

Comparitive study of noise descriptors and noise exposure level due to diwali noise in metropolitan city: lucknow

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Abstract: Noise is harsh, disagreeable, irritable and unwanted sound which may cause irritation and annoyance to the public as well as to the surroundings. It is a global challenge as it is considered one of the major environmental issues in the present era. In this paper studies have been made for finding variations for noise exposure level, noise descriptors and the comparative study of the noise exposure level (L_{den}), average day night noise level L_{dn} and other noise descriptor such as L_{10} , L_{50} , L_{90} & L_{eq} at four selected locations in metropolitan city Lucknow viz. Aliganj, Jankipuram, Indiranagar and Krishnanagar on pre diwali and on diwali day. The sampling was done at four locations on the pre diwali day and the diwali day from 06:00 to 10:00 (daytime), 18:00 to 22:00 (evening time) and 23:00 to 24:00 (night time). Data was taken at an interval of 15 seconds continuously for the 15 minutes and again for the next 15 minutes with the gap of 15 minutes in successive reading. The results indicate that L_{eq} was from 55.5 dBA on pre diwali to 62 dBA on diwali day at Aliganj while the L_{den} and L_{dn} were 61.7 and 61.1 respectively on pre diwali to 70.5 dBA and 76.3 dBA respectively on the diwali day. At Krishnanagar location, variation was between 59.2 dBA on pre diwali to 84.1 dBA on diwali day while the L_{den} and L_{dn} were 65.8 and 65.2 respectively on pre diwali to 90.6 dBA and 91.6 dBA respectively on the diwali day. Variation at the site of Indiranagar shows L_{eq} 72.1 dBA on pre diwali to 77.8 dBA on diwali day while the L_{den} and L_{dn} are 82 and 81.9 respectively on pre diwali to 87.5 dBA and 87.4 dBA on the diwali day. The variation of L_{eq} at Jankipuram was 56.7 dBA on pre diwali to 76.8 dBA on diwali day while the L_{den} and L_{dn} are 64.2 and 63.5 respectively on pre diwali to 85.8 dBA and 85.4 dBA on the diwali day. It is observed that mostly all the noise parameters at the all study locations are beyond the prescribed limits.

Index Terms— Noise pollution, noise exposure level, noise descriptors.

I. INTRODUCTION

Noise is considered as an environmental issue and a global challenge. Long-term exposure in the form of unwanted sound significantly imposes environmental problem to humans and animals. The audible range for human ear is 20 Hz to 20 KHz. If the frequency is less than 20 Hz then it is called sub-sonic while more than 20 KHz it is said to ultrasonic range of frequency. Since the sound produced may be liked by one

person and may be discarded by other person. Environment (Protection) Act, 1986 recognizes noise as an "environmental pollution" and empowers the Central Government to frame the laws and regulations prescribing the maximum permissible limits for the noise at different locations. The main sources of noise pollution are the construction activities, traffic emergence, industrialization etc. Noise can affect badly to our environment and threat to humans. Long term exposure may cause permanent hear loss, annoying behaviour, headache, fluctuation in blood pressure, muscular strain and nervous breakdown, lowering of concentration and affect on memory, insomnia, emotional disturbance. Diwali is a Hindu festival of lighting and full of joy, celebrates using firecracker in the month of October or November every year. There is huge use of firecrackers in the diwali festival by the young people, children and the fascinated peoples in all over the country. The burning of firecracker induces a lot of air pollution as well as the noise pollution. The pollution produced by this makes the environment more polluted over the existing pollution.

Undesirable sounds that are emitted by various mechanisms are defined as Noise. The acoustic noises are mainly categorised into three types:

- Steady Noise (industrial machines, transformers, air conditioners and turbines etc.)
- Fluctuating Noise (road and rail traffic, aviation, sound and music etc.)
- Impulse Noise (land mines, ammunition explosion and crackers etc.), so we can say that it is a worst type of noise pollution occurs in the environment.

II. LITERATURE REVIEW

The motor vehicle is the very significant and important sources of noise pollution in the urban environment it contributes to 55% to the total noise pollution (Banerjee et al, 2008). A study based on noise pollution and ordinance, proposed the revision in the noise abatement pollution based on the adequate knowledge followed all over the world, apart from the standards followed in India (Garg et al, 2005).

