International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN: 2347-5552, Volume-3, Issue-6, November 2015

Noise Exposure in Printing House

Sukwon Kim

***Abstract*— The purpose of this paper was to find if noise exposure (dBA) in a printing house met the recommended exposure limits (REL) as recommended in the National Institute for Occupational and Safety and Health's (NIOSH) Criteria for a Recommended Standard: Occupational Noise Exposure [DHHS (NIOSH) Publication No. 98-126]. The house has printed college publications, such as business cards, weekly and monthly student newletters, departmental and collegial catalogues. The house produces 3000 printed sheets per 3 hours period elapsed. Noise exposures were recorded by a sound level meter (a calibrated Type II, 5-dB exchange) for two different periods of 6 continuous minutes (the cycle time of 0.06 minute/sheet) nearby the operators 1) while the web press machine was running alone or 2) while the web press machine and the Heidelberg GTO four-color press were running simultaneously. Simple calculations and graphs were included in order to describe the findings. The results of the study suggested that the noise exposure levels at the house was acceptable based on the NIOSH criteria.**

***Index Terms*— Noise, dBA, REL**

I. INTRODUCTION

According to the National Institute for Occupational and Safety and Health (NIOSH), noise was one of health problem at workplaces. NIOSH[1] stated "noise, which is essentially any unwanted or undesirable sound, is not a new hazard." Indeed, the noise induced hearing loss (NIHL), a term referring to the slowly progressive sensorineural hearing loss that resulted from exposure to intermittent and/or continuous loud noise had been observed for centuries.

According to the National Institute on Deafness and Other Communication Disorders (NIDCD), NIHL could be caused by a one-time exposure to an intense "impulse" sound, such as an explosion, or by continuous exposure to loud sounds over an extended period of time, such as noise generated in a woodworking shop. Sources of noise for NIHL included motorcycles, firecrackers, and small firearms, all emitting sounds from 120 to 150 decibels. Long or repeated exposure to sounds at or above 85 decibels could be roots for hearing loss. The louder the sound, the shorter the time period before NIHL occurred. Sounds of less than 75 decibels, even after long exposure, were unlikely to cause hearing loss.

In 1981, the Occupational Safety and Health Administration (OSHA) estimated that 7.9 million U.S. workers in the manufacturing sector were occupationally exposed to daily noise levels at or above 80 decibels [46 Fed. Reg.* 4078 (1981a)]. In the same year, the U.S. Environmental Protection Agency (EPA) estimated that more than 9 million U.S. workers were occupationally exposed to daily noise levels above 85 decibels, as follows:

Major Group	*Number of Workers*
Agriculture	323,000
Mining	255,000
Construction	513.000
Manufacturing and Utilities	5,124,000
Transportation	1,934,000
Military	976,000
Total	9,125,000

Source: http://www.cdc.gov/niosh/docs/98-126/chap2.html[2]

The table of data showed us that manufacturing workers were affected most severely by the noisy environment at their workplaces. Together, they represented more than 56% of the affected workers. NIOSH stated that "Because printing equipment produces a noisy environment, control measures should be implemented to reduce noise to the lowest possible level. Adequate hearing protection should be provided, and surveys of noise level should be conducted routinely."

The above information suggested that noise exposure should be monitored at the printing house. The purpose of the survey in the present study was to find out if the noise level inside the printing house when the machines were running met the standard set by the NIOSH (less than 85 decibels over 8 hours).

II. METHOD

A. Environment

The printing house was capable of handling bulk mails, collecting and delivering departmental mails, printing, designing, binding and copying documents for the college. There were a Heidelberg GTO four-color press and 5 web press machines ready to handle the jobs. The popular order for the house was to make two-sided, two-color departmental business cards. For this service, the house charged $35.00 for 250 cards or $52.45 for 1,000 cards. Another popular order was to print letterhead papers for the different departments. For every month, the house receives and processes 100 different types of orders. Different types of jobs took different times to complete, depending on types of printing material used. For instance, printing departmental letterhead could be completed at a rate of 500 sheets per hour, that is a cycle time of 8.33 pages per minute. Another example was the college newspaper, the

Manuscript received November 10, 2015.

Sukwon Kim, Department of Physical Education, Chonbuk National University, Jeonju, South Korea, 82-63-270-2860 (e-mail: rockwallkim@naver.com).

weekly-issued on-campus newspaper. For this job, it could take 3 hours to print 3,000 copies. The job included a set-up time of 60 to 90 minutes because the first 300 to 500 copies produced were always non-use. As a result, the cycle time for this weekly newspaper was 16.67 copies per minute.

B. Survey's Procedure and Analysis

Noise level survey was performed while the machines were running. The first noise level survey was performed while the web press machine was running. The second survey was performed while both the web press machine and the Heidelberg GTO four-color press were running. Before the survey began, the EXTECH sound level meter model 407764 was set to meet the standards required for OSHA related testing. The frequency weighting to set to "A" and the response time was set to "SLOW." as recommended by the manufacturer for OSHA related testing. 150 different noise levels were recorded during a period of 6 minutes. All of the recorded data points were used to calculate the average, standard deviation, maximum value, minimum value, and the range of the data. A line graph for each set of the data was created in addition. The cycle times of the two most common orders usually were a lot less than 6 minutes. Therefore, the data collected within the 6 minute period was sufficient to represent an eight-hour work day at the printing house.

III. RESULTS

The values and graphs were presented below (Table 1).

