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Research paper

Noise exposure and induced hearing loss to workers in small and large scale industries

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Abstract

The purpose of this research is to determine the level of noise exposure to workers and to recommend how to manage the occupational high level of noise, understanding the workers noise exposure and providing personal ear protectors is the responsibility of employers. After visiting almost all the industries it was noticed that none of these industries are following these requirements. Knowing that exposure to excessive noise can cause health problems including temporary or permanent hearing loss, concentration problems, stress, nervousness, sleeping problems and fatigue. The noise levels was measured in different industrial settings in North Cyprus using a noise detecting equipment, cirrus 273 integrated sound level meter with octave band filters. The Safety and health standards for noise exposure were used as the benchmark for our data analysis. Questionnaires were designed to determine how much employees were affected by high noise levels in the workplace. Data's were analyzed using SPSS statistical program. Survey responses identified the most likely problems faced by industrial workers in North Cyprus. Sound level mapping informed worker noise exposure. It was found the most of the workers were exposed to high level of noise so therefore future studies will focus on industries with the highest noise levels, monitor- ing worker noise exposure using a dosimeter. The use of engineering method is considered best in reducing the high level of noise in these Industries.

Keywords: *Noise Exposure; Small and Large Scale Industries; North Cyprus; Engineering; Occupational Noise Management.*

1. Introduction

Health and safety are interdepending and complementing to one another. Generally, consideration given to health and safety has consistently increased. Developments started from the times of the old Babylonians. Around then, the ruler enforced some laws which part of it was on health and safety, focusing on managing injuries and also the monitoring of the charges by the physicians and fee penalty for those who were found guilty of inflicting injuries to others. This improvement proceeded in later Egyptian civilization when an industrial medicinal administration was cre- ated. As the civilization improved so did thoughtfulness regarding matters of health and safety with the industrial revolution. The improvement in the commercial enterprises prompted more con- cern in regards the health and safety of the workers. The industri- alization with utilization of steam force increased the risk and hazards of occupational injuries and illnesses. Throughout the industrial revolution staffs usually worked in the processing plants with long working hours, in a very noisy and unsafely conditions. With these circumstances the workers began to ask for upgrading of the work environment thereby launching the first review in the health and safety laws. With the development of the industrial area, the distinctive health and safety boards and associations were created. At the same time, different laws and regulations were enforced. Particular health issues that were attached to work envi- ronment hazards have had noteworthy influence in the improve- ment of the advanced safety and health movement. [5]

2. Occupational noise

With the development of industrial sector, committees and association addressing health and safety of both the environment and individuals at work place were established in distinctive countries. One of the most well-known organizations is the Occupational Safety and Health Administration (OSHA) which is an agency of the United States Department of Work. OSHA has around 40 year's history in health and safety [11]. Since its establishment, OSHA has helped to reduce the hazard rate. In spite of the fact that exact records are not found, it is estimated that in 1970 around 1400 workers lost their lives in the United State of America [10]
In 1971 OSHA was established and started to work almost im- mediately. Following its formation, a training institute was est ablished to teach private and public government safety precautions. Over 210,000 safety professionals have gained a lot at the training institute since its inception. In 1992, OSHA Training Institute started collaborating with colleges and universities to enforce work environment safety law. In 1972 OSHA state plans regula- tions was affirmed in South Carolina and reached out to the ad- ministrative workers. That same year OSHA various laws for di- verse workplaces and sectors. In 1975 OSHA established On-site Consultation programs keeping in mind the end goal to help small sizes businesses. On 16 January 1981 OSHA issue the listening to conservation standard, which requires that listening to defensive supplies, be given to workers who are exposed to noise levels over 85 dBA. In 2007 OSHA confirms through study that employers must pay for personal protective equipment. [10]

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A common threat to health and safety is excessive exposure to noise which can result in perpetual hearing loss. Excessive noise exposure can occur in small and large industrial and manufactur- ing environments, as well as in farms and other exposable areas, with the advancement of industries undesired noise levels are created in plants. Noise has been a threat since the inception of the industrial revolution [10]. Noise can influence the ears as a short term issue which usually resolves in the wake of clearing out the nature's turf. Such transient problems include groping stuffed in ears or provisional tinnitus. Nonetheless, monotonous exposure to permanent high noise levels can lead to serious hearing loss or long time tinnitus.

