Bangladesh Development Research Working Paper Series (BDRWPS)

BDRWPS 29 (December 2015)

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Kamrul Islam
University of Chittagong

and

Sahadeb Chandra Majumder
University of Chittagong

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Bangladesh Development Research Center (BDRC)

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Bangladesh Development Research Center (BDRC)
2508 Fowler Street
Falls Church, VA 22046-2012, U.S.A.

Tel. +1 703 532 4893
E-Mail: contact@bangladeshstudies.org
http://www.bangladeshstudies.org

Status of Industrial Noise Levels and Impact on Workers' Health: A Case Study of Kalurghat Heavy Industrial Area in Bangladesh

Kamrul Islam and Sahadeb Chandra Majumder*

Abstract

Noise is the silent killer which has the ability to deteriorate the normal health condition of a person. People working in heavy industries have a high risk of being affected by noise and this phenomenon is unequivocally true for a country like Bangladesh. This paper identified the status of noise levels, their ultimate impact on workers' health, and noise reduction compliance in Kalurghat Heavy Industrial Area (KHIA) of Chittagong. Eleven companies gave access to collect data related to noise issues inside and outside of their factories. While the average inside and outside noise levels were within the limit of 75 decibels (dBA), excessive noise at 89 dBA from several source like dryer machines and generators are a concern. A semi structured questionnaire was also used to collect data related to noise related compliance issue from the respective personnel of the factories. The study found that most of the factories hardly use physical mechanisms to control excessive noise.

* Institute of Forestry and Environmental Sciences (IFES), University of Chittagong, Bangladesh. This work would not have been possible to publish without the kind help of some people. Thanks to Nahid-tuz-Zannat (Mumu) for her inspiration during the preparation of this manuscript. We express our gratitude to Mr. Md. Humayain Kabir, Assistant Professor at IFES, University of Chittagong, for his kind help in reviewing the manuscript, and to Dr. S. M. Shamsul Huda, Associate Professor at IFES, University of Chittagong, for his suggestions and comments to improve the standard of this paper. We also express our gratitude to the personnel of visited industries to provide us the opportunity to visit their industries. Finally, we express our special thanks to Dr. Bernhard Gunter for useful editorial comments. Any remaining mistakes are those of the authors. Comments are welcome to be sent directly to the corresponding author, Kamrul Islam, at E-mail: ksujonifescu@gmail.com.

I. Introduction

Noise is generated from sound. When sound goes on higher and higher pitches with loudness that the human ear cannot persist, it becomes unwanted and is termed as noise (Farzana et al., 2014). Noise pollution is a source of pollution that ultimately affects the health condition of human beings, mostly by destructing the normal hearing condition. Various industrial activities deal with the generation of noise as an unwanted side-product. Among the various other environmental concerns resulting from expanding industrial production, noise is a very important one, yet many times overseen. Evidently, industrialization along with rapid urbanization and increased levels of transportation play a significant role behind the increased noise levels globally.[1] Noise, ranging from mild to severe, emanating from industrial sources is affecting a large number of individuals, including the industrial work force and people living in the vicinity of these industries.[2]

Excessive noise deteriorates the health of workers. Hence, knowing the noise status of industrial production provides a better chance to monitor noise-related issues and its effects. Noise pollution is one of the aspects of environmental pollution in a specific region or area. Thus, it is required to prepare an Environmental Management Plan (EMP) related to noisy activities, noise control measures, compliance, impact, and recommendation for improvements.

This study was designed to find out the noise levels inside and outside of industries of Kalurghat Heavy Industrial Area (KHIA) along with the noise related monitoring and compliance status. This paper is structured as follows: Following this introduction, the next section describes the objectives, survey area and methodology of the study. Section III presents and discusses the results, while section IV will summarize the impact of noise and general noise control techniques, before the last section provides some conclusions and recommendations.

II. Objectives, Survey Area, and Methodology

The main objectives of this study are to find out:

- the present status of noise levels inside and outside of the factories,
- the sources of noise in the factories, and
- the present status of noise control, noise monitoring related activities, and compliance.

