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Evaluation of Ambient and Source Noise in a Charge Chrome Plant

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A B S T R A C T

In the present study, an attempt has been made to monitor the ambient and source noise in a Charge Chrome Plant, Odisha. For the purpose, eight numbers of stations were chosen (four ambient noise monitoring stations and four source noise monitoring stations). The monitoring was done for a period of four months (January, February, March and April, 2014). At Station-1(Product Processing Yard) the noise level during day time is within the prescribed limit of 75 dBA. However, during night time, it was little higher (70.7 dBA) against the standard value of 70 dBA. At Station-2 (Main Gate) during day time the noise levels are within the prescribed limit of 75 dBA and the night time it is also within the prescribed limit of 70 dBA. At Station-3 (Weigh Bridge near Bottom of ESP and Ash Silo) day time and night time noise level are within the prescribed limit. At Station-4 (South East Direction of Coal Crusher House) day time and night time noise level are within the prescribed limit. The source noise monitoring was also carried out at four different stations. It was observed that, except in station-5(Near Furnace Casting Bay), in all other stations the source noise level is within the limit. Further, it was observed that, with increase in distance from the source up to 100 m, there is a considerable decrease in noise level about 60.5% at furnace casting bay, 52% near briquetting plant, 54% near boiler house and 52% near coal crusher room.

1. Introduction

Out of the many environmental problems, noise has emerged as one of the major unban environmental pollution [1,2]. Development in technology, commerce, communication and education has enhanced the urban growth in both developed and developing countries in the modern world. The perception of sounds in day-to –day life is of major importance for human well-being. Noise pollution problem can be combated when there are means of measuring noise levels and a system of classification. Decibel is a dimensionless number which relates sound intensity or sound pressure levels to some reference point. When we use the term decibel or discuss noise level in decibels, we refer to decibels as related to the A-weighted scale (dBA).

The A-weighted scale parallels the sensitivity of the human ear and uses the lowest audible sound that the human ear can detect as the reference point for determining the decibel levels of a noise. The human ear is able to hear 1-130 decibels. The noise rating above 80 dBA produces physiological effects and any long exposure above 90-100 decibel will produce permanent damage to person's hearing. With an increase of 10 dBA is a doubling of loudness with respect to human ear. Generally, noise consists of various tones with varying rate of vibration or

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frequency. The frequency expressed in cycles per second and referred to as cps Hertz (Hz), which is usually in the range of 20-20,000 cycles per second. Human ear is not very responsive to very low or very high tones as it is selective to tones of medium frequency. According to the World Health Organization, noise pollution is now-a-days the third most hazards environmental pollution, preceded only by air and water pollution[3] and 4.2 % of World's population suffers from hearing impairment. Noise degrades the quality of life by affecting physical and mental well being of a person[4].

A study carried out among the workers in a Midwestern auto assembly plant shows that, noise pollution has the acute effects on the systolic blood pressure, diastolic blood pressure and heart beat rate of the workers [5] in the plant. Some of the major health hazards caused by noise as suggested by experts are permanent hearing loss, high blood pressure, muscle tension, migraine, headaches, high cholesterol levels, gastric ulcers, irritability, insomnia, increased aggression and psychological disorder [6,7,8].

Industrial noise pollution is a threat to safety and health of the people working in the industry and common people as well. It has been proved that, noise more than 85 decibels can cause hearing impairment and does not meet the standards set for healthy working environment and it can cause accidents. Regulations limiting to noise exposure of industrial workers have been instituted in many countries. For example, in the U.S., the Occupational Noise Exposure Regulation states that, industrial employers must limit noise exposure of their employees to 90 dBA for one 8-h period[9,10]. A great majority of people working in industry are exposed to noise.

Therefore, it is important to monitor the industrial noise on a regular basis and to maintain the industrial noise level within the permissible limit to protect the health of the industrial workers. Many field surveys have been conducted to evaluate the outdoor noise environment in several countries [11-25.] The researchers and society in general are increasingly concerned about the issue of noise pollution and there has been a surge for the development of research in this area and the creation of laws and regulations and their proper enforcement to mitigate the impact of these disagreeable noises in the social environment, emphasizing about the fight against this current and harmful type of pollution [26-32]. In this study, ambient and source noise monitoring of a Charge Chrome Plant, Odisha were made within the industry.

2. Materials and Methods

2.1 Monitoring Instrument

Lutron SL-4001 instrument was used for both ambient and instant noise monitoring.