A most common occupational related illnesses from excessive exposure to noise is loss of hearing, which regularly goes unrec- ognized because these are non-visible effects. Other health effects might be [13]

An increase in heart rate which leads to high blood pressure, stress which can prompt irritability and cerebral pains, annoyance and speech interference, lack of sleep, fatigue, reduction in white blood cell and immune response, ulcer (gastric), development which can lead to stroke.

Noise level must be controlled to reduce occupational injuries, the best way to reduce noise is from the source because in the transmission mode noise is transmitted from the source through the transmission path to the receiver.

2.1. Occupational noise and regulations in other Countries

Consistently, more or less 30 million individuals in the United States of America are occupationally affected with high noise level [11] Over 1 million workers in Great Britain are at risk due to high levels of noise that puts their listening ability at danger [12] A Canadian Hearing Social order Awareness study showed five years prior that 25% of individuals with hearing problem were under 70 percent under 40 years of age. The normal period of those encountering listening risk was 51, and 16 percent of 6 to 19 year olds [12] In the vast majority of the developing nations there has been no actual enforcement of occupational health. Most importantly they don't give careful consideration to the impact of high level of noise and the employers don't provide safe environment. In line with these situation developing nations need to enact changes in the current law and change their guidelines that is related to health and safety circumstance in their nation. In the greater part of these nations, the noise regulations are embraced from developing na- tions. however the high noise level of the developing nations are not suitable for them on the grounds that the working hours in the majority of the plants in developing nations are 8 hours for every day, six days a week. Working hours deciphering to about 20% all the more in developed nations [8].

2.2. Section headings

According to the new law prepared by Northern Cyprus government in collaboration with the European Union, minimum re- quirements regarding noise exposure area as follows:

a) Maximum exposure limit
- Daily noise level of 87dbBA with a high sound pressure of 200pa (or 140dBC)

b) Lower exposure activity value
- Daily noise level 80dBA with a high sound pressure of 112pa (or 135 dBC)

c) Upper exposure activity value
- Daily noise level 85dBA with a high sound pressure of 140pa (or 137 dBC)

On the situation that the noise level shows a daily variety, weekly sound levels might be utilized to detect on the exposure.

The employer is responsible for analysing and detecting noise related risks in the work environment. Noise exposure ought to be prevented or reduced by employer. This could be carried out by applyingthe following standards:

a) Choosing systems with less level noise
b) Selecting equipment with most minimal possible noise for the work
c) Reducing noise with specialized systems.
d) Applying a great maintenance system to the strategies and equipment in the working environment.
e) Organizing work in a manner to minimize exposure

Employers ought to recognize, designate with proper signage and advise workers of noisy areas.

The Employers ought to give ear protection gear (EPE) to workers and supervise their use.

In the event of high noise level the employers ought to identify the reason, reduce to worthy limits and take measures to prevent it from occurring.

2.3. Occupational noise level with its effect

There are different published journals and research studies done in this particular field of study, the relationship of the noise in human health, the effect of the noise on the body, noise character- istics, hearing protection, noise emission level, noise exposure and threshold level, and measurement such as farms, trains, traffic, and different industries.

A significant study done in Nicosia included estimation on noise exposure measurement in 90 commercial industries found in south Cyprus, more than 200 labourers in this study were in- spected. Audio metric examination of the concentration on labours indicated that 2.78% endured some listening hearing damage while 7.7% suffered hearing loss [3]. The significance of this arti- cle is the comparability of these two countries industrial sector.

The European Union nations and developed nations permit a maximum occupational noise exposure of 85dba leq for 8 hours for every day. However in developing nations the majority of the mechanical plant work for 8 hour for every day and 6 day s for every week. An investigation of noise exposure of workers [4] in the construction sector in Spain was conducted by the use of a sound level meter and a dosimeter. The measurement was com- pared to that of the current regulations. Between 60 percent and 70 percent of the labourers in these sectors are exposed to a high dosage which was higher than 100 percent along their working day, workers were uninformed of the harmful effect of exposure to the high noise levels, comparing their hearing threshold to those predicted by ISO-1999. Medical report of 29,644 workers were reviewed. The audiometric result was compared with ISO-1999 predictions, they analysed the relationship between hearing loss when the daily noise exposure level rose from 80 dBA towards 96 dBA, and here the duration to the exposure was an important fac- tor that was used for the investigation. Due to the level of noise in the work place by machines and other equipment, the workers have low auditory acuity in the left ear, about 62% of the workers have problem of hearing at high noise levels.