Noise is measured by the energy in a sound wave, which is typically measured using decibels (dB), which is a logarithmic unit used to express the ratio of two values of a physical quantity, like power or intensity. The amplitude measures how forceful the sound wave is, and the most widely used sound level filter is the A scale, which roughly corresponds to the inverse of the 40 dB (at 1 kHz) equal-loudness curve. Measurements made on this scale are expressed as dB(A) or simply dBA. The study used a standard audio meter to determine the noise levels inside and outside the industries. For the measuring of noise outside industrial plants, the audio meter was used approximately 10 meter away from the factories.

[1] Hunashal and Patil (2012).
[2] Rahman, Haughton and Jonas (2010).

This study was undertaken in the Kalurghat Heavy Industrial Area (KHIA) of Chittagong, Bangladesh. It is one of the most important industrial areas of Bangladesh, with the products produced in KHIA being supplied to the whole country. Workers' health safety is a prime issue in industrial management but rarely considered in a country like Bangladesh.

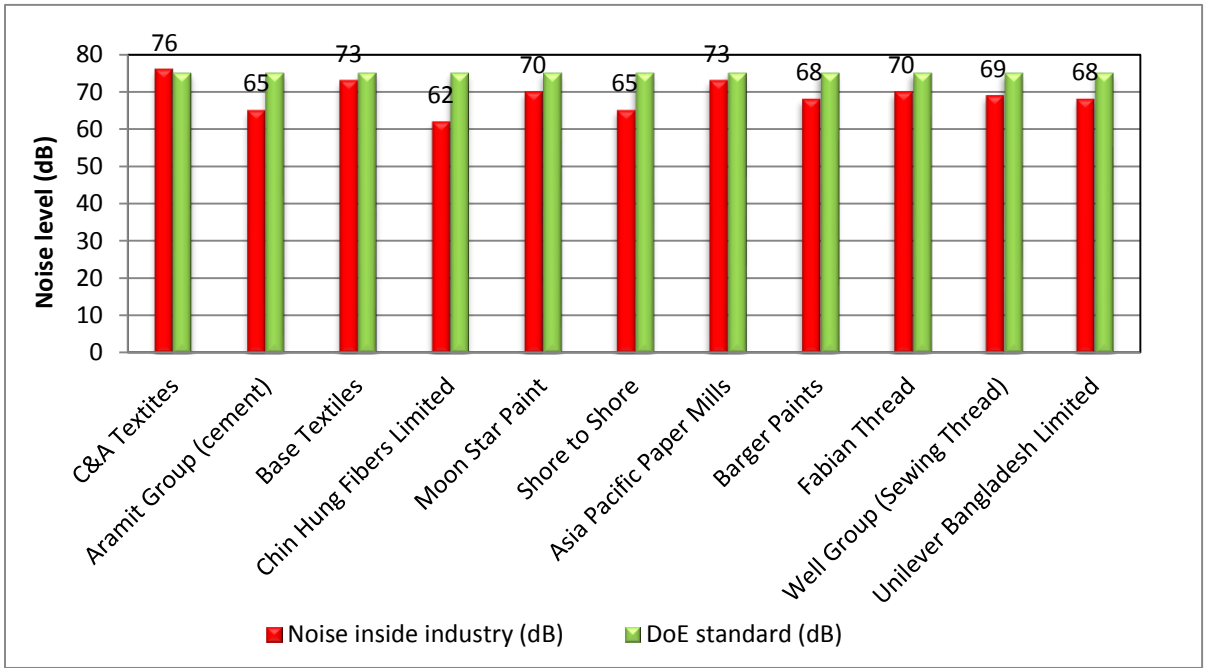
A total of eleven companies in the KHIA allowed us access to visit and collect the necessary data related to noise. As the sources of noise among the different companies visited were not the same, the different noise sources were recorded along with the noise level they produce. Furthermore, a semi-structured questionnaire was prepared to collect noise related compliance and monitoring data. The respective personnel responsible for managing environmental aspects of the factories were interviewed using a preset questionnaire. The obtained data was then analyzed and evaluated.

