A Study on Noise-Induced Hearing Loss in Employees of a Paper Mill: Exposure Levels and Audiometric Out Comes

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ABSTRACT- The Research worldwide has indicated a significant number of workers with hearing loss attributed to noise exposure. Noise-Induced Hearing Loss (NIHL) claims are responsible for the majority of occupational disease payouts. The study was undertaken in order to determine the extent of hearing loss due to noise exposure that could be ascribed to excessive exposure to noise, and to describe the noise-induced hearing loss by severity, type of work, and area of work and duration of service. The cross-sectional study included 100 workers employed in a pulp and paper mill. Audiometry results were presented for noise-induced hearing loss in relation to area of work, duration of service, categories of severity and age group. The prevalence of noise-induced hearing loss in the pulp and paper mill was 18%. Type of work, area of work and years of service correlated significantly with a diagnosis of noise-induced hearing loss. As a department, the wood yard (which included the wood chipping facility, maintenance workers and workers with 8-10 years of service) showed the most significant association. In categories of severity 13% of workers suffering from NIHL fall in the ≤ 5 Percentage Loss of Hearing PLH category. This study has confirmed the findings of others that noise exposure is a significant hazard in industry and an effective noise control programme is the only way to reduce the risk of NIHL.

Keywords- ***IOT, Noise Safety, Hearing Loss, Sound, Hazardous***

1. INTRODUCTION

The paper manufacturing industry is characterized by the use of large-scale mechanical equipment such as rollers, presses, conveyors, and dryers, which contribute significantly to occupational noise exposure. Prolonged exposure to high noise levels has been associated with hearing loss, increased stress levels, cardiovascular issues, and reduced worker productivity. As a result, noise safety has become a critical component of occupational health programs in this sector.

2. LITERATURE SURVEY

2.1 NOISE SAFETY IN THE PAPER INDUSTRY

Numerous studies have documented excessive noise levels in paper mills, often exceeding 85 dB(A), the permissible exposure limit recommended by organizations such as the Occupational Safety and Health Administration (OSHA) and the World Health Organization (WHO). Neitzel et al. (2009) found that paper mill workers are exposed to continuous noise levels between 85–95 dB(A), with peaks surpassing 100 dB(A) in areas near machinery. Rabinowitz et al. (2007) observed a direct relationship between chronic noise exposure and permanent hearing threshold shifts in industrial workers, highlighting the need for effective hearing conservation programs. Basner et al. (2014) demonstrated that prolonged exposure to noise above 70 dB can lead to physiological stress. Techniques include Installing noise barriers, enclosures, vibration isolators, and using quieter machinery. The adoption of modern technologies is transforming noise management in paper mills are IoT-Enabled Sensors to real-time monitoring of sound levels across the facility, predict areas of high noise and optimize maintenance schedules using AI-Based Predictive Analytics, allow workers and safety officers to track exposure levels and respond proactively. Therefore, noise safety in the paper industry is a multidimensional challenge requiring continuous monitoring, worker involvement, and the integration of emerging technologies. Enhancing awareness, improving assessment methods, and adopting preventive strategies are essential for creating safer work environments.

3. EXISITING SYSTEM

Occupational noise safety systems aim to protect workers from noise-induced hearing loss by implementing a hierarchy of controls. This includes eliminating or reducing noise at the source, using engineering controls like barriers and enclosures, and finally, providing hearing protection such as earplugs or earmuffs. The NIOSH recommended exposure limit (REL) for occupational noise exposure is 85 A-weighted decibels (dBA) over an eight-hour shift. If workers are repeatedly exposed to noise at or above the REL, employers must provide a hearing loss prevention program. Since sound is a wave, it has all of the properties attributed to any wave, and these attributes are the four elements that define any and all sounds. They are the frequency, amplitude, wave form and duration, or in musical terms, pitch, dynamic, timbre (tone color), and duration.

3.1 CONTROL MECHANISMS

The best way to reduce exposure to noise is to eliminate it at the design stage. In terms of equipment, always try to choose features that will reduce the noise level to a minimum acceptable level. In terms of new installations, select quiet equipment, have a procurement policy that opts for acquiring quiet equipment, and eliminate design flaws which would amplify the noise. Engineering modifications include changes that affect the source or the path of the sound. Engineering controls are the preferred method of noise control in already established workplaces where noise protection was not factored in at the design stage. It is generally agreed that controlling the source is more cost-effective than those controlling noise along the path. See the engineering controls section below for examples.