In industries, workers are exposed to impermissible noise of about 85 dBA, according to [1] the research was carried out with the use of direct interviews, audiogram and audiogrametric eval- uation, the workers had at least 3 years of work experience. The result showed that 41.3 percent of employees had standard thresh- old shift in their ears, the relationship between risk realization and occupational noise is aimed at evaluating the relationship between individual factors and the use of hearing protective equipment. A study reveals that another way of reducing noise to workers is by constant use of noise protective equipment, the use of question- naire also helps in predicting the risk perception and also the col- laboration of workers. In small scale hand manufacturing indus- tries like the hammer section, cutting presses, punching and grind- ing sections will be more than 90 dBA, there by exceeding OSHA noise level standard. A study using questionnaire showed that about 68% of the workers do not wear their ear protective equip- ment, out of this percentage about 5% have not been given per- sonal protective equipment like the ear plugs and others. 20% of the workers surfer from high noise level. It concluded that a very high noise exposure affected the workers in the industries that worked more than 8 hours per day for 6 days per week and more than 90% of the workers were working

12 to 24 hours over time per week, which indeed leads to a very high risk of noise.
A research was carried out on the occupational noise exposure to adverse pregnancy outcomes, this study shows that the noise have direct effect on the foetus because it induces a stress on the mother there by leading to a reproduction disturbance, also this high level noise causes a negative effect on birth weight and length of gestation. [9] Later concluded that exposure to a high level noise causes a very high risk to reproduction

3. Materials and methods

3.1. Selection of noise measurement sites

The industries were selected based on the locations with the highest expected noise level and industries that use lots of equipment with high noise level. The Northern Cyprus consist of four geo- political zones which are Famagusta, Lefkosia, Kyrenia, and Lefke. Data's were collected from the two major cities with the highest number of industries which is Famagusta and lefkosia, and these industries were carefully selected to represent all the indus- tries in North Cyprus. Questionnaires was also distributed to vari- ous industries to ascertain the level of noise in the industries from the workers.
The diagram below shows the activities and products of each location. 1, 2, 4, 5, 8, 9, 11 and 13 are located in Famagusta. Location 1 has printing activities, location 2 produces Turkish coffee, location 4 and 11 both produce mineral water and do bottling, location 5 produces alcohol beverage, location 8 produces construction materials with PVC and aluminum, location 9 is an industrial scale dry cleaners and location 13 produce different kinds of beverage. Location 3, 6, 7, 10 and 12 which are considered as the case stud- ies are situated in Lefkosa; location 3 is a milk factory and pro- duces dairy products, location 6 produces marble and mosaics, location 7 produces furniture, location 10 produces metal hand- craft and location 12 is a printing office.

Table 1: Activities and Products of Each Location

Location	Activities/products
1	Printing products publish- ing
2	Turkish coffee
3	Dairy
4	Mineralwater
5	Alcoholbeverage
6	Marble and mosaic
7	Furniture
8	PVC and aluminum construction material
9	Industrialdry cleaners
10	Metalhandcraft
11	Mineralwater
12	Printing products publish- ing
13	Beverage

Based on our study observations all of these factories had a congested layout and all machines placed in indoor space and the production process is carried out adjacent to each other without any barrier between the noise source and the employees. General- ly in each factory, there are different kinds of machines working simultaneously. The number of workers in these industries varies from 2 to 75. Some factories have old machinery which generate high noise levels which also affect the environment outside of the plant, few factories, had relatively new and quieter machines how- ever because these machines were in small spaces, noise levels were still high
Questionnaire was developed base on Health and Safety Executive (HSE) of United Kingdom (14) with consideration of OSHA standards and criteria (12) and after reviewing questionnaires from previous studies (10). The data collection was based strictly on questionnaires. Oral interviews were not conducted among the workers with the assumption that none of the workers were illit- erate.