III. Results and Discussion

III.1. Status of noise level inside the industries

Industrial activities generate noise but it differs from source to source and again from the inside of the industry to outside. As Figure 1 shows, in the selected industrial units of KHIA, the inside noise level was the highest in C&A Textiles (76 dBA) and the lowest in Chin Hung Fibers Ltd. (62 dBA). With exception of C&A Textiles, the noise levels were below the limits set for industrial areas at 75 dBA by Bangladesh's Department of Environment (DoE).[3]

Figure 1: Present Status of Noise Level inside the Factory Plants of KHIA



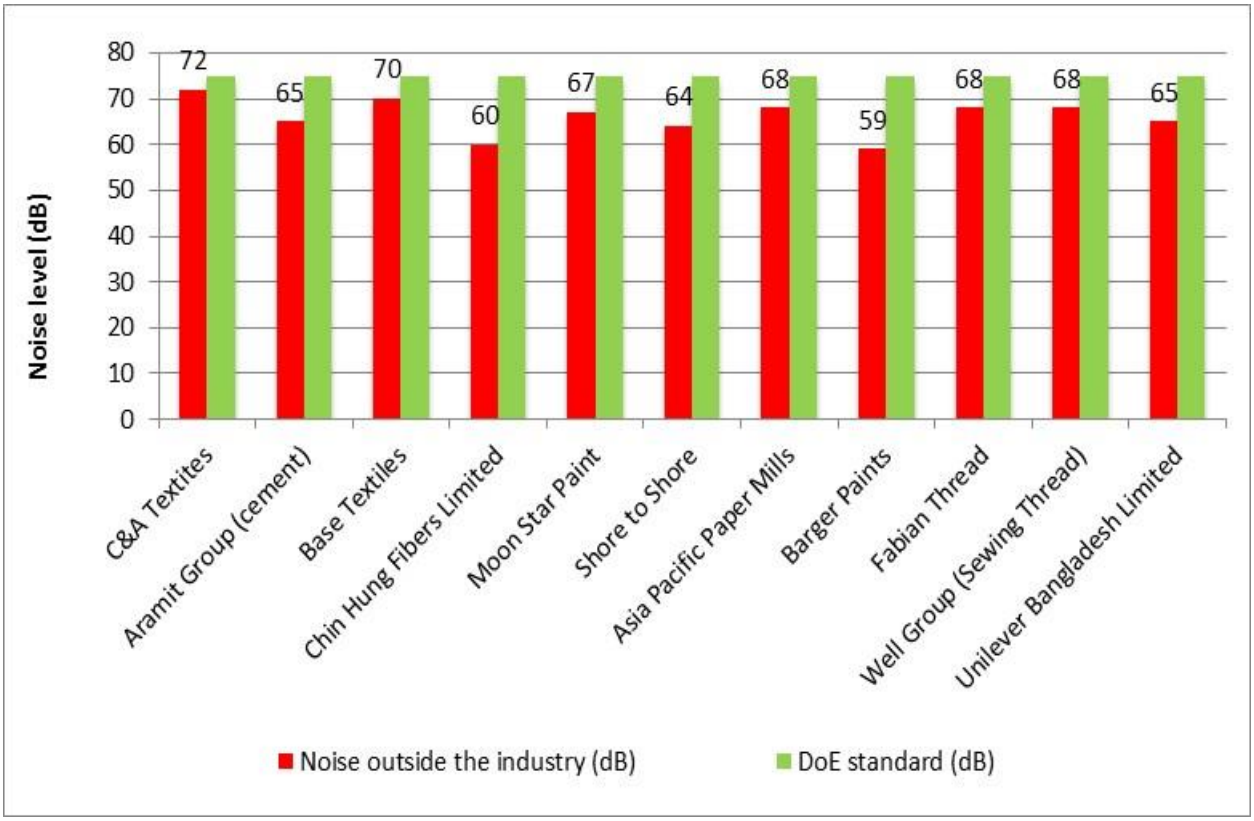
Source: Created by the authors based on primary data collection.

[3] See Ministry of Environment and Forest (MoEF), Government of Bangladesh (1997).

III.2. Status of Noise outside the Factories

As Figure 2 shows, the noise level outside of the factories was also the highest in C&A Textiles (72 dBA) and lowest in Chin Hung Fibers Ltd. (60 dBA), though all industries' outside noise levels were below the limit of 75 dBA set by the Department of Environment (DoE).

