatment. Employees who have worked for 35 to 40 years at a company deserve to enjoy their retirement and socialize with family without the hindrance of hearing loss (5,6).

A hearing conservation program is a series of planned, dynamic, systematic, integrated, interdisciplinary, and multiprofessional actions. This program is designed to protect workers from significant noise exposure in the workplace, safeguarding their hearing even if they are continuously exposed to noise throughout their careers. A study examining the impact of hearing conservation programs on noise-induced hearing loss in the workplace was conducted across 13 metallurgical plants from 2003 to 2018. The results showed a decrease in the number of workers exposed to noise levels above 85 dBA by 2018. Additionally, the findings indicated that the better the implementation of a hearing conservation program in a company, the lower the incidence of noise-induced hearing loss in the workplace (7–9).

PT Paiton Operation and Maintenance Indonesia (POMI) is a coal-fired power plant that collaborates with Paiton Energy to supply electricity to the Java and Bali regions. In its production process, several pieces of equipment, such as turbines and boilers, serve as sources of workplace noise. According to data from workplace environment noise measurements and noise exposure assessments on representative workers, the highest noise exposure at PT POMI was recorded at 97.9 dBA.

Method

The research conducted at PT POMI used a qualitative descriptive method. Data collection was conducted through observation, interviews, and literature review. Evaluation of hearing conservation program implementation was conducted through in-depth interviews using an interview guide sheet in the form of a checklist made in accordance with the hearing conservation program requirements required in OSHA 1910.95 concerning Occupational Noise Exposure. Interviews were conducted with Safety Specialists and Safety Officers. Assessment aspects include noise exposure monitoring; engineering and administrative controls; audiometry tests; hearing protection; education and training; and record keeping.

Results

PT POMI has implemented a hearing conservation program as a preventive measure against occupational diseases, specifically hearing loss. This is outlined in procedure PP-03-25 on Medical and Personal Monitoring and procedure PI-03-25-01 on Hearing Conservation. Noise exposure measurements in the workplace are conducted using a sound level meter that is calibrated annually. PT POMI possesses two sound level meters for measuring workplace noise. The calibration of these sound level meters is performed by a third-party calibration laboratory, PT Unilab Persada. Noise exposure measurements are also conducted on representative workers every three years. The final report on workplace environment quality monitoring is provided to PT POMI by a third party, PT Envirolab Nusantara. The results of personnel noise exposure measurements conducted by the third party. The measurement method uses IKAS-5.7.8-EN (direct reading) with a noise dosimeter as the measuring instrument.

PT POMI has isolated noise sources, such as turbines and boilers, from workers by placing them in dedicated rooms to minimize noise exposure. This ensures that workers are not exposed to noise for 8 hours a day. PT POMI also conducts regular inspections and maintenance of equipment to prevent unusual conditions that could cause excessive noise. These inspections and maintenance are carried out every six months by the engineering and maintenance team.

PT POMI conducts audiometric tests for all its employees at least once a year, alongside other regular health examinations, to assess the early effects of noise exposure. The audiometric tests utilize an audiometer that meets the American National Standard Institute (ANSI) Specifications of SC-1969. These tests include both a baseline audiogram and an annual audiogram. However, the baseline audiogram is not conducted six months after noise exposure; instead, PT POMI performs the audiometric test before employees are hired and then again one year afterward.

PT POMI provides hearing protection in the form of earplugs, which can be freely taken by anyone in areas where noise exceeds the threshold limit. Any area where noise measurements exceed the threshold limit is equipped with warning signs indicating the need for hearing protection. PT POMI has not received any written complaints from workers regarding the hearing protection provided by the company. The hearing protection available in PT POMI's work areas is the Honeywell MAX-1 earplug, with a Noise Reduction Rate (NRR) of 33 dBA. The reduction level of the earplug can be calculated using the formula: (NRR-7)/2. Therefore, the earplugs used by workers can reduce noise by 13 dBA. The highest personal noise measurement recorded is 97.9 dBA, so the earplugs used by PT POMI workers can reduce this noise level to 84.9 dBA.