3.2. Sound level meter

The noise exposure level was assessed by using type 1 CR: 273 model CIRRUS sound level meter (A11947F serial No.), and the device was calibrated with CR: 513A. This instrument is appropriate for measuring industrial sound level, and it is compliant with standards IEC 804 and IEC 651 (international electro technical commission regulations) (12). It is also able to measuring noise in A-weight and C-weight level, Cirrus Research PLC
The sound level meter was adjusted to the A-weight level measuring noise levels in the range of 80 to 140 dBA in the slow re- sponse position throughout all measurements at every location. The instrument was calibrated to 94 dBA in all measurements as described in the user manual.
The average temperature and humidity in North Cyprus did not affected in the noise measurement of this survey, since the device met both IEC 804 and IEC 651 standards and according to user manual, the device can work from -20 °C to 50 °C and 0-99% RH. There was no need to use a windshield as the measurements were all conducted indoors area with less than 5ms-1 wind.

3.3. Procedure of measuring and noise layout

The sound level measurement device was placed on a tripod in each area of measurement to meet IEC 651 standard regulation, in order to increase the accuracy of measurement the operator stood away from the device and the device was placed in an area without vibration. According to OSHA standards and EU directives the sound level meter was adjusted to stand 1.5 meter from the floor, 1 meter from any machine(s) or equipment, and 0.5 meter from the shoulder of any employee. After each measurement the Lpeak and Leq values were recorded in the designated record sheet, the de- vice was restarted and ready for next measurement.
We measured sound levels from different noise sources in each study area. The sound level meter was positioned near busy machines with an operator present and if the operator was present, the device was positioned near the operator's ear. Measurements were taken from different machines at each location and at the end of each measurement the device was installed in the middle area of the factories in order to measuring inside environmental noise levels.
The duration of measurement was considered 5 minute for each machinery place at work station and 15 minute for measurements conducted at the middle of the factories. Measurements were carried out with different timing duration from 5 to 15 minutes, during the pretest and in order to check for accuracy of measure- ments. A minor difference of 0.5 to 1.0 dBA was found which was considered unlikely to affect study results.

4. Result

Occupational hearing loss or hearing disability in many industries are caused by harmful sound levels that is above the maximum tolerable level. This injuries are listed in the top 10 injuries in work place (11). Although controlling sound level is the best and most effective way to reduce occupational exposure to noise, most companies refuse to implement sound control solutions due to high initial cost. They instead prefer to protect their workers by personal hearing protection devices (10). However, usage of per- sonal hearing protection device is the last way to protecting work- ers, but most workers do not use these devices regularly or proper- ly (10).

4.1. Analyzing locations

The number of workers who responded to the survey form each location is shown in Table 2. This table also shows the percentage of respondents from each factory and a percentage of total re- sponses from each plant.
From the effects on communication and performance it clearly shows that 67.8% of the respondent are reported to having uncomfortable feeling or being annoyed at high noise level most times,

67.2% and 69.8% reported headache during or after work due to high noise level and had speech interference with high noise level at least sometimes respectively. 62.4% reported had feel stressed during or after work in noisy area at least sometimes.

4.2. Results on noise levels

Figure 1 shows noise level at the center of each study site. The equivalent noise levels at all the small sized industries were more than 90 dBA except location 5 at 89.4 Leq. C weighted maximum values reached by sound pressure (Peak) were more than 100 dBC. Figure 1 displays the Leq and Lpeak for industrial machine at each location

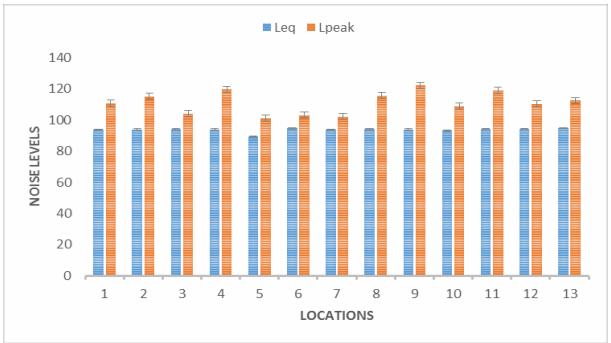


Fig. 1: Noise Level at the Center of Study Site.