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Study is conducted in Mumbai results that diwali festival creates a lot of noise pollution and there is continuous increment in noise level from the previous year (Patel et al, 2014). In Duhok city (Iraq) during Nawruz festival, results showed measured noise level was 20% higher than the normal days and also beyond the noise standards so we can say that the festivals are the main cause of increase in noise level (Yousif et al, 2014). In a study held during diwali festival in Chindambaram town (Tamilnadu, India), the recorded noise level on the diwali day for 30 sites it was found that noise level were higher than the prescribed limits (Balashanmugam et al, 2014). Firecracker uses in enjoying the diwali festival lead to generation of lot of air pollution as well as the noise pollution which affects the human health (Sharma et al, 2016). A review conducted for ambient air and noise quality in India during diwali festival resulted that air quality was degraded and increase in noise level on diwali day than the normal day which is liable to serious health hazard, the study also emphasises on the control on bursting of firecracker to save human health (Chirag et al, 2014). A study was conducted in Raipur city (Chhattisgarh, India) during the diwali festival which resulted that recorded value at all the sites were higher than the prescribed limit and the main source of increase in noise level were firecracker and traffic emergence after the holidays (Ahirwar et al, 2015). A study was conducted at Mhaswad (Dist. Satara in Maharashtra) where ten different sites were taken and it was found that, the residential zone and silence zone had higher noise level (Sujeet et al, 2016). Study was conducted in Calabar Municipality during pre-carnival, carnival and post carnival indicated that sound level were at a higher edge at morning, afternoon as well as evening. This made adverse effect to all aged humans (Alpan et al, 2015). A lot of efforts had been done to apply the noise exposure management strategies but resulted less improvements (Tickell, 2012). The DNL (day-night average sound level) was selected by EPA as the uniform descriptor of cumulative sound exposure to correlate with health and welfare effects. DNL methodology has given consistent results in the national and international literature under a wide range of noise conditions (including loud and soft noise levels, and frequent and infrequent numbers of discrete aircraft events) (Fidell, 2012). School based study in Italy was done to know the sound exposure effects on students (human being) and formulated; Annoyance Index (AI) score, global noise score (GNS) (Fabrizio et al, 2018).

L_{Aeq} : It is the A-weighted equivalent sound pressure level,
 L_{90} : It is a good measure of background noise and the noise level that exceeded 90% of the time.

L_{50} : It is median noise, which is necessary, the same thing as Leq
 L_{10} : It is the noise level that exceeded 10% of the time. It is a good measure of intermittent or intrusive noises, such as traffic, aircraft flyover, barking dogs etc.
 L_{den} (Noise exposure): is defined in terms of the "average" levels during daytime, evening, and night-time. The L_{den} (Day Evening Night Sound Level) or CNEL (Community Noise Equivalent Level) is the average sound level over a 24 hour period, with a penalty of 5 dB added for the evening hours or 19:00 to 22:00, and a penalty of 10 dB added for the night time hours of 22:00 to 07:00.
 L_{dn} : The L_{dn} is the day night average equivalent

sound level over a 24 hour period, with a penalty added for noise during the night time hours of 22:00 to 07:00. During the night time period 10 dB is added to reflect the impact of the noise. L_{dn} measurements are useful for assessing the impact that road, rail, air and general industry has on the local population. Noise exposure is a term which shows the exposure of noise pollution to the population resides in any area in a given time period of noise occurrence. Study of noise exposure easily makes comprehensive about the noise pollution to common people and we can easily educate them about the pollution created by the bursting of firecracker which is harmful to our society and the human health. This can be further a great help in the awareness program, not to burn the huge amount of firecrackers at the festival.

III. MATERIAL AND METHOD

A. Study area

Lucknow metropolitan city is the capital city of Uttar Pradesh State which is at 80.95°E longitude and 28.70°N latitude, selected as a study area at four sites for monitoring the noise level at the site considering as an area source (Aliganj, Indiranagar, Jankipuram and Krishnanagar) in the city on pre-Diwali day and on Diwali day with the help of noise meter (Lutron- SL 4010). Since noise is considered as a global challenge and it is produced by many anthropogenic activities. In the same way noise pollution created by firecracker in the diwali festival creates a lot of nuisance i.e. psychological and physiological living standard with many health hazard problems. This study is a part of awareness program of noise pollution because of bursting of firecrackers. The all locations selected for study are residential areas and contains high population density. These highly populated sites taken to study the noise exposure and would give the better idea of exposure condition. Map of study area is shown in figure 1.

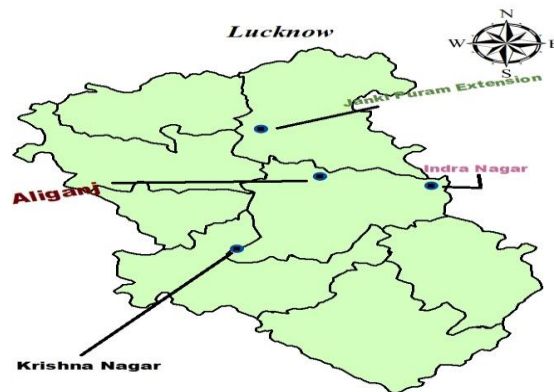


Figure 1- Map of Study Area

B. Experimental procedures

Instrument was installed at 1.5 m above the ground and instrument set up by proper calibration at several meters from the firecrackers.

