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Assessment of Health Risk due to Stone Crusher Pollution at Bharatkoop Town, District Chitrakoot

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Abstract

Now a days air pollution is a major problem in India. Unplanned urbanization and industrialization are the biggest cause of environmental pollution. Air pollution due to stone crusher industries causes major environmental and health risk. Sampling of respirable particulate matter (PM_{10} and $PM_{2.5}$) was done with the help of APM 550 instrument and Whiteman filter paper. The concentrations of particulate matter were found above the permissible limit as per the standards given by Central Pollution Control Board (2009). A physical survey was carried out with the help of questionnaire, personal interviews and health data were also collected from hospitals, Primary health centers etc. The questionnaire also covered duration of a particular disease when the disease was perceived in apex extent. This study also reveals the acute and chronic effects of dust pollution on health of stone crusher's workers. Higher concentration of respirable particulate matter causes various respiratory diseases, lung diseases, skin problems, eye irritations and heart diseases etc. There is a strong relation between dust pollution and health effects. It is identified that the study area is at very high risk due to stone crusher industrial emissions.

Keywords: Air pollution, Respirable particulate matter, PM_{10} , $PM_{2.5}$, Health risk.

Introduction

Environmental pollution is a common problem in both developing and developed countries. Urban outdoor air pollution is associated with several adverse health impact due to various pollutant sources like vehicular exhaust, re-suspended road dust, biomass burning and industrial emissions (Goel and Chinthala, 2015). Stone crushing Industry is an important industrial sector in the country engaged in producing crushed stone of various sizes depending upon the requirement which acts as raw material for various construction activities such as construction of roads, highways, bridges, buildings, canals etc. It is estimated that there are over 12,000 stone crusher units in India. These stone crushers though socio-economically are important sectors yet give rise to substantial quantity of fine fugitive

dust emissions which create health hazards to the workers as well as surrounding population by way of causing respiratory diseases (CPCB, 2010). In recent years, a large number of studies on health impacts due to air pollution have been undertaken in developing countries (Anonymous, 1980). Urban air pollution is a matter of concern in today date because of exposure of a large number of people to it and their adverse effects on human and environmental health (Barman *et al.*, 2010). In the absence of proper control devices in these units, the work place can become highly polluted (CPCB, 1984). PM_{10} , a specific indicator of anthropogenic fine dust, represents the thoracic fraction of the ambient particles while $PM_{2.5}$ is an alveolar fraction of the ambient particles (ISO, 1995). There is also strong evidence that fine particles ($dp < 2.5\mu m$) play an important role in

the observed health effects (Stern *et al.*, 1984). Coarse particles ($2.5 \mu\text{m} < dp < 10 \mu\text{m}$) are effectively removed in the upper part of respiratory track while fine particles ($dp < 2.5\mu\text{m}$) are deposited on the bronchi walls in the bronchi tree (Akeredolu, 1996). Interestingly the important role of air pollutants in genesis and augmentation of allergic disorder which can lead to enhance risk of infection and diseases by causing immune supersession has been reported (Gupta and Gupta, 2016). After decades of industrialization, air pollution has become a major environmental issue for both developed and developing countries. Poor air quality has both acute and chronic effects on human health (Yang *et al.*, 2004, Afroz *et al.*, 2003). The ill effects on health are severe with the fetus, children, elders and cardiovascular and angina pectoris patients (Balashanmugam, *et al.*, 2012). Suspended particulate matter, sulphur oxide (SO_x), nitrogen oxide (NO_x) and CO pollution cause a risk for human health (Gupta and Gupta, 2014).

Material and Methods

Five sites of Bharatkoop town were selected for sampling of respirable particulate matter. These were Bharatkoop East (BKE), Bharatkoop West (BKW), Bharatkoop Central (BKC), Bharatkoop North (BKN), Bharatkoop South (BKS). Sampling of respirable particulate matter was done for 24 hours during summer, 2015. Fine particulate sampler model APM 550, Envirotech model was used for sampling of respirable particulate matter. Whatman glass microfiber and PTFE filters were used for sampling of PM₁₀ and PM_{2.5}. Concentrations of respirable particulate matter were analyzed as per standard methods of National Ambient Air Quality Standard (NAAQS) prescribed by CPCB (Central Pollution Control Board) 2009. Health survey was done with the help of questionnaire, interviews and reports of hospital data.

Study Area

The present study focuses on Bharatkoop town of district Chitrakoot (U.P.). It is situated at Jhansi-Allahabad train route. Its geographical location is at latitude 25⁰, 21' N and longitude 80⁰, 77' E. There are a number of small, medium and big stone crushing industries at and in surrounding of Bharatkoop town. In view of above facts it is planned to carry out monitoring of the concentration of respirable particulate matter of Bharatkoop region and its effect on the health of stone crusher workers.