Figure 2: Status of Noise outside the Selected Industries of KHIA

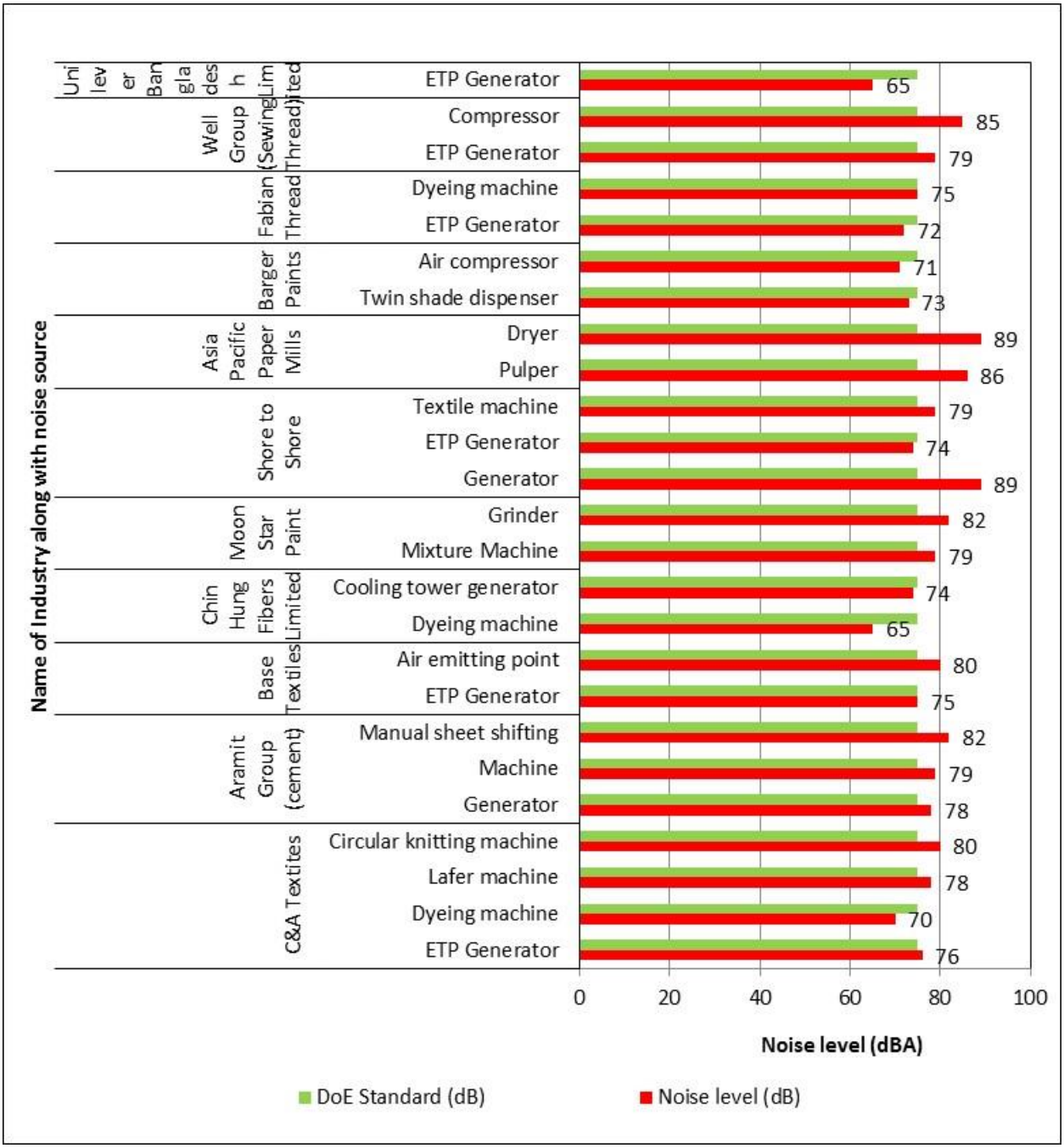


Source: Created by the authors based on primary data collection.

