International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 03 | Mar 2022 www.irjet.net p-ISSN: 2395-0072

Effect of Air Quality in vicinity of Stone crusher: A case study in Billaua Gwalior

Yogesh Jain[1], A. K. Saxena[2]

[1]*M.Tech Environmental Engg. Scholar Madhav Institute of Technology & Science Gwalior (M.P.)*
[2]*Associate Professor, Civil Department, Madhav Institute of Technology & Science Gwalior (M.P.)*

ABSTRACT - *The presence of harmful material in the air cause pollution in air. The source which cause air pollution such as emission of harmful gasses in the atmosphere from the automobiles, industries, crusher unit etc. These harmful material in the air polluted and makes it harmful for human being as well as it deteriorates the natural ecosystem. There are many sources of air pollutions and crushing unit are one of the major contributors in crushing air pollution by emitting large quantity of dust particle. A cluster of 47 stone crushing units placed in Billaua, in Gwalior, Madhya Pradesh state, India, is one of the main sources of high amount of dust generation in the vicinity of the crushers and in the communities residing near them. We use 8 sampling locations that were monitored regularly for particulate matter concentration (PM_{10}) the daily means ambient PM_{10} concentration ranged between 313.42 to 784.11 µg/m3 near the source of air pollution, while the average concentration varied from 31.38 to 115.88 µg/m3 in ambient air in vicinity. Concentrations of particulates found out exceeding the limits prescribed by in Indian National Standards for various locations. Health survey is accomplished by questioning the workers and local persons residing in the vicinity area.*

Key Words: Stone Crusher, PM_{10}, Control Measures, Air Quality, Health Survey.

INTRODUCTION

Considering the current scenario, it is apparent that many concrete productions are doing away with natural aggregates in favour of crushed sand, so to fulfil these demands, many crushing units running in India (