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A REVIEW ON THE EFFECTS OF OCCUPATIONAL NOISE ON THE EFFICIENCY OF INDUSTRIAL WORKERS

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ABSTRACT

Exposure to high level noise has many adverse effects on human health. Noise has become one of the major causes, which brings annoyance in human beings. With the never ceasing demand and very high expectations from customers, industrial growth is booming far from the imagination. As a result of industrialization people are more exposed to noise and are facing physical, physiological and psychological disorders. There are many studies which suggest that prolonged exposures to high noise levels have a negative impact on various aspects of human physiology. Chronic exposure to high noise levels in an industrial setup have more adverse effects on human health compared to any other setup. The intent of this work is to summarize the pre-known effects of noise and its affect on the efficiency of industrial workers, and to establish their importance relative to the control of noise in industries.

Keywords: Noise, Noise sources, Physical Effects, Physiological Effects, Psychological Effects

I. INTRODUCTION & REVIEW

Noise is defined as the unwanted sound and is a pollutant whose effects on health have been neglected, despite the ability to precisely measure or calculate exposure from peak level or energy averaged over time [1]. Sound which is loud and which disturbs the people is called noise. Nowadays noise has become one of the major pollutants of the environment. It is not only imbalancing the ecology but also causing damage for the human beings. Noise is the most ubiquitous industrial pollutant. The ear does not distinguish between social, military or industrial noise; they are additive [2]. A peaceful environment is a basic requirement for human comfort. However, because of the rapid growth of modern industries people are getting habituated to high exposure of noise. Noise produced by the industries has been an increasing cause for concern, and the field of acoustics has therefore become exceptionally important.

In 1972, National Institute of Occupational Safety and Health (NIOSH) published “Criteria for a Recommended Standard–Occupational Exposure to Noise” which provided the basis for a recommended standard to reduce the risk of developing permanent hearing loss because of occupational noise exposure. NIOSH recommends that workers should not be exposed to noise at a level that amounts to more than 85 decibels for 8 hours. The permissible level of exposure is as shown in Table 1.

Table 1: Permissible Noise Exposures (Source: OSHA 1910.95)

Duration per day (hrs)	OSHA 1910.95 (US)
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
< ¼	115

The Central Pollution Control Board constituted a Committee on Noise Pollution Control. The Committee recommended noise standards for ambient air and for automobiles, domestic appliances and construction equipments, which were later notified in Environment (Protection) Rules, 1986 as given in Table 2

Table 2: Permissible Noise Exposures in Different Zones (Source: The Central Pollution Control Board)

Code	Category of Area Zone	Limits in dB(A) Leq	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence Zone	50	40

In the table, Day time is reckoned in between 6 a.m. and 9 p.m. Night time indicates the noise level reckoned in between 9 p.m. and 6 a.m. Silence zone is referred as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are declared by the Competent Authority.

Although industrial noise is one of the less prevalent community noise problems, neighbors of noisy manufacturing plants can be disturbed by sources such as fans, motors, and compressors mounted on the outside of buildings Interior noise can also be transmitted to the community through open windows and doors, and even through building walls. These interior noise sources have significant impacts on industrial workers, among whom noise- induced hearing loss is unfortunately common.

Even though developed countries in particular and developing countries in general have established their noise control standards in order to protect the people from the adverse effects/impacts of noise, most of the industries have noise level much above the permissible limits. Providing workers a safe and healthy working environment should be the basic responsibility of any industry. Safety measures have to be taken in industries for the well

being of the workers. The influence of noise on workers, their stress reactions, noise induced hearing loss and other parameters, to date, have been investigated separately.