3.5 EXTING BLOCK DIAGRAM

To draw a block diagram, start by identifying the main components or functions of the system. A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks

connected by lines that show the relationships of the blocks. They are heavily used in engineering in hardware design, electronic design, software design, and process flow diagrams.

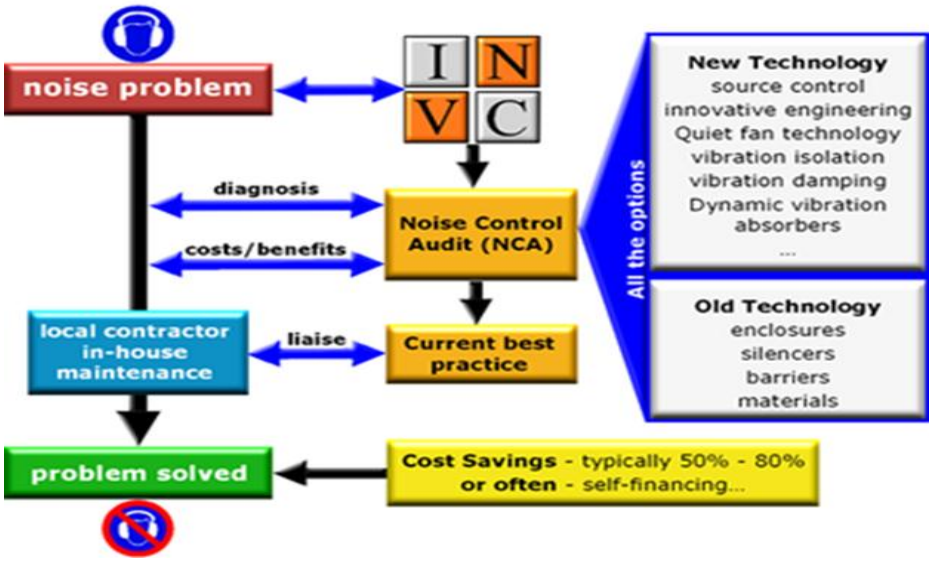
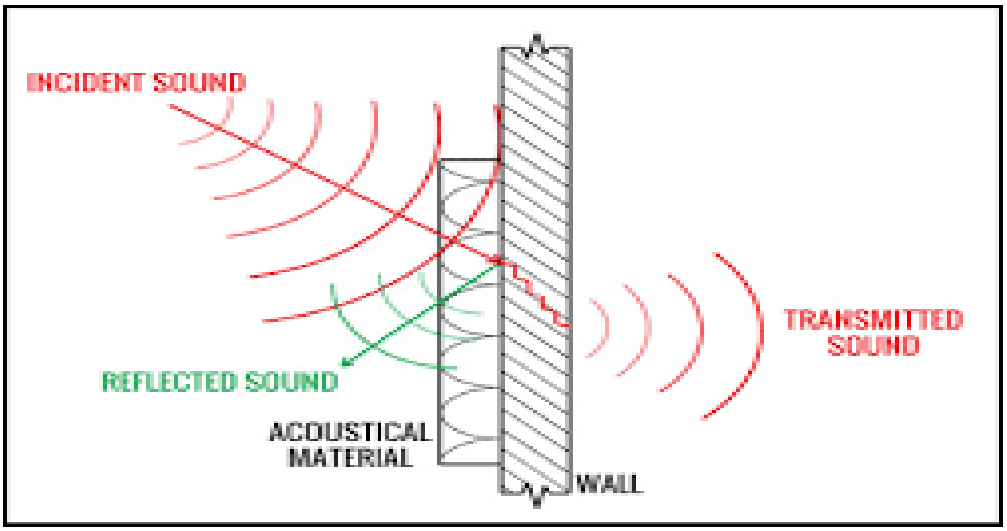


FIGURE 2. EXISITING BLOCK DIAGRAM

3.7 SOUND INSULATION AND SOUND REDUCTION COEFFICIENT

When a sound meets a wall or partition, only a small proportion of the sound energy passes through. Most is reflected back. A wall with 10 dB insulation allows 10 % of the sound energy through, (20 dB corresponds to 1%, 30 dB corresponds to 0,1% etc.). The sound insulation ability of a partition separating two rooms is called the sound reduction coefficient and is expressed in db.