III.3. Status of noise from industrial source

Industrial noise levels come from different sources within and across industries. The study found that manual sheet shifting activities, generators, dryers, and compressors were the dominant source of noise generated inside the workplace of the various industries of KHIA. As many of the dryers, compressors, generators, circular knitting machines and other machineries used by the different industries produced noise exceeding 80 dBA, which is above the safety limit set by the government of 75 dBA, workers operating this kind of machineries need special precautionary measures to protect them from the impact of excessive noise. Figure 3 shows the source along with their noise levels in decibel units (dB) in the studied industries.

Figure 3: Noise from Various Industrial Sources inside the Industries of KHIA



Source: Created by the authors based on primary data collection.

III.4. Status of Noise Related Compliance

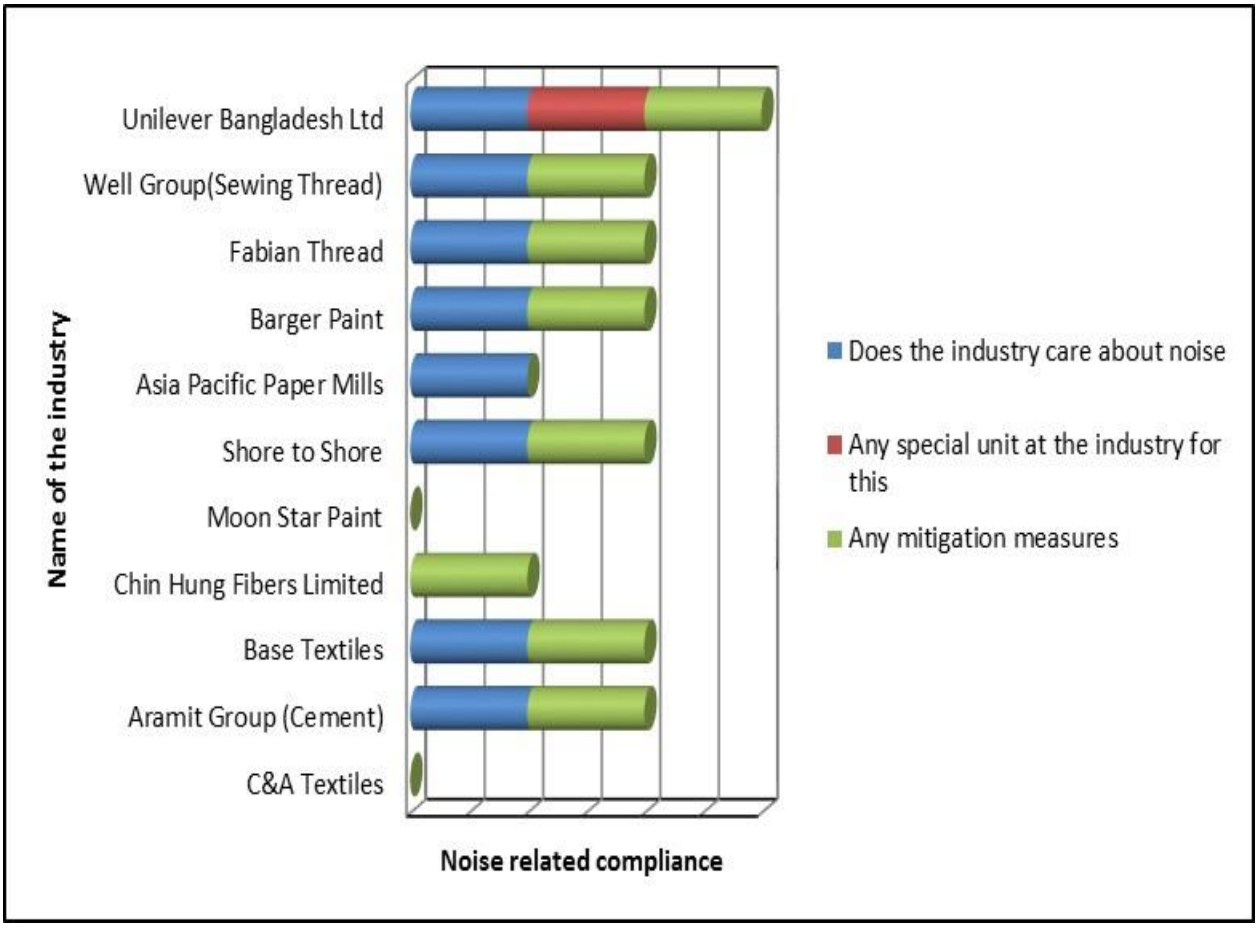
Noise related compliance is an important part for the overall environmental compliance of an industry. In this study, compliance related to noise was unveiled from using questions such as does the industry care about noise, any special unit at the industry for noise monitoring and finally any mitigation measures for noise impact to the respective personnel of the industry. Status of noise related compliance of the industry of KHIA is shown in Table 1. For better visuals, the data of Table 1 is then also illustrated in Figure 3, using blue bars if an industry cares about noise, red bars if there is any special unit at the industry looking into noise issues, and green bars if there are any mitigation measures.