Effects of noise can be categorized into Auditory and Non-auditory effects. Auditory effects correspond to noise induced hearing loss and non-auditory effects relates to cardiovascular problems, hypertension, respiratory problems and so on. In industries, major effects of noise can be categorized as shown in Figure 1

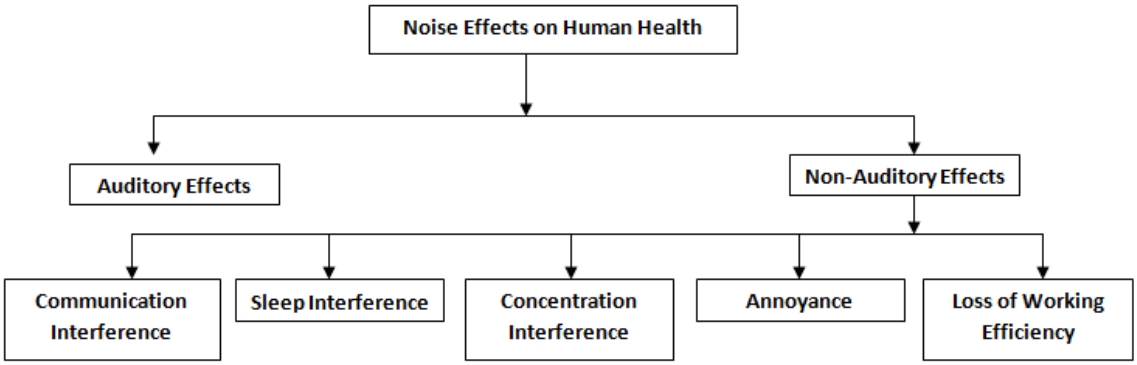

Figure 1: Noise Effects on Workers

1.1 Auditory Effects

Any effect of reduction in hearing sensitivity is generally called as "hearing loss". Occupational hearing loss is the common health hazard found in most of the workers. Even though there are many causes of hearing loss, the main cause is the result of intense exposure of noise. The noise can affect the human ears in mainly three ways. It can deafen or damage the hearing capability instantaneously; it can severally reduce the sensitivity of ear to the sounds of certain frequencies over a period of time, and it can numb the human ears for a limited period of time and return to the normal position within minutes, days or weeks depending upon the intensity of noise. It is possible to classify the effects of noise on ears in three groups: acoustic trauma, temporary hearing losses and permanent hearing loss [3]

1.2 Non- Auditory Effects

Apart from damage to hearing, many researchers have shown that noise may cause communication inference, sleep interference, concentration interference, annoyance and loss of working efficiency as shown in Fig. 1. It is very clear that due to noise workers will be affected physically, physiologically and psychologically. Increase in blood pressure, pulse rate accelerations, appearance of muscle reflexes, sleeping disorders may be considered among the other physiological effects. The psychological effects of noise are more common compared to the psychological ones and they can be seen in the forms of annoyance, stress, anger and concentration disorders as well as difficulties in resting and perception [4-6]. Complaints on fatigue, irritability and social conflicts in many noise exposed workers have also been reported. . Previous studies have demonstrated the adverse effects of acute and continuous noise on vigilance [7,8], attention [9,10], reading deficits and skill [11,12], employee concentration [13], and cognitive processing [14,15,16]

1.2.1 Psychological Problems

Noise may interfere with working efficiency and disturb concentration, especially where work is highly skilled and decision taking. Different scientists subscribes to the comparable supposition that disturbance and sleep disturbance influences are the most across the board and decently recorded subjectively reported impacts of noise[17-19], yet morning tiredness, cerebral pains and milder mental conditions have likewise been accounted for to be connected with noise in adult population[20]. Annoyance reactions are often associated with the degree of interference that any noise causes in everyday activities, which probably precedes and leads on to annoyance [21]

1.2.2 Physiological Problems

Many occupational studies have suggested that individuals chronically exposed to continuous noise at levels of at least 85 dB have higher blood pressure than those not exposed to noise [22-23]. Exposure to excessive noise amid pregnancy may bring about high-recurrence listening to misfortune in newborns, rashness, intrauterine development impediment, cochleae harm, interruption to the ordinary development and advancement of untimely babies [24]. Negative impacts of noise are connected with a patients expanded levels of anxiety [25]

1.3 Noise Control

Regulatory bodies or agencies insist on keeping the levels of noise within the set standards and practices pertaining to the country of action. However, noise needs to be controlled form the point of view of impending damages and thus, noise control becomes inevitable. Noise control is mainly categorized as

- Passive Noise Control
- Active Noise Control

Most of the control process is passive. However, active control is adopted in select applications as the same involves a sophisticated design and execution.