4.3. Result discussions

The daily noise exposure of small and medium size factory workers in North Cyprus exceeds the maximum OSHA exposure limit of 90 dBA. Factory workers further exceeded OSHA standards for occupational exposure to high noise levels due to long work hours. 70% reported working more than 8 hours per day and 25% more than 5 days per week. Old machines are responsible for most of the noise and 50% of workers are machine operators. Our study demonstrated that noise exposure was not limited to machine op- erators. Sound levels in the center of the factory also exceed OSHA standards. At some factories noise levels also extended beyond the factory to the surrounding neighborhood.

From the result obtained the factories need to address this very serious occupational safety issue. A number of very simple engineering solutions can often be implemented with great success (3):

- Proper maintenance formachinery.
- Modified operating procedures such as relocating an operator and equipment controls to a quieter position.
- Relocation of noisy vents away from workers.
- Replacement of equipment such as buying a quieter version of the product.
- Modified room treatment such as introducing sound absorption in the space between equipment and worker to reduce noise in the distant reverberant field.
- Relocation of equipment, for example putting noisy equipment in areas that are often unoccupied.
- Proper operating speed for instance running equipment at lower speed to reduce noise.

If such controls fail to reduce sound levels, PPE should be provided and use to decrease noise levels.

Table 2: Sample Percentage for Each Plant Site Specific Response Rates Ranged Between 31 and 100 Percent

Factory	Industri- Al Popu- Lation	Number Of Response To Question-Naire	Response Percent (%)	Sample Percent- Age (%)
Location-1	21	12	9.5	57.14
Location-2	11	6	4.8	54.55
Location-3	45	18	14.3	40.00
Location-4	9	6	4.8	66.67
Location-5	15	10	7.9	66.67
Location-6	27	12	9.5	44.44
Location-7	10	5	4	50.00
Location-8	3	3	2.4	100.00
Location-9	36	16	12.7	44.44
Location-10	2	2	1.6	100.00
Location-11	20	11	8.7	55.00
Location-12	5	2	1.6	40.00
Location-13	75	23	18.3	30.67
Total	279	126	100	

4.3.1. Subjective response to noise

Summary of main content from statistical analysis of 13 locations and cross-sectional investigation from 126 workers which are representative of North Cyprus industries can be enumerated as follows; the average of the workers in these industries was in mid- dle age between 31 and 40 and most of them were male. Older workers were less educated and had longer work experience.

Our finding are consistent with the literature demonstrating that common occupational illnesses are observed when exposed to high noise levels. Symptoms reported while working in a high noise area included speech interference, headaches, feeling un- comfortable, and stresses or annoyed. Feeling stressed or uncom- fortable was correlated with the duration of work or operating a machine. Workers who often or always had headaches were more likely to have a known diagnosis of hypertension.

Workers knowledge of the hazards of high noise level and the benefit of usage earing protection equipment was linked to OSH training and worker education level. Most workers did not have occupational health and safety training. Most workers did not use ear protection because one was not provided and they were not in the habit of using these devices.

Those workers with OSH training and higher education level were more likely to be aware of the risks of exposure to high noise levels. Small scale industries of developing countries like North Cyprus are still far behind in implementing occupational health and safety programs. For more effective control of occupational noise in small and medium sized of industries, it is recommended that an integrated noise control approach be taken. Such an approach would consider all the noise influencing factors in the context of occupational and environmental impacts to determine effectively and technically feasibility options. The focus of the approach

Should be prevention of noise generation followed by controlling noise at the source. Other reactive measures such as use of PPE should be considered as a last resort.

Perception of risk in workplace influence workers behavior, hence they avoid to expose to the high noise level. Awareness of noise could play an important role in safety and health behavior. Also awareness of industry's managers has effective role to exclude their workers from expose to high noise levels by providing per- sonal

hearing protection or by holding applicable occupational safety and health training classes.
Workers should be motivated to use PPE and be educated regarding noise induced hearing loss and other non-auditory effects of noise exposure. The factories should be encouraged and assisted in implement hearing conservation programs under the direction of an occupational and environment health professional. There is a dire need ethical and legal obligation to implement the noise working hour standard and hearing conservation programs in North Cyprus.

