

Ambient Air Quality And Noise Monitoring During Deepawali Festival In Haridwar City Of Uttarakhand State (India)

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Abstract: The present study was conducted to find out the impact of human activities during the festival of light, i.e. Deepawali, on ambient air quality. Four parameters viz. RSPM, SPM, SO₂ and NO₂ were studied for non-festive and festive days during Deepawali at two busy intersections of Haridwar city namely; Ranipur More and Singh Dwar. Noise levels were also monitored for both sites with the help of Sound Level Meter. The concentration of RSPM was found 13.64% higher on festive day as compared to the non festive day at the study site of Ranipur More crossing point, whereas 17.63% increase was found on festive days at Singh Dwar crossing point. Similarly, the SPM values increased by 12.47% and 13.73%, on festive day at Ranipur More and Singh Dwar, respectively. The concentration of SO₂ were found 32.93% and 51.84% higher on festive day at Ranipur More and Singh Dwar, respectively. While the concentration of NO₂ was found to have increased by 10.68% and 12.87%, during the festive day as compared to non festive day at Ranipur More and Singh Dwar, respectively. The results of noise monitoring show an enhanced pressure of noise during the festival of light. The average noise level on festive day show a rise of 23.6% and 16.1% as compared to non-festive day, respectively for Ranipur More and Singh Dwar, respectively.

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Key words: religious festival; fireworks; particulate matter; noise pollution.

1. Introduction

Air pollution is the presence of undesirable substances in ambient atmosphere, generally resulting from the activity of man, in sufficient concentration, for a sufficient time and under circumstances which interfere significantly with the comfort and health. Air pollutants consist of gaseous pollutants, odour, and particulate matters such as dust, fumes, mist, and smoke. A persistent presence in specific amounts of such pollutants in our ambience leads to severe pollution causing an invisible but certain impacts and effects on various aspects of human behavior and physiology in a very subtle manner. These effects are manifested after a long time only, but sometimes immediately too, as happened in case of Bhopal Gas Tragedy following massive leakage of Methylene Isocyanate in 1984 (Sharma, 2006). The long term exposure to even low levels of Particulate Matter (PM) are linked with deleterious health problems, including asthma, bronchitis, pneumonia, upper and lower respiratory tract disorders (Mohanraj and Azeez, 2004). The largest causes and sources of air pollution are our requirements for energy generation, transportation, and industrial activities that use a great deal of chemicals and synthetic materials, besides energy constituents. It is being realized that during relatively a short period of about recent 200 years of history of human civilization and industrial activities, almost one half part of the land surface has been

transformed by human activities with heavy concentration of pollutants in Air (Fenger, 2009).

For the purpose of the present study, fire crackers are one of the most important source of degradation of ambient air quality, as and when used on various occasions. In India, fire crackers are being used in a massive amount during the festival of Deepawali, i.e., the festival of light, which is celebrated almost all over the country, assigned to a number of Gods, Goddesses and Deities, besides during many other festive occasions including marriage ceremonies and jolly processions like elections. Fireworks take many forms to produce the four primary effects i.e. noise, light, smoke, and floating materials. Besides causing the noise pollution, the massive amount of fire crackers used also contribute to the atmospheric particulate pollution which cause respirable diseases among human beings (Vecchi et al, 2008).

2. Materials and Methods

To make this study, two locations i.e. Singh Dwar and Ranipur More crossing points within the Haridwar city were selected. Both site have a difference of about 2 km to each other and also have difference in activities. Ambient noise and air monitoring were carried out during festive (on the day of deepawali) and non festive (3 days before deepawali) of Deepawali in November 2012. Monitoring of particulates was undertaken as per the norms prescribed by the Central Pollution Control

Board of Govt. of India, and the analysis of gaseous pollutants viz. SO₂ and NO₂ were carried out as per the modified method given by West and Gaecke (1956) and Jacob and Hochheiser (1958), respectively. The sampling was done for a period of 24 hours on each sampling site, by Envirotech Respiratory Dust Samplers (APM 460) on the same dates and timings. Noise level was also measured during 600 hrs-2400 hrs on non festive and festive day during Deepawali on the both sites. Ambient sound levels were compared with that of the standards prescribed in Environmental Protection Rules, 1986 (vide Tripathy, 1999) and standards of CPCB (vide Kudesia and Tiwari, 1994).