The study was carried in the month of October of year 2017. The interval 15 second was taken for successive reading, L_A (A-weighted instantaneous sound pressure level) measurements was recorded continuously for 15 minutes. There were 120 noise data available for the one hour. The measurement of noise level for the areas was done at pre diwali day and on the diwali day in the form of A weighted noise level and described in the form of $L_{eq}(A)$. Measurement was taken in an open space using the noise metre from the distance of more than 15 metre from the firecrackers. Data was collected in morning (6:00–10:00), evening (18:00–22:00) and night (23:00–24:00). Commonly used community noise evaluation quantities like the exceedance percentiles such as L_{10} , L_{50} and L_{90} , the A-weighted equivalent sound pressure level L_{Aeq} , the noise exposure level L_{den} , and L_{dn} , were determined.

C. Exposure limits for noise fireworks

There may be loss of hearing if noise levels exceeds by 90 decibels exposure for long periods and may cause permanent loss of hearing due to 150 decibels or greater even with a single exposure of such intensity (Noise standards for fire-crackers as per Environment (Protection) Act, 2000).

IV. RESULT AND DISCUSSION

The results are compared graphically. all the sites which were selected for study indicated the higher noise level than the prescribed limits by the cpcb, 2000.

In figure 2 the L_{eq} for a whole day varies from 55.5 dBA on pre diwali to 62 dBA on diwali day at Aliganj, which increases 18.82% on diwali day from the pre diwali day. Minimum L_{eq} for a pre diwali day was recorded 48 dBA during 06:00-07:00 while the maximum value recorded was 59 dBA during 09:00-10:00. For the diwali day it was seen that the recorded values was minimum during 06:00-07:00 which was 58 dBA and maximum was during 22:00-23:00 i.e.76 dBA, these are presented in Table 1.

TABLE 1: NOISE DESCRIPTORS AT ALIGANJ SITE

ALIGANJ SITE	L_{eq}	L_{10}	L_{50}	L_{90}	L_{den}	L_{dn}
PRE DIWALI DAY	55	58	55	48	61.7	62.1
ON DIWALI DAY	67	65	58	53	76.5	76.3

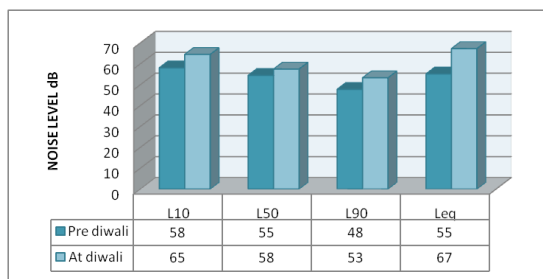


Figure 2: Variation of noise parameters at Aliganj

In the figure 3 at Krishnanagar location, variation in L_{eq} was from 59.2 dBA on pre diwali to 84.1 dBA on diwali day which increases 42% on diwali day from the pre diwali day. This was more concerning place among all the selected location taken for the study purpose, the enormous volume of traffic and firecracker was the main contributor to increase in noise level. Minimum recorded L_{eq} on pre diwali

day was 50 dBA during 06:00-07:00 and the maximum value recorded was 61 dBA during 07:00-09:00. For the diwali day, minimum reading was 50 dBA during 06:00-07:00 and maximum was 89 dBA during 19:00-20:00.

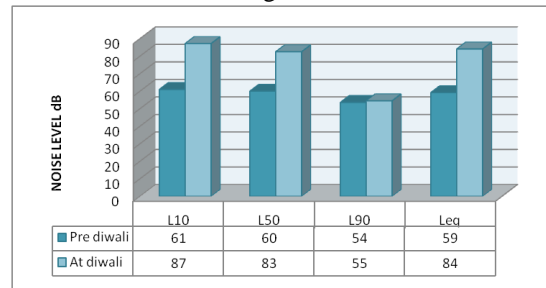


Figure 3: Variation of noise parameters at Krishnanagar

In the figure no 4 the variation at Indiranagar shows L_{eq} 72.1 dBA on pre diwali to 77.8 dBA on diwali day and the noise level are the beyond the prescribed limits. There was approximately 8 % exceedance in noise level on diwali day from the pre diwali day. Minimum L_{eq} for a pre diwali day was recorded 51 dBA during 06:00-07:00 and the maximum value recorded was 79 dBA during 22:00-23:00. On diwali day the minimum values recorded during 06:00-07:00 i.e. 50 dBA and maximum value was 86 dBA during 23:00-24:00.