5. Conclusion

Health and safety are independent and complementary to each other. Attention to occupational health and safety has historically increased. One of the most common hazards of occupational health and safety is noise. In small and big industrial and manufac- turing environments, as well as in farms and in the public areas, permanent hearing loss is the main concern. Noise is not a new hazard. It has been a constant threat since the industrial revolution. Occupational noise exposure has been identified as a very obvious hazard for some industries especially in the small scale and hand tool industries which are still not mechanized. In most developing countries, manpower and traditional methods still play an im- portant role for small scale industries. In countries like North Cy- prus with rapid economic growth and associated industrial growth, it is essential that there is more attention given to worker safety and health in order to prevent irreversible consequences of occu- pational injury. We looked at noise levels in various small and medium-sized industries in North Cyprus in order to identify oc- cupational noise exposure of workers and to make recommenda- tions on how to reduce occupational noise levels in these sectors with several limitations. The levels of the noise in these locations were in the action level.
Small scale industries of developing countries like North Cy- prus are still far behind in implementing occupational health and safety programs. For more effective control of noise pollution from the small and medium sized of industries, it is recommended that an integrated noise control approach be taken.
The workers should be motivated to use PPE and educated for the noise induced hearing loss and other non-auditory effects of noise exposure. The factories should be encouraged and assisted in implement hearing conservation programs under the direction of occupational environment health professional. There is a dire need, ethical and legal obligation to implement the noise working hour standard and hearing conservation programs in North Cyprus.

References

[1] Attarchi, M.S., Sadeghi, Z., Dehghan, F, Sohrabi, MM. & Mohammadi, S. (2010). Assessment of hearing standard thresh- old shift based on audiometric findings in steel company workers. *Iranian Red Crecent Medical Journal*, 12 (6) 644-649.

[2] Climatetemp, Cyprus climate guide to average weather & temperatures with graphs eluc idating sunshine and rain- fall data& information about wind speeds & humidity. (Accessed april 20140) http://www.climatetemp.info/cyprus.

[3] Eleftheriou, P. C. (2002). Industrial noise and its effectson human hearing. *Applied Acoustic*, 63(1), 35-42.

[4] Fernandez, M. D., Quintana, S., Chavarria, N, & Balles- teros, J. (2009). Noise exposure of workers of the con- struction sector. *Applied Acoustic*, 70(5), 753-760.

[5] Goetsch, D. L. (2008). *Occupa tional Safety and Health for Technologists Engineers and Managers*. New Jersey: PEARSON Prentice Hall

[6] Kunal, P., Jay, P., Priya, .P. (2013). Impact of no ise on humans and its control measures. *International Journal of Engineering Science and Technology*.40 (3) 148-154.

[7] Leensen, M. C. J., Duivenboo den, J. C. Van, & Dreschler, W. A. (2010). A retro spec tive analysis of noise-induced hearing loss in the Dutch construction industry. *Applied Acoustic*, 84(5), 577-590.

[8] Shaikh, G. H. (1999). Occupational no ise exposure limits for developing countries.*Applied Acoustic* 57(1), 89 92.

[9] Nurminen, T. (1995) Female no ise exposure, shift work and reproduction. *Journal of Occupa tional and environmen- tal medicine*. 8 945-950.

[10] Moses F.L., Ertan A. (2015) Occupational Noise Manage- ment in Small and Large scale Industries in North Cy- prus. . *International Journal of Science and Engineering re- search*.6 (4) 590.

[11] National Institute for Occupational Safety and Health (NIOSH), (2009). Noise and Hearing Loss Preventio n. (accessed.April 2014) http://www.miosh.net/?pr_content=199&pr_popup=1

[12] U.S. Department of Labor Occupational Safety and Health Administration, (2009). Reflec tions on OSHA's Histo ry. *OSHA*, 1-62, http://www.osha.gov/history/OSHA_HISTORY_3360s.pd f.