Table 1: Status of Noise Related Compliance

Name of industry	**Does the industry care about noise?**	**Any special unit at the industry for noise?**	**Any mitigation measure regarding noise?**
C&A Textiles	No	No	No
Aramit Group (Cement)	Yes	No	Yes
Base Textiles	Yes	No	Yes
Chin Hung Fibers Limited	No	No	Yes
Moon Star Paint	No	No	No
Shore to Shore	Yes	No	Yes
Asia Pacific Paper Mills	Yes	No	No
Barger Paint	Yes	No	Yes
Fabian Thread	Yes	No	Yes
Well Group(Sewing Thread)	Yes	No	Yes
Unilever Bangladesh Ltd	Yes	Yes	Yes

Source: Created by the authors based on primary data collection.

Figure 4: Status of Noise Related Compliance in KHIA



Source: Created by the authors based on primary data collection.

III.5. Noise Control and Monitoring Status

Noise control and monitoring is another important aspect that ensures better heath of industrial workers in the industry. Noise abatement techniques are essential and it should be applied inside the industry also. The responses related to noise control and noise monitoring of the studied industries of KHIA is shown in Table 2, whereby the noise control and monitoring status of the various industries is based on a) measures taken to control noise, b) the noise abatement system available, c) the artificial or natural noise abatement system present, and d) the monitoring of noise related issues by each industry. Based on the observations, it was found that only three out of the eleven industries studied satisfied all four indicators: Unilever Bangladesh Ltd., Well Group (sewing thread), and Shore to Shore. Moon Star Paint dissatisfied all the indicators, while the remaining seven plants maintain between one to three indicators related to noise control.

Table 2: Response Related to Noise Control and Monitoring Activities

Name of industry	Measures taken to control noise	Any noise abatement system?	Natural of artificial noise abatement system available?	Monitoring of noise related issues by the industry itself
C&A Textiles	×	×	×	✓
Aramit Group (Cement)	✓	×	✓	×
Base Textiles	✓	✓	×	×
Chin Hung Fibers Limited	✓	✓	✓	×
Moon Star Paint	×	×	×	×
Shore to Shore	✓	✓	✓	✓
Asia Pacific Paper Mills	×	✓	✓	×
Barger Paint	✓	✓	✓	×
Fabian Thread	✓	✓	✓	×
Well Group(Sewing Thread)	✓	✓	✓	✓
Unilever Bangladesh Ltd	✓	✓	✓	✓