Further, based on the location where the same is controlled it is further categorized as:

- Control at source
- Control along the path
- Control at the receiving end

Noise control in most of the applications is a means of reducing sound emissions, often sensitized to personal comfort, environmental considerations or legal compliance. Practical and efficient noise control is wholly reliant on an accurate diagnosis of what is causing the noise, which first involves finding the source of noise. Once the source of noise has been found, the focus is reducing the noise at source by engineering means.

The most common noise sources can be divided into aerodynamics (fans, pneumatics, combustion, etc) and mechanical (impacts, friction, etc). Effective noise control focuses on reducing the noise from these sources as close to the source as possible. Noise control for aerodynamic sources includes quiet air nozzles, pneumatic silencers and quiet fan technology.

In architectural acoustics and environmental acoustics, **noise control** refers to the set of practices employed for noise mitigation. Within architectural acoustics these practices include: interior sound reverberation reduction, inter-room noise transfer mitigation and exterior building skin augmentation. More specific architectural noise control methods include the installation of acoustical gypsum, ceiling tiles, ceiling panels,

carpet and draperies. In the field of environmental sound, common noise control practices include: design of noise barriers, development and enforcement of noise abatement legal codes and urban design

II. METHODOLOGY

The available literatures were searched extensively on this topic. Articles were procured from several web sites. The materials were scanned thoroughly and the views of various authors were analyzed. Literature review was done based on the specific key words like noise, effects of noise on human beings, physical effects, physiological effects, psychological effects , auditory and non auditory effects of noise and so on. Abstracts and full papers were procured and studied the relations among the various parameters of noise which affected the human beings. Procured papers were sorted based on the priority of applicability. Later, the causes and effects of noise on industrial workers were analyzed. The methodologies followed by the authors were vigilantly analyzed. Remedies that have to be taken were listed.

III. DISCUSSION

Noise is the perseverance of human beings, but any noise level above 85dB has ill effects on the human beings. It is evident from the previous researches that, noise has many undesirable effects on the health of human beings. Unless it is taken care properly, it becomes fatal. Noise related problems should be addressed separately and remedies should be taken for the specific context.

People spend most of their time in working place and hence it should be comfortable. Nowadays ergonomics is playing a major role in industries, in order to give workers a pleasant environment to work in. The efficiency of the workers directly depends on the satisfaction levels they have in their working location. More efficient the working better will be the productivity of that particular industry. Hence, it becomes the prime responsibility of the employers to provide its employees a safer and healthier environment.

Noise is one such disturbance which affects the efficiency of the workers due the impact they have on the physical, physiological and psychological conditions of the workers. The impact caused by the noise varies from plain headache to the permanent hearing loss. All the effects caused by it can be comprehended and can be directly linked with the performance of the workers.

The sources of noise in industries are many, starting from the noise produced due to conservations of the workers to the noise produced by the working of machineries. Eliminating noise from all the sources becomes a highly challenging and a high expenditure project. Framing a single solution for all the noise produced is quite unrealistic. Each source should be addressed separately and remedy should be taken for a specific condition. As a common remedy it is recommended that workers must be provided with the noise protection devices like mufflers, silencers or ear plugs to reduce the exposure to intensity of noise. Acoustic enclosures can also be provided in high noise level areas.

IV. CONCLUSION

Whether knowingly or unknowingly, each one of us contributes to noise pollution in one way or not as most of our day-to-day activities generates some noise. However, if the noise produced in within the limits of

acceptance then the effect of the same is not felt at all. However, if the noise generated is excessive and if neglected then, noise pollution adversely affects our environment in general and human beings in particular leading to many problems.

The previous studies related to the noise and its effects reveals that noise can be fatal if not addressed to it properly. Noise produced in most of the industries is much above the permissible noise levels prescribed by the environmental standards of noise. A peaceful and a safe working place is the basic right of any worker. Educating the industries to adhere noise standards, making them to understand the ill effects of noise caused on their workers should be administered properly. The literatures show the adverse effects of noise on human beings. In order to enhance the performance of the workers along with several other factors the effects of noise should also be considered with utmost importance. The effects of noise on the performance of workers and the remedies from the previous literatures can be summarized as below:

1. Noise causes physical, physiological and psychological disorders.
2. Noise affects the performance of the workers
3. Workers must be provided with ear protection devices
4. Acoustic enclosures should be provided in intensified noise environment

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