2.2 Environmental Monitoring

Actual noise level in the industry has been measured for a period of four months i.e. January- April 2014 and their maximum and minimum values have been found out. Measurement results have been recorded by holding the instrument at a height of 1.5 m from ground in living and working environments of the workers in order to determine the noise levels to which the workers are exposed.

2.3 Monitoring Stations

For ambient noise monitoring, four stations were chosen which are as follows:

1. Station-1: Product Processing Yard
2. Station-2: Main Gate
3. Station-3: Weigh Bridge Near Bottom Of ESP & Ash Silo
4. Station-4: South East Direction of Coal Crusher House

For instant noise monitoring, four stations were chosen which are as follows:

1. Station-5: Near Furnace Casting Bay
2. Station-6: Inside Briquetting Plant
3. Station-7: Near Boiler House
4. Station-8: Coal Crusher Room

3. Results and Discussion

3.1 Ambient Noise Monitoring

As discussed earlier, in the present study ambient noise was monitored from the following four stations during day, night and day-night in all the four months during the year 2014 and the results have been discussed.

3.1.1 Station-1(Product Processing Yard)

At product processing yard, the average day, night and day-night noise level (dBA) was found to be 71.0, 69.3 and 70.6, respectively, during the month of January, 71.2, 70.7 and 69.5, respectively, during February, 71.5, 69.8 and 70.7, respectively, during March and 71.3, 69.3 and 70.6, respectively, during the month of April, 2014. This shows that during day time the noise level is within the prescribed limit of 75 dBA. However, in the month of February, during night time, it was little higher (70.7 dBA) against the standard value of 70 dBA. There is not much variation in the sound pressure level during day and night because of the fact that, the normal activities done during the day is also done

during night. The levels of Product Processing Yard are well below the prescribed norms without affecting the nearby environment. Fig. 1 shows the ambient noise near product processing yard.

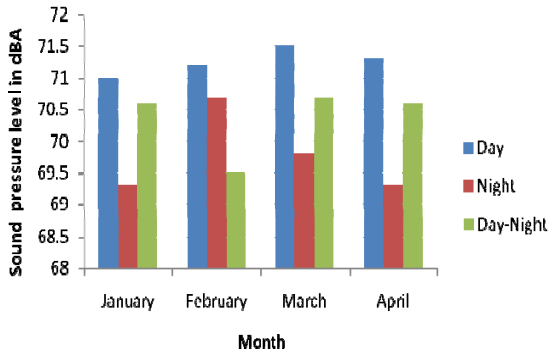

Fig. 1. L_{eq} values in dBA near Product Processing Yard

3.1.2. Station-2 (Main Gate)

At main gate, the average day, night and day-night noise level (dBA) was found to be 69.3, 68.5 and 69.0, respectively, during the month of January, 69.1, 69.0 and 69.0, respectively, during February, 69.7, 69.5 and 69.2 respectively during March and 68.9, 69.0 and 68.9, respectively, during the month of April, 2014. This shows that during both day and night time, the noise level was within the prescribed standard. The Main Gate is near to the road and hence, during day, values are higher than compared to night due to vehicular movement and traffic. Fig. 2 shows the ambient noise near the main gate.

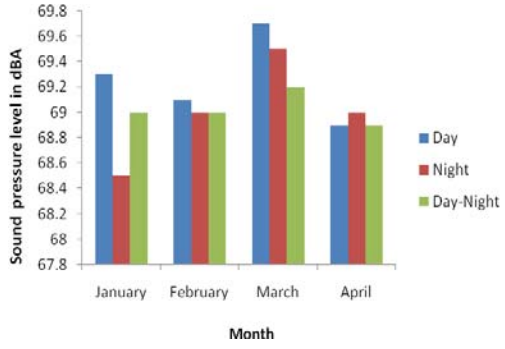

Fig. 2. L_{eq} values in dBA near Main Gate

3.1.3. Station-3 (Weigh Bridge near Bottom of ESP and Ash Silo)

At weigh bridge near bottom of ESP and ash silo, the average day, night and day-night noise level (dBA) was found to be 70.2, 69.4 and 69.9, respectively, during the month of January, 70.8, 69.3 and 70.8, respectively, during February, 71.4, 69.7 and 70.8, respectively, during March and 71.0, 68.5 and 70.5, respectively, during the month of April, 2014. This shows that during both day and night time the noise level was within the prescribed standard. There is not much variation in the sound pressure level during day and night because of the fact that the normal activities and vehicular movement during day is also the same during night. Fig. 3 shows the ambient noise near weigh bridge near bottom of ESP and ash silo.