Table 1: Noise Levels Measured in dBs When Web Press Machine Runs Alone (During a 6-minute Interval)

Average Noise Level	77.1
Standard Deviation	1.3
Maximum Noise Level	82.3
Minimum Noise Level	74.8
Noise Level Range	7.5

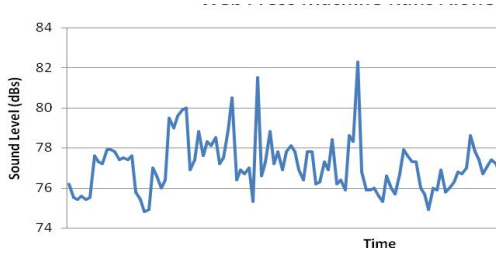
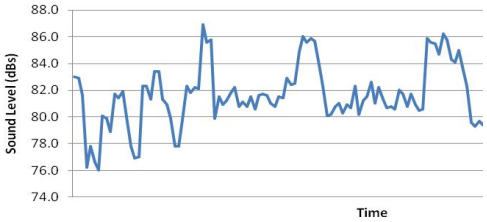


Table 2: Noise Levels Measured in dBs When Web Press Machine and Heidelberg GTO Four-Color Press Run at the Same Time (During a 6-minute Interval)

Average Noise Level	81.5
Standard Deviation	2.2
Maximum Noise Level	86.9
Minimum Noise Level	76.0
Noise Level Range	10.9



IV. CONCLUSION

In the present study, the noise exposure level for the each case, when the web press machine was running or when both the web press machine and the Heidelberg GTO four-color press were running at the same time was below 85 dBs recommended by NOISH for an 8 hours work period. The average noise levels for the first and second cases were (77.1± 1.3) dBs, and (81.5 ± 2.2) dBs, respectively. However, when the machines were running simultaneously, a maximum noise level of 86.9 dBs was detected once during the 6 minute interval of measurement. The noise level was above the standard 85 dBs, which may had caused serious injuries, such as hearing loss, to the worker. However, this high noise level occurred for a very short period of time (a few seconds) and was not consistent. The consistent noise levels in both cases were below the restricted level. So this maximum noise was not a dominant consideration to the workers.

V. LIMITATIONS AND RECOMMENDATION FOR FUTURE WORK

In order to assess human exposure to noise, the type of noise must first be determined as there are three basic kinds of noise such as continuous, impulse, and impact noises. Printing presses typically generated both continuous and impulse noises although the noise appeared to be continuous due to the brief time interval between printing cycles; impulses were created from the press cycle of operation.

Noise exposure guidelines are published by both the American Conference of Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH)[3]. These recommendations are more conservative, and therefore more protective, than regulatory requirements established by the US Department of Labor, Occupational Safety and Health Administration (OSHA). Noise exposure guidelines are based on an 8-hour work day, and are time-adjusted for increased noise exposures; that is, as noise levels increase, allowable time for exposure decreases. The ACGIH and NIOSH guidelines use the 3 decibel (dB) doubling criteria to determine the noise exposure while the OSHA uses the 5 decibel (dB) doubling criteria. The public university being a State institution, NIOSH or ACGIH regulations should have applied for the present study.

In the present study, only two (2) six minute samples were collected. The data collected were not representative of an 8-hour work day. Just because a machine may produce 80 or 90 dB, did not indicated that the operator was exposed to that level of noise at all time. Noise exposure should have been measured using both a Sound Level Meter (SLM) and a personal noise dosimeter for the present study. To assess noise exposures, measurements must have been made in the hearing zone of the operator – a sphere of approximately two

feet surrounding the operator's head. A personal noise dosimeter, with the microphone placed on the lapel, should have been worn by the operator for the entire workday, providing a continuous exposure database for the day. The SLM is used as a screening tool, to attempt to determine where the noise is being generated, how much noise is present, and to determine the approximate noise exposure to the operator. In the present study, the SLM was placed on a laptop and used to record noise; data was inputted into the laptop. The placement of the SLM could have provided false positive or false negative noise level readings. Noise measurements were not made at the operator's hearing zone, and therefore, were not representative of his actual exposure. In operating a printing press, the operator was free to move about and was not constantly exposed to elevated noise levels. The noise dosimeter should have been used for this purpose. The average noise level exposures reported were 77.1 and 81.5 dB(A) for the six minute runs.

ACKNOWLEDGEMENT

This research was supported by "Research Base Construction Fund Support Program" funded by Chonbuk National University in 2015.

REFERENCES

[1] "Glossary." EHDI WYOMING. Wyoming Department of Health Developmental Disabilities Devision. 25 Oct. 2008 <http://www.wyomingehdi.com/resources/glossary/>.

[2] NIOSH Chapter 2: Introduction "Criteria for a Recommended Standard: Occupational Noise Exposure." National Institute for Occupational Safety and Health. June 1998. 27 Oct. 2008 http://www.cdc.gov/niosh/docs/98-126/chap1.html

[3] NIOSH Publication No. 98-126, comp. "Criteria for a Recommended Standard: Occupational Noise Exposure." National Institute for Occupational Safety and Health. June 1998. 27 Oct. 2008 http://www.cdc.gov/niosh/docs/98-126/chap1.html

Sukwon Kim completed his Ph.D in Industrial and Systems Engineering with a focus in Human Factors Engineering. He has published 17 journal articles in regard to falls of older adults. He has 10 years of teaching and research experience in human factors engineering and biomechanics in several universities in USA and South Korea.