FIGUER 3.1. SOUND INSULATION

3.11 IN A NEW PLANT ONE CAN GO EVEN FURTHER BY:

1. Installing quieter electric motors and transmissions,

2. Choosing hydraulic systems with specially stiffened oil tanks,

3. Mounting dampers in the hydraulic lines

4. Dimensioning these lines for a relatively low flow velocity (a maximum of about 5 m/s.

5. Providing ventilation ducts with sound attenuators to prevent transmission between noisy and quiet rooms via the ductwork.

3.14 THE SCOPE OF NOISE EXPOSURE

As mentioned above, noise is especially prevalent in the manufacturing industries.The levels are likely to be somewhat higher in less developed nations, where engineering controls are not used as widely, and somewhat lower in nations with stronger noise control programmes, such as the Scandinavian countries and Germany.

Many workers throughout the world experience some very hazardous exposures, well above 85 or 90 dBA. For example, the US Labor Department has estimated that nearly half a million workers are exposed to daily average noise levels of 100 dBA and above, and more than 800,000 to levels between 95 and 100 dBA in the manufacturing industries alone.

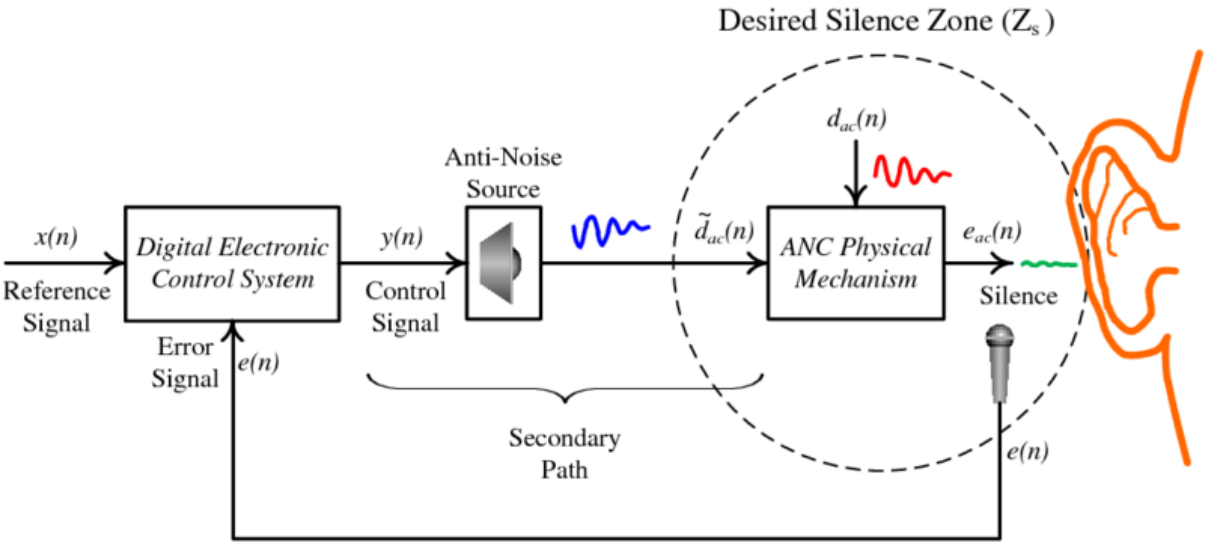


FIGURE 3.5. GENERAL DIAGRAM FOR FEEDBACK ANC

The most common instruments used for measuring noise are the sound level meter (SLM), the integrating sound level meter (ISLM), and the noise dosimeter. It is important that you understand the calibration, operation and reading the instrument you use.

5. CONCLUSION &FUTIER SCOPE

The relevant line manager should be informed of all noise survey results and recommendations made concerning noise reduction at source and the feasibility of implementation should be investigated. Although primary prevention through engineering controls is the best way of reducing exposure it is not always possible. In conclusion, noise safety is crucial for worker well-being and productivity. Effective noise management involves identifying and addressing noise hazards, implementing engineering controls, using personal protective equipment (PPE), and providing education and training. Beyond hearing loss, noise can cause stress, reduced concentration, and even affect cardiovascular health, highlighting the importance of proactive noise control measures. Elaboration Identifying Noise Hazards. A thorough risk assessment is the first step, identifying noise sources and their levels in the workplace.

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