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Short Communication

STUDY ON THE EFFECT OF NOISE POLLUTION IN THE OIL AND GAS INDUSTRY

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ABSTRACT
Sound is a form of energy which requires material medium for propagation. Any sound between 50-85dB is considered as noise while one beyond 85-120 dB produced by aircraft, pop music, heavy truck and railways are considered to be a health hazard. Long-run exposure to noise will result to deafness, hypertension, headache, dry skin, weak eye sight, and abnormal conscience state of mind. The present study was conducted to determine the awareness level of noise pollution and induced hearing loss among exposed staff in Kaduna Refining and Petrochemical Company (KRPC), Kaduna, Nigeria. Also, to detect the noise level (dB) in KRPC operational areas, as whether is in line with the WHO provision of 85dB (global standard) and 90dB Nigerian acceptable noise level. The procedure for data collection involves carrying out physical measurement of noise levels in the process plants, review of existing records, questionnaires to relevant staff, oral interviews and site visits. The sample size of the study consists of 30 workers randomly selected from the KRPC's three most noisy operational areas in the power plant unit *viz.* compressor unit (CU), turbine generator room (TGR), and steam let down section (SLD). A portable hand held noise meter was used to collect data from the various units under study. The average noise level exceeded 90dbA in all locations. In addition, the impulse signal exceeded the peak Action level of 140db SPL at the SLD Section. The highest noise measurement of 141.1 dBA (range: 108-141.1dBA) was recorded from the SLD Section. This was followed by the CU, which recoded SEL of 137.8db (A) and the highest measured signal (HMS) of 105.8dB (A). The noise level in the TGR averaged 93.1dB (A). The highest recorded level at this location was 126.8 dBA for a single event measurement. The questionnaire revealed 16 (53%) awareness level of the exposed staff. Conclusively, all workers in these units are potentially exposed to noise above the acceptable safety limit of 90.0dBA in the course of a day's shift. Hearing conservation programme for these categories of workers should be introduced.

KEYWORDS: noise, pollution, health hazards, dosimeter, KRPC.

INTRODUCTION

Sound is a form of energy which requires material medium for propagation. It is asserted that sound propagates through solids and liquids but not through vacuum and that any kind of vibration is capable of producing sound. It is therefore explained that noise originates from sound and vibration. Noise was derived from the Latin word "nausea" which means 'unwanted sound' or 'sound that is loud, unpleasant or unexpected' (Mangalekar *et al*., 2012; Harris, 2003). According to World Health Organization noise is considered to be the third most hazardous type of pollution in large cities after air and water pollution (Khilman, 2004). The sources of sound or noise are domestic as well as industrial. Noise pollution is one of the main problems of urban communities that has numerous hazardous effects on the urban environment and may result in a great deal of costs on the society (Martin *et al*., 2006; Chien and Shih, 2007). Loudness is the degree of sensation depending on the intensity of sound and sensitivity of ear (Garg *et al*., 2007). Any sound between 50-85dB is considered as noise while one beyond 85-120 dB produced by aircraft, pop music, heavy truck and railways are considered to be a health hazard. Noise pollution is different from other pollution categories due to its source and diffusion characteristics though noise pollution is a slow and subtle killer, yet very little efforts have been made to ameliorate the same problem (Hunashal *et al*., 2012). Noise is any unwanted or harmful outdoor sound created that is detrimental (Bhagwat and Meshram, 2013**)** along with other types of pollution has become a hazard to quality of life. The worrisome effects of