PT POMI has provided additional hearing protection for workers to use in case of machinery malfunctions that result in higher noise levels than usual in the workplace. The additional hearing protection consists of earmuffs, specifically the PELTOR™ Optime™ 95 Earmuffs H6A/V. These earmuffs have a Noise Reduction Rate (NRR) of 21 dB. The combined noise reduction from using both earmuffs and earplugs is calculated using the formula: ((Highest NRR-7) + 5) / 2. Therefore, the earmuffs and earplugs together can reduce noise by 15.5 dBA.

PT POMI has conducted education and training on the effects of noise exposure, the purpose of using hearing protection devices, and how to use them. This education and training are provided during safety inductions, and PT POMI has also posted instructions for using hearing protection in the work area. However, they have not yet fulfilled the criteria for providing education and training on the hearing conservation program and the purpose of audiometric testing for employees. Education and training on the hearing conservation program can be conducted during safety talks attended by employees. The goal of this education and training is to help employees understand the program. When employees know the reasons and mechanisms behind the hearing conservation program, they are more likely to participate for their own benefit, rather than viewing it as an obligation. Bulletins can be used as a instructional media for educating and training employees.

The results of workplace noise exposure measurements, stored by the safety specialist as a junior environmental safety expert, and the personal noise exposure measurements conducted by the third party, PT Envirolab Nusantara, have been archived in both hardcopy and softcopy formats by the safety officer. These records of noise exposure measurements for both the workplace and individuals have been maintained for over 10 years. PT POMI has been maintaining records of noise exposure measurements and audiometric test results. According to Procedure PP-03-25-08 regarding medical check-ups, point 5.12.1 states that health and safety are responsible for ensuring that health examination results are archived for 25 years in softcopy format and for up to 2 years in hardcopy format. Based on observations and interviews with the Health and Safety Specialist, the softcopy records of employees' medical check-ups have been stored since the medical check-ups were conducted at PT POMI.

The criteria for record-keeping that PT POMI has yet to meet involve maintaining records for the hearing conservation program and audiometric testing. Hearing conservation program records should include details such as the worker's name, department, job description, and the type of hearing protection used. Audiometric testing records should involve creating a list of workers enrolled in the hearing conservation program. These records should include the examiner's name, the date of the audiometer's last calibration, the worker's name, department, date of audiometry, noise exposure in the work area, and noise levels at the audiometric test location.

Discussion

Assessing noise involves identifying and regularly monitoring all relevant noise sources. Based on the assessment results, preventive and corrective measures will be implemented if necessary. For an effective noise control program, the industry must routinely review the action plan in place. Regular measurement and monitoring of personal noise exposure are essential to ensure that noise levels in the workplace remain within acceptable limits, thereby protecting workers' health, reducing the risk of negative effects, improving working conditions, and enhancing productivity and product quality (10).

Noise controls and administrative actions should be prioritized as the primary defense against noise issues in mines. The study suggests implementing engineering noise control measures, such as selecting processes with lower sound pressure levels, enclosing noise sources, preventing noise transmission, and relocating noisy machinery to less frequently used sections of the mine. Peterson (2018) proposed that engineering controls involve making physical changes to the workplace, such as redesigning equipment to eliminate noise sources and building barriers to prevent noise from reaching workers. Additionally, research by Manwar, Mandal, and Pal (2016) utilized noise mapping from European mines as a strategy to address noise issues. Their findings indicated that predicting the total noise emissions from a mine can help determine the appropriate noise reduction measures to protect miners and nearby communities (11–13).

A temporary threshold shift (TTS) occurs when a person is exposed to high levels of noise for a certain period. During TTS, damage and changes occur within the cochlea of the ear, potentially disrupting various fundamental cochlear processes, such as damage to hair cells. Repeated instances of TTS over time can lead to a permanent threshold shift (PTS). Workplace interventions to prevent noise-induced hearing loss (NIHL) are based on identifying deteriorations in hearing thresholds, known as significant threshold shifts (STS). Identifying workers hearing thresholds involves comparing the results of annual audiometric tests with the baseline audiogram (14,15).