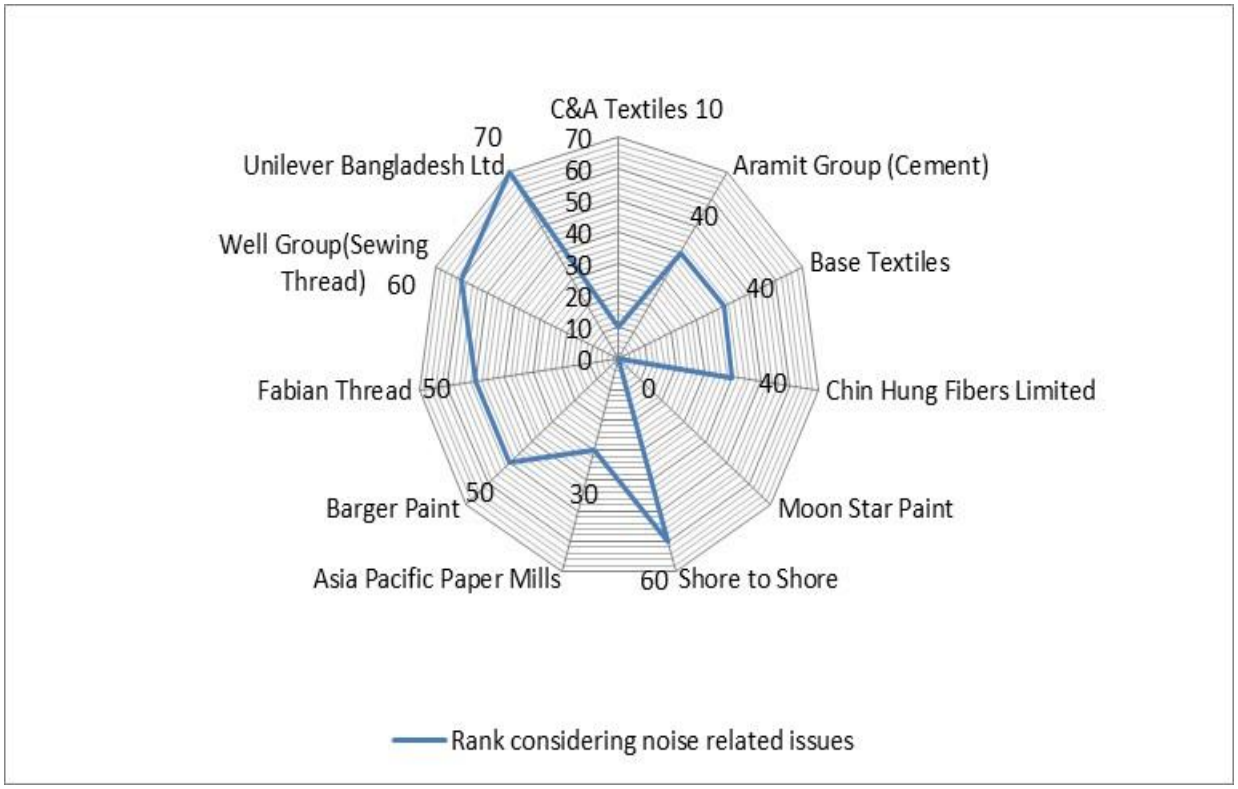
× = No	✓ = Yes

Source: Created by the authors based on primary data collection.

III.6. Rank of the Industries Considering Noise Related Issues

Finally a ranking of the industries was prepared using all the noise related data obtained from the questionnaire. If the specific question related to noise satisfied then a value of 10 was assigned in it and 0 was assigned if it dissatisfied. All the values of a single industry were finally added to make a cumulative score.

Figure 5: Ranking Based on Noise Related Issues



Source: Created by the authors based on primary data collection.

IV. Impact of Noise and Noise Control Techniques

IV.1. Impact of Noise

Noise can interfere with the human activities, disrupt the proper functioning of human, and can ultimately damage human health condition. Although present noise level inside and outside the studied industries are under recommended level, still noise generating from different sources inside the industries are very much exceeded the safe limit. That's why precaution must be needed for person or worker engaging in that specific region inside the industry. Exposure to noise at work can harm workers' health. The most well-known effect of noise at work is loss of hearing. However, it can also exacerbate stress and increase the risk of accidents.[4]

Premature hearing loss, blood pressure alteration, hypertension, several cardiovascular and non-cardiovascular, diseases, and lack of concentration among industrial workers are well-known outcomes of noise exposure at work.[5] There is mounting confirmation that noises above 80 dBA in the workplace are hazardous to health.[6] Besides, louder occupational noise level can cause a reduction in behavioral efficacy and may lead to workers being predisposed to aggressive

[4] See http://europa.eu.int/eur-lex/.
[5] Eleftheriou (2002) and Salehin et al. (2014).
[6] Hanidza et al. (2013) and Salehin et al. (2014)

behavior and it has more social conflicts both at home and work, consequently decreasing confidence and leading to consistent deterioration in performance.[7] According to Onder and Kocbeker (2012), noise pollution is the third most hazardous environmental type of pollution, which proceeded by only air and water pollution.