noise are dangerous enough that noise problem is considered next to crime by certain countries (Ijaiya, 2014), it has been recognised as a pollutant (Nagi *et al*., 1999). Noise has several adverse effects on health. Long-run exposure to noise will result to deafness, high blood pressure and hypertension, headache, dry skin, weak eye sight, and abnormal conscience state of mind. Also, noise effects are both health and behavioural in nature. Unwanted sound can damage small letter Physiological and psychological health. Noise pollution can cause annoyance and aggression, hypertension, high stress levels tinnitus, hearing loss, sleep disturbances, and make conversation difficult as well as leads to productivity losses due to poor concentration (Bond, 1996). The physical environment seemed to be polluted badly. Noise pollution contributes to having a telling influence on our behaviour, cognition, mental performance and alertness, normal sleep patterns and studies of the students. Apart from these it can create havoc with human nervous system leading to wide spread damage to our health. It can certainly affect our persona and charisma, our behaviour in public life as well as in private life. Even when we are sleeping, different environmental noises enter our brains like a bullet and get themselves registered in the hard-disk of mind and cause unnecessary mental activity. According to Maura *et al.* (1997), noise in the environment is one of the major contributors in increasing the systolic/ diastolic blood pressure, pulse rate, blood glucose levels, and perspiration rate and oxygen consumption in humans. So due to the above facts present study was conducted to detect the noise level (dB) in Kaduna Refining and Petrochemical Company (KRPC) operational areas, as whether is in line with the WHO/FME provision of 85dB (global standard) and 90dB Nigerian acceptable noise level and also to determine the awareness level of noise pollution and induced hearing loss among exposed staff in KRPC, Kaduna, Nigeria.

MATERIALS & METHODS

Kaduna is located on Dry tropical northern midland with co-ordinates Latitude 10^{o} 19' 10" N and Longitude 07^{o} 45' 0" E. The Kaduna Refining and Petrochemical Company (KRPC) occupy a land area of 2.89 square kilometres approximately 15km Southeast of Kaduna city (Figure 1).

FIGURE 1: Map of Kaduna State showing the study area

Its location has an elevation of approximately 615 m above mean sea level. KRPC Ltd was constructed by the Chiyoda Chemical Engineering and Construction Company (now Chiyoda Corporation). KRPC Ltd was commissioned in 1980 with an initial capacity of 100,000 BPSD. Kaduna Refining and Petrochemical Company limited (KRPC) is a subsidiary of the Nigerian National Petroleum Corporation (NNPC), which came to existence since 1977 (KRPC Records, 2012). The procedure that was applied in data collection involves carrying out physical measurement of noise levels in the process plants, review of existing records, questionnaires to relevant staff, oral interviews and site visits. The sample of the study consists of 30 workers randomly selected from the KRPC study population (three most noisy operational areas in the power plant unit: Compressor unit, Turbine Generator room, and Steam let down section). A portable hand held noise meter was used to collect data from the various units under study. The Metrosonics Brand model db- 2100 sound level meter and Larson Davis type 1 precision 800B integrated sound level meter (Dorsimeter - set up on a steady tripod stand) which measures frequency weighted and instantaneous sound pressure level were used in carrying out the research. Measurements were taken close to the highest exposure level of the workers. The meter is operated with simple slide switches. An output jack on the bottom of the meter is provided for connecting to peripheral devices such as chart recorders, oscilloscopes, audio recorders, etc. Noise level readings recorded at each location are: a) the intergrated Sound Pressure Level (SPL) during the test sequence. b) The lowest measured signal during the test interval (LMS). c) The highest measured signal during the test interval (HMS).

d) Peak or Impulse Signal (P/IS). e) Single Event Level (SEL).

RESULTS & DISCUSSION

The results of the survey are as outlined in table 1 below: The average noise level exceeded 90dbA in all locations. In addition, the impulse signal exceeded the Peak Action level of 140db SPL at the Steam Let down Section. The highest noise measurement of 141.1dBA (range: 108-141.1dBA) was recorded from the Steam Let down Section (Table1). This was followed by the Compressor Unit, which recorded SEL of 137.8dB (A) and the highest measured signal (HMS) of 105.8dB (A). The noise level in the Turbine Generator Room averaged 93.1dB (A). The highest recorded level at this location was 126.8dBA for a single event measurement. In table 2 below showed that the questionnaire revealed 16 (53%) awareness level of the exposed staff.