Installing safety signs is a method used to inform workers about potential hazards in their work area and how to avoid them. When safety signs are properly installed and effectively communicate the dangers and ways to avoid them, they can prevent workplace accidents and occupational illnesses (16). According to the Indonesian Law No. 1 of 1970 on Work Safety, Article 14b states, "Install all required

occupational safety signs and other instructions in the workplace, in locations that are easily visible and readable, as directed by safety inspectors or experts".

The selected hearing protection should be comfortable for workers to wear and provide sufficient protection to prevent hearing loss. Hearing protectors must adequately reduce noise levels. Companies can use the noise reduction rate (NRR) of each hearing protector to determine the noise level in the work environment after the protection is used (5,17). Hearing protection devices are used in workplaces to prevent hearing loss due to noise exposure. These devices must be worn correctly and consistently when working in environments where noise levels exceed the permissible exposure limit. Proper use of hearing protection appropriate to the workplace noise can enhance the effectiveness of a hearing conservation program. An Effective Hearing Conservation Program (EHCP) aims to minimize the risk of hearing loss at work and to preserve and protect hearing. The use of hearing protection devices is a component of the EHCP, where employers must provide these devices when technical and administrative noise control measures do not reduce noise exposure below the permissible limit (18,19).

A 2021 systematic review assessed the effectiveness of hearing protection devices (HPDs), concentrating on their impact on sound attenuation, sound localization, and speech perception. The study underscored the essential role of HPDs in reducing noise exposure and preventing noise-induced hearing loss in workplace environments. Additionally, research conducted in a metallurgical plant showed that hearing conservation programs significantly decreased occupational noise-induced hearing loss, highlighting that high compliance with HPD use is crucial for the success of these programs (9,20).

A 2023 study focusing on vector control workers revealed that training and educational programs significantly enhanced their knowledge, attitudes, and practices in preventing noise-induced hearing loss (NIHL). The research emphasized that ongoing training is vital for fostering positive safety behaviors in the workplace, thereby reducing the risk of NIHL. Studies have demonstrated that hearing conservation programs (HCPs) effectively decrease occupational noise-induced hearing loss. These programs typically include elements such as education on using hearing protection devices, regular hearing assessments, and awareness sessions about the effects of noise exposure on hearing and health. These educational initiatives are essential for enhancing the effectiveness of HCPs and reducing hearing loss among employees (21–23).

Maintaining accurate records for the hearing conservation program is essential for the early identification of workers at risk of noise-induced hearing loss, efficient audiometric monitoring, and facilitating medical decision-making and intervention strategies to reduce or prevent hearing loss due to noise. Comprehensive data on noise exposure, the list of employees enrolled in the hearing conservation program, and audiometric test data can make the implementation of the hearing conservation program more effective. Record keeping is crucial for a hearing conservation program as it enables the monitoring and evaluation of the program's effectiveness. Maintaining accurate and complete records helps employers demonstrate compliance with applicable regulations and accurately track employees' hearing over time, which is important for recording cases of work-related noise-induced hearing loss and responding to worker compensation claims. Good record keeping allows for the evaluation of hearing loss prevention efforts and helps determine the effectiveness of noise control measures, including tracking noise exposure levels, audiometric testing results, and the use of hearing protection devices. Additionally, digital record keeping offers advantages such as quick retrieval of information and the ability to manage large volumes of data over extended periods. This is particularly useful given the long retention periods recommended by organizations like NIOSH, which suggests keeping records for the duration of employment plus 30 years (24–26).

Conclusion

PT POMI has implemented six elements of a hearing conservation program, which include noise exposure monitoring, engineering and administrative controls, audiometric testing, hearing protection devices, training and education, and record keeping. In its implementation, PT POMI involves multiple parties to ensure the effective execution of the hearing conservation program. However, there are still two elements that do not fully meet the OSHA 1910.65 requirements: the training and education element and record keeping.

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