Fig. 3. L_{eq} values in dBA near Weigh Bridge near Bottom of ESP and Ash Silo

3.1.4. Station-4 (South East Direction of Coal Crusher House)

At south east direction of coal crusher house, the average day, night and day-night noise level (dBA) was found to be 69.8, 69.2 and 69.6, respectively, during the month of January, 69.9, 69.1 and 69.7, respectively, during February, 70.0, 69.2 and 69.8, respectively, during March and 69.8, 69.1 and 69.5, respectively, during the month of April, 2014. The monitoring station is close to the coal crusher house and differences in values are noticeable due to the crushing activity which is done when required during day or night. But, still, all the values are below the prescribed standards for ambient noise. Fig. 4 shows the ambient noise near South East Direction of coal crusher house.

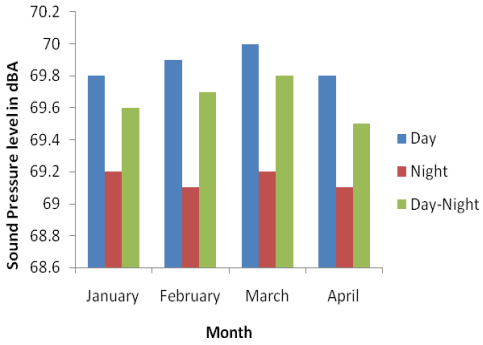

Fig. 4: L_{eq} values in dBA near South East Direction of Coal Crusher House

Table 1 shows the day, night and day-night ambient noise monitoring results with their mean and standard deviation values near all the four monitoring stations. In general, it was found that, the ambient noise level in all the four monitoring stations are just below the permissible limit except the day time noise near station-1 during the month of February.

Table 1: Ambient Noise Monitoring Results.

	January			February			March			April		
Stations	**Day**	**Night**	**Day – Night**	**Day**	**Night**	**Day – Night**	**Day**	**Night**	**Day – Night**	**Day**	**Night**	**Day – Night**
Station- 1	71.0 ± 0.27	69.3 ± 0.52	70.6 ± 0.43	71.2 ± 0.30	70.7 ± 0.45	69.5 ± 0.53	71.5 ± 0.26	69.8 ± 0.59	70.7 ± 0.49	71.3 ± 0.22	69.3 ± 0.62	70.6 ± 0.56
Station- 2	69.3 ± 0.32	68.5 ± 0.46	69.0 ± 0.22	69.1 ± 0.36	69.0 ± 0.39	69.0 ± 0.12	69.7 ± 0.42	69.5 ± 0.43	69.2 ± 0.19	68.9 ± 0.33	69.0 ± 0.44	68.9 ± 0.23
Station-3	70.2 ± 0.49	69.4 ± 0.53	69.9 ± 0.42	70.8 ± 0.52	69.3 ± 0.39	70.8 ± 0.44	71.4 ± 0.55	69.7 ± 0.56	70.8 ± 0.39	71.0 ± 0.42	68.5 ± 0.45	70.5 ± 0.36
Station 4	69.8 ± 0.22	69.2 ± 0.21	69.6 ± 0.23	69.9 ± 0.19	69.1 ± 0.19	69.7 ± 0.20	70.0 ± 0.25	69.2 ± 0.22	69.8 ± 0.21	69.8 ± 0.17	69.1 ± 0.25	69.5 ± 0.23

Table 2 shows the Ambient Air Quality Standards with respect of Noise as per the guidelines for Environment (Protection) Act, 1986 as amended in 2002.

Table-2: Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area/Zone	Limits in dB(A) L_{eq} *	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

3.2 Source Noise Monitoring

The source noise monitoring was carried out at all the four stations (near furnace casting bay, inside briquetting plant, near boiler house and coal crusher room) and the readings were taken at a distance of 2 meter and 100 meter from the source. It was also observed that, the average source noise was below the limit except near furnace casting bay where it was found to be 86.2 dBA. Further, while comparing the source noise at a distance of 2 meter with respect to a distance of 100 meter for the respective source, there is a noise level reduction of 60.5% at furnace casting bay, 52% near briquetting plant, 54% near boiler house and 52% near coal crusher room.

4. Conclusion

The problem of noise should be taken into consideration during their establishment phases. Use of the latest technology should be provided in the industries. Industrial noise pollution is a major concern with respect to occupational health hazards of the workers. In the present investigation, it was observed that, though both the ambient and source noise levels are below the limit, they are very close to the standard. To protect the health of the workers with respect to noise pollution, the industry is providing the personal protective equipments to the workers, health checkup and health insurance. In the present study, more attention should be given to mention the noise level well below the limit.

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