3. Results and Discussion

The results of the intensive ambient air and noise monitoring at selected two locations in the city are summarized below in Table 1-2 and Fig.1.

Case 1- Ranipur more crossing point:

During the present study the concentration of RSPM was found 13.64% higher on festive day as compared to the non festive day at Ranipur More study site. The SPM value increased by 12.47% on festive day at Ranipur More. The concentration of SO₂ and NO₂ were found 32.93% and 10.68% higher on festive day at Ranipur More. The average noise level on festive day show a rise of 23.6% as compared to non-festive day, respectively for Ranipur More.

Case 2-Singh Dwar crossing point:

The concentration of RSPM was found 17.63% higher on festive day as compared to the non festive day at the study of Singh Dwar crossing point. The SPM values increased by 13.73%, on festive day at Singh Dwar. The concentration of SO₂ and NO₂ were found 51.84% and 12.87%, higher on festive day at Singh Dwar, respectively. The average noise level on festive day show a rise of 16.1% as compared to non-festive day, respectively for Singh Dwar, respectively.

The foregoing results show that all the parameters increased on account of use of fire crackers, during festive days as compared to non festive day. Parrish et.al. (2009) have compared the air pollutant emission among the three non US mega cities and found a rapid increment in pollutant as compared to the pollutant emission in US. Senthilnathan (2008) has monitored the ambient air

quality in the urban area of Chennai city and observed the exceeded values of particulate matter in respect of standard limits. The toxic substances used in the firecrackers release toxic gases that are harmful to the health of all living beings. Wang et, al. (2007) assessed the effects of the burning of fire crackers on air quality in Beijing during the lantern festival and found that over 90 % of the total mineral aerosol, 98 % of Pb and 43% of total carbon were from the emissions of fireworks on the lantern night.

Increase in Sulphur dioxide is on account of more use of crackers which are rich in Sulphur components. However, the concentration of Sulphur dioxide at all the locations was within the prescribed residential standards. The findings of the study also reveal that concentration of all pollutants including noise was at its peak from 2100 hrs to 2400 hrs during Deepawali night. This is due to continuous use of fire crackers with the advance of night hours, in a huge amount.

During the present study the noise level was found exceeded at both sites. In an earlier study, Sharma et, al. (2010) reported that the residents of areas nearby these crossing points of Ranipur More and Singhdwar are being faced various problems of headache, hypertension, High BP etc. due to heavy traffic noise even in non-festive days. This certainly needs attention of city administration as also pointed out by Guttikunda and Aggarwal (2009) who suggested that the governing bodies need to make special provisions in transport sectors to prevent and control pollution.

The problem of noise during religious festivals, apart from other human activities has been causing concern as Banerjee and Niyogi (2007) monitored the noise level during Kali Puja festival in Asansol, West Bengal and observed 19.2% rise in noise level on festive day as compared to non festive day. Noise level on Deepawali festival as recorded by Pulikesi et al (2006) in Chennai and by Agarwal (2006) in Lucknow City.

In both cases, noise was found significantly higher in residential areas. The noise level on Deepawali festival even in a small township of Haridwar city was also found higher than the prescribed limit (Sharma and Joshi, 2010).