Results and Discussion

The maximum and minimum concentration of respirable particulate matter (PM₁₀) were 2041.00 $\mu\text{g}/\text{m}^3$ in Bharatkoop Central (BKC) and 331.08 $\mu\text{g}/\text{m}^3$ in Bharatkoop South (BKS) respectively (Table 2 & Figure 1). The maximum and minimum concentrations of respirable particulate matter (PM_{2.5}) were 896.40 $\mu\text{g}/\text{m}^3$ in Bharatkoop Central (BKC) and 197.02 $\mu\text{g}/\text{m}^3$ in Bharatkoop South (BKS) respectively during summer, 2014 (Table 2 & Figure 1).

Survey was conducted in 200 workers for general incidence of various diseases among stone crusher workers of Bharatkoop. Result from table 2 indicated that about 63% workers (46% male and 17% female) were suffering from respiratory diseases, 47% workers (36% male and 11% female) from asthma, 29% workers (20.5% male and 9.5% female) from skin diseases, 43% workers (26.5% male and 17.5% female), 25% workers (21% male and 4% female) from hearing problems and 28% workers (18.5% male and 9.5% female) suffering from other diseases such as sleeplessness, tiredness and headache etc. due to stone crusher air pollution.

Table 1 National Ambient Air Quality Standard (2009)

Pollutants	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Particulate Matter (Size less than 10 μm) or PM ₁₀ , μg/m ³	Annual 24 Hours	60 100	60 100	Gravimetric method
Particulate Matter (Size less than 2.5 μm) or PM _{2.5} , μg/m ³	Annual 24 Hours	40 60	40 60	Gravimetric method

Table 2 Measurement of RSPM of Bharatkoop during summer, 2014

S. No.	Sampling sites	PM ₁₀ (μg/m ³)	PM _{2.5} (μg/m ³)
1	BKE	735.06	340.72
2	BKW	1781.00	609.94
3	BKC	2041.00	896.40
4	BKN	1484.69	257.40
5	BKS	331.08	197.02

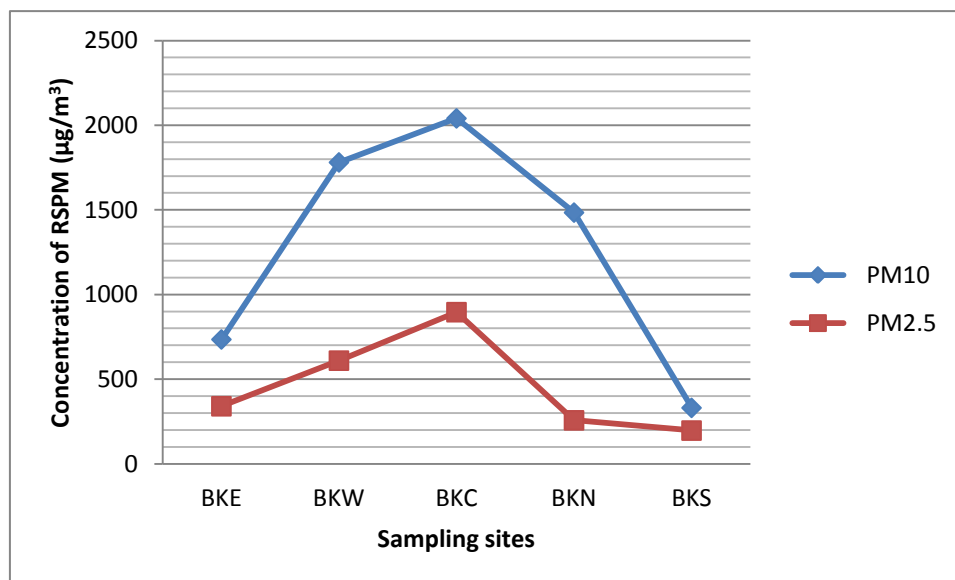


Figure 1: Relation between PM₁₀ and PM_{2.5}

Table 3 Impact of Dust Pollution on Health of Stone Crusher Workers

S.No.	Diseases	Total no. of workers	% of Effective workers		% Effectiveness
			Male	Female	
1	Respiratory diseases (Cough, TB, , Chest pain)	200	46	17	63
2	Asthma	200	36	11	47
3	Skin diseases	200	20.5	9.5	29
4	Eye irritation	200	26.5	17.5	43
5	Hearing loss	200	21	4	25
6	Others (sleeplessness, headach)	200	18.5	9.5	28

Conclusion

The study of respirable particulate matter of Bharatkoop, district Chitrakoot (U.P.) and its impact on stone crusher's workers of Bharatkoop town was done. This study reveals that the dust generated from stone crushing activities contains excessive amount of respirable particulate matter which were twenty times more than the permissible limits. To contain the RSPM concentrations within an acceptable level, it will be controlled by sprinkling of water and plantation. There will be an insignificant impact on ambient environment and ecology due to the crushing activities. Workers of stone crusher should use safety equipments such as ear mufflers and mouth masks etc. It is suggested that massive green plantation must be taken up in the entire area because trees have high dust trapping efficiency.

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