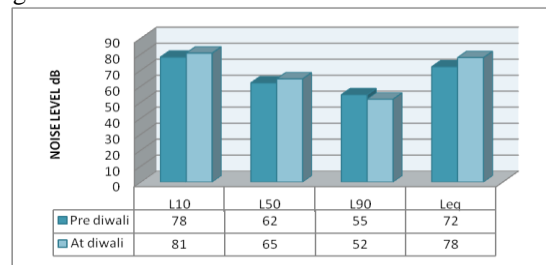


Figure 4: Variation of noise parameters at Indiranagar.

The figure 5 shows the variation of L_{eq} at Jankipuram was 56.7 dBA on pre diwali to 76.8 dBA on diwali day, this shows that there was increase of 35.50% in noise level at diwali day than the pre diwali day.

The value of noise level at this site was beyond the standard limits. L_{eq} for a pre diwali day was recorded 48 dBA during 23:00-24:00 while it was 62 dBA during 21:00-22:00. For the diwali day the minimum L_{eq} was 50 dBA during 06:00-07:00 and maximum was 81 dBA during 21:00-23:00.

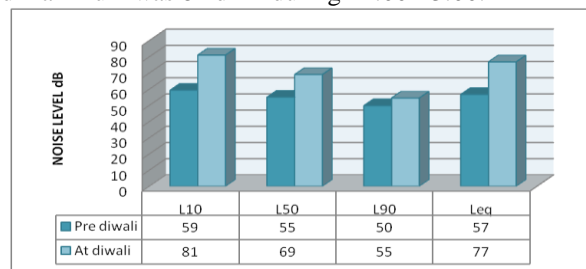


Figure 5: Variation of noise parameters at Jankipuram.



In the figure 6 the values of L_{den} and L_{dn} were 61.7 and 61.1 respectively on pre diwali to 70.5 dBA and 76.3 dBA respectively on the diwali day at Aliganj site. The L_{den} and L_{dn} on Krishnanagar were 65.8 and 65.2 respectively on pre diwali to 90.6 dBA and 91.6 dBA respectively on the diwali day. At Indiranagar the values of L_{den} and L_{dn} are 82 and 81.9 respectively on pre diwali to 87.5 dBA and 87.4 dBA on the diwali day. The L_{den} and L_{dn} at jankipuram are 64.2 and 63.5 respectively on pre diwali to 85.8 dBA and 85.4 dBA on the diwali day. The figure 6 shows the noise exposure variation at all locations.

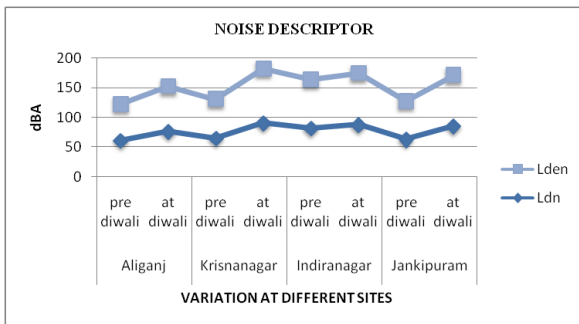


Figure 6: Comparative Variation of L_{den} and L_{dn} at all sites

V. CONCLUSION

Firecracker used in diwali festival creates a lot of pollution. Burning of firecracker produces impact noise rather than the other type of noise such as continuous and intermittent noise. This impact noise is more harmful for the humans living in nearby place, by the generation of impact noise from the firecrackers it will be more damaging to hearing loss. So this study helps to better understanding of exposure of noise pollution generated by the bursting of firecracker at the diwali festival. This study can be used for making the strategic action plan to better health of peoples living in the residential areas and to curb the noise pollution.

RECOMMENDATION

From above all discussion we can say that the firecracker used in the festivals creates a lot of nuisance in the form of degraded air quality and noise pollution which is health hazard to all humans as well as to animals. There is need of awareness to the people, not to make such level of high noise pollution because of high decibel producing firecrackers. Platforms like electronic media, print media, governmental body such as CPCB, state pollution control board etc, educational institutes, NGOs and other responsible bodies should make the awareness programme to peoples to curb the such pollution during diwali festival. As per the order based on the Supreme Court, prohibition of use of firecrackers in residential zone should be strictly followed during the time 22:00 to 06:00. Enforcement of legal laws should strictly follow against the unauthorised producers and sellers of firecracker. Play of firecracker should be based on the community or grouped level, not at the individual level so that nuisance can be reduce. Government should forcefully interfere in a way so that it can help to promote the good things to mitigate the problem by legal procedures.

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