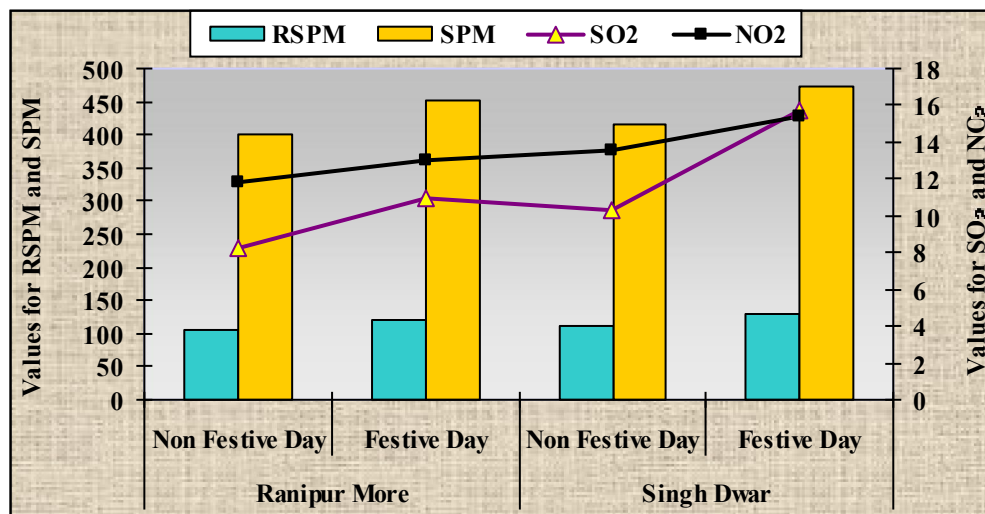
Table 1. Average concentration* of RSPM, SPM, SO₂ and NO₂ at selected sites within Haridwar city

Parameters Studied	Ranipur More		Singh Dwar	
	Non Festive Day	Festive Day	Non Festive Day	Festive Day
RSPM	106.20	120.68	110.0	129.39
SPM	400.50	450.44	415.0	471.97
SO ₂	8.20	10.90	10.32	15.67
NO ₂	11.80	13.06	13.60	15.35

*(All values are mean and range for four observations each, in µg/m³)

Table 2. Average noise level (dB) at selected sites within Haridwar city

Time Period	Ranipur More		Singh Dwar	
	Non Festive Day	Festive Day	Non Festive Day	Festive Day
0600	52.8	65.5	54.3	61.2
0900	59.5	74.9	58.2	66.0
1200	64.9	78.6	65.7	75.3
1500	67.5	79.4	63.1	75.0
1800	70.5	78.2	68.2	70.1
2100	73.6	89.6	71.5	83.2
2400	50.2	76.3	51.2	71.0

**Fig 1: The quantitative variation of RSPM, SPM, SO2 and NO2 (in µg/m³) in Haridwar City**

(A)



(B)

Photo 1: (A) Children purchasing the fire crackers, (B) Children celebrating Deepawali with crackers

4. Conclusion

Deepawali is one of the most important festival in India, which is celebrated by all walks of life. The traditional way of celebration was eco-friendly and an indication of simplicity in Indian culture. Only earthen lamps made by potter, were lit and no crackers were used during Deepawali in the

traditional way of celebration. As a result, there was neither noise nor air pollutions. But now the equation has been changed due to extravaganza using modern modes of celebrations. The excessive use of fire crackers converts the clean and jolly atmosphere to a hazy air full of smokes of explosives and noise pollution. The festival of lights also puts a

considerably heavy load on electrical energy sources that are already overloaded.

The study clearly shows that the RSPM, SPM, SO₂, NO₂ and noise levels in ambient atmosphere on the festive day were comparatively higher than the values observed on the non festive day, on account of Deepawali festive celebration and of bursting of fire crackers. The noise level was observed exceeding the prescribed limit at the both site during festive day. The bursting of cracker release pollutant and generate noise in the ambient air which may have adverse impact on the general health of the living beings. The increasing concentration of pollutant in the atmosphere during Deepawali can affect the respiratory system of the human being and increasing level of noise causes irritation, hearing loss. Improper use of fireworks may be dangerous (risks of burns and wounds), both to the person operating them and to the bystanders.

Recommendations

- Noise level of the crackers must be prescribed and checked before allowing to be sold.
- A surveillance team constituting the officials from city administration, responsible as per said rules and notification may be constituted for patrolling and compounding the offence on the eve of festivals like Deepawali, Dusshera, State level fairs / functions etc. for maintaining the ambient air quality level.

Acknowledgement

Authors are grateful to Indian Academy of Environmental Sciences, Haridwar and Society of Environmental Education & Mass Awareness, Haridwar for financial support to carry out this research.

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10/17/2013