[13] U.S. Department of labor OSHA, (2011). John S tender Administration, 1973-1975: OSHA Becomes an Agency in Crisis.(accessed April 2014) http://www.dol.gov/o asam/programs/histo ry/osha13sten der.htm.

[14] Health and Safety Laborato ry UK, (2002(ISBN 0 7176 2571 0)) Noise levels and no ise exposure of workers in pubs and clubs-a review of the literature, from http://www.hse.gov.uk/research/rrpdf/rr026.pdf.

[15] Ho ng, O. (March 2005). Hearing loss amo ng o perating en- gineers in Americ and co nstruc tion industry. *Springer*, 78(7), 565-574 (doi: 10.1007/s00420-0050623-9).

[16] Karlidaq T, Yalcin S, Ozturk A, Ustundaq B, Gok U, Kaygusuz I, et al. The ro le of free o xygen radicals in noise induced hearing loss: effects of melato nin and methylpred- nisolone. *Auris Nasus Larynx.2002; 29(2):147-52.*

[17] Ko pper, H., Teixeira, A. R. & Dorneles, S. (2009). Cognitive Performance ofa Group of Elders: Influence of Hearing, Age, Sex, and Educa- tion. *Arq. Int. Otorrinolaringol*, 13(1), 39-43.

[18] Leensen, M. C. J., Duivenbooden, J. C. Van, & Dreschler, W. A. (December2010). A retro spec tive analysis of noise- induced hearing loss in the Dutc h construc tion industry. *Springer*, 84(5), 577-590, (doi: 10.1007/s00420-0100606-3).

[19] Mbuligwe, S. (January 2004). Levels and influencing fac tors of no ise po llutionfrom small-scale industries (SSIs) in a de- veloping country. *Springer*, 33(6), 830-839 (do i: 10.1007/s00267-003-0060-z).

[20] Mihailovic, A., Grujic, S. D., Kiurski, J., Krstic J., Oros, I. & Kovacevic, I. (November 2010). Occupational no ise in print- ing companies. *Springer*, Volume 1 / 1981 - Volume 180 / 2011, (doi: 10.1007/s10661-010-1817-5).

[21] National Institute for Occupational Safety and Health (NIOSH), (June 2009). Noise and Hearing Loss Prevention.Retrieved February 2011, from http://www.miosh.net/?pr_content=199&pr_popup=1.

[22] Oloqe F.E., Akande TM. & Olajide TG. Noise exposure, awareness, attitudes and use of hearing protiction in a steel rolling mill in Nigeria. *Occupational Medicine*.2005 55(6):487- [9].

[23] Pinto, P.C., Sanc hez, TG. & Tomita, S. (Feb 2010). The im- pact of gender, ageand hearing loss on tinnitus severity. *US National Library of Medicine National Institutes of Health*, 76(1), 18-24.

[24] Powazka, E, Pawlas, K, Zahorska-Markiewicz, B, & Zejda, Jan E (2002). A cross-sectional study ofoccupational no ise exposure and blood pressure in steelworkers. *Noise Health*, 5(17), 15-22.

[25] Sevenson E.B., Morata T.C., Nylen P., Kerieq EF. & Jo hnson AC. Beliefs andattitudes amo ng Swedish workers regarding the risk of hearing loss. US National Library of Medicine Na- tional Institutes of Health. 2004 43(10):585-93.

[26] Shaikh, G. H. (May 1999). Occupational noise expo sure lim- it's for developing countries. *Science direct*, 57(1), 89-92 (doi: 10.1016/S0003-682X (98)00038-3).

[27] Occupational noise exposure in small-scale hand tools man- ufacturing (fo rging) industry (SS I) in Northern India. *US Na- tional Library of Medicine National Institutes of Health*, 47(4), 423-430 (PMID: 19672017).

[28] The State of Queensland (Department of Justice and Attor- ney-General), (2009). Health risks of no ise exposure. Re- trieved June 2011, from http://www.deir.qld.gov.au/workplac e/subjects/no ise/effects /risks/index.htm.

[29] UK legislation, (June 2005). The control of Noise at work reg- ulations 2005. Retrieved June 2011, from http://www.legislation.gov.uk/uksi/2005/1643/regulatio n/6/mAde.