TABLE 1: Noise Levels Survey (dBA)

Parameters	Turbine generator room	PPU compressor unit	PPU steam let down section
Intergrated SPL level (ISPL)	93.1	105.0	108.4
Lowest Measured Signal (LMS)	92.5	99.5	105.3
Highest Measured Signal (HMS)	94.5	105.8	109.3
Peak or Impulse Signal (P/IS)	110.8	120.0	123.8
Single Event Level (SEL)	126.8	137.8	141.1
Time	40	32	31
Equipment in use	50%	100%	100%

TABLE 2: Sowing view of Respondents (Total questionnaires)

Number of Questionnaire Distributed	Awareness Level	Not Aware	Not Sure
Total Number of Respondents	Yes	No	Don't Know
30	16	6	8
Percentage (%)	53	20	27

TABLE 3: Showing preferred solution to Noise Pollution in KRPC

Action	Number of Respondents	Percentage (%)
Public Awareness	20	67.0
Medical Surveillance	18	60.0
Use of personal protective equipment	18	60.0
Enforcement	20	67.0
Staff Redeployment	14	47.0
Equipment redesign	10	34.0

Out of the total respondents 8 (27%) were not sure of the noise effects on their hearing loss while 6 (20%) were on a believed of no any effects on their health status over time (Table 2). Majority of the respondents also believed that, public awareness and enforcement to the use of PPEs are the vital means of controlling the effects of noise pollution among the exposed staff in KRPC (Table 3). Conclusively, all workers in these units are potentially exposed to noise above the acceptable safety limit of 90.0 dBA in the course of a day's shift. Similar to present study Pal and Bhattacharya, (2012) examines the problems of reduction of individual's efficiency in his/her respective working places because of road traffic noise pollution in India due to rapidly growing vehicular traffic and observed higher noise level in most of the areas under investigated as recommended by WHO. The effects of excessive noise could be so severe that either there is a permanent loss of memory or a psychiatric disorder (Bond, 1996). The digestion, stomach contractions, flow of saliva and gastric juices all stop proper working due to the high frequency of noise, because the changes are so marked, repeated exposure to astonishing noise should be kept to a minimum (Broadbent, 1957). Noise pollution causes certain diseases in human sue to traffic noise such as the headache, high blood pressure and other stresses among the exposed individuals (Pathak *et al.*, 2008). Noise pollution is closely related to increase in industrialization and urbanization (WHO, 1999). Noise is increasing everywhere, yet unnoticed form of pollution even in developed countries (Singh and Davar, 2004). It cannot be entirely eliminated but it can be kept at a safe level through adoption of some measures. It was strongly recommended that periodic audiograms should be conducted on staff of KRPC Ltd at employment, deployment and disengagement from service so as to ascertain the threshold shift and take the necessary actions to prevent an induced hearing loss situation. From the research carried out and findings made, it was recommended that the control measures should be put in place in order to effectively control exposure to excessive noise hazards. The hearing hazards monitoring and medical surveillance, engineering and administrative control, mandatory audiometric testing / evaluation should be done. The use of noise-badge (tagged) for personal noise exposure evaluation over time, personal hearing protective devices (Lavanya *et al*., 2014**)**. It is also necessary to increase compliance to the use of personal hearing protectors, education and motivation; particularly on

programme evaluation. Therefore, it is recommended that KRPC intensify effort in its health, safety and environment (HSE) refresher training programme for permanent staff by including a module on hearing protection, record keeping for audiometry, training of exposed workers and noise monitoring of HRA, redeployment of operation staff from time to time, compliance with the FME/WHO recommended acceptable noise-level for people at risk (85dB global standard or 90dB for Nigerian), redesign of equipment and fitting noise abatement facilities such as acoustic insulators.

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