IV.2. Noise Control Techniques and Measures

As with any occupational hazard, control technology should aim at reducing noise to acceptable levels by action on the work environment. Such action involves the implementation of any measure that will reduce noise being generated, and/or will reduce the noise transmission through the air or through the structure of the workplace. Such measures include modifications of the machinery, the workplace operations, and the layout of the workroom. In fact, the best approach for noise hazard control in the work environment is to eliminate or reduce the hazard at its source of generation, either by direct action on the source or by its confinement.[8]

To control noise at the source, it is first necessary to determine the cause of the noise and secondly to decide on what can be done to reduce it. Modification of the energy source to reduce the noise generated often provides the best means of noise control. For example, where impacts are involved, as in punch presses, any reduction of the peak impact force (even at the expense of a longer time period over which the force acts) will dramatically reduce the noise generated.[9]

The noise generated by a source can be prevented from reaching a worker by means of an obstacle to its propagation, conveniently located between the source and worker. This is the concept of sound isolation. Although one would ideally like the obstacle to isolate the noise completely, in practice, some of the noise always passes through it and the amount by which the noise is reduced by the obstacle, in dB, is dependent on the noise reducing properties of the material (its "transmission loss") and the acoustic properties of the room into which the noise is being transmitted.[10]

Receiver control in an industrial situation is generally restricted to providing headsets and/or ear plugs for the exposed workers. It must be emphasized that this is a last resort treatment and requires close supervision to ensure long term protection of workers' hearing. The main problems lie in ensuring that the devices fit adequately to provide the rated sound attenuation and that the devices are properly worn. Extensive education programs are needed in this regard. Hearing protection is also uncomfortable for a large proportion of the workforce; it can lead to headaches, fungus infections in the ear canal, a higher rate of absenteeism and reduced work efficiency. It is worth remembering that the most protection that a properly fitted headset/earplug combination will provide is 30 dBA, due to conduction through the bone structure of the head. In most cases, the noise reduction obtained is much less than this.[11]

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[7] Ali (2011), Nelson et al. (2005), and Salehin et al. (2014).
[8] Handley (1972).
[9] National Institute for Occupational Safety and Health (NIOSH) (1978).
[10] Bies and Hansen (1996).
[11] Bell (1982).

V. Conclusion and Recommendations

Though the noise level inside and outside the visited industry is in the satisfactory level but still there are some problems regarding noise coming from different machinery used in the production system of the industries. Thus specific workers involved in operating that specific machinery need special care as the noise can ultimately affect the workers' health.

Thus the following activities can be taken as general recommendation for the control of noise inside the industry:

- Use of ear muff as a mandatory by the workers engaged in operating machinery that produces sound in the range of 80 dBA and above.
- Replacing very old machineries that produce excess noise.
- Isolation of the generator room from the main industrial workplace and use of ear muff by the respective personnel engaged in operating the generator

Beside the general recommendations, based on the observed scenarios and findings some more specific suggestions can be implemented by various industries for the improvement of noise and its related status in the industries of KHIA.

- Workers who operate the circular knitting machines, lafer machines and other high noise producing machines at C&A Textiles can be encouraged to use ear muffs or head phones during working. Beside this, the generator lids need to be in place while the generators are in operation. Manual sheet shifting workers of Aramit Group (Cement) should be encouraged to use ear muffs during working time. Base Textiles, Fabian Thread can avail the opportunity of noise absorption by installing sound absorbing screens in their industries.
- The present nature of the use personal protective equipment (PPE) from noise is found present more or less in most of the industries visited. In spite of this, many workers do not use these PPE to protect them from excessive noise. Workers handling the grinder machine (Moon Star Paint), compressor (Well Group), dryer and pulper machine (Asia Pacific Paper Mill) need to be encouraged to use ear muffs as the generated sound exceeds the safety limit.
- Monitoring of noise related issue is found present in one industry (Unilever Bangladesh Ltd.) and it is expected that they will continue this. All other industries can take measures like Unilever Bangladesh Ltd. and improve the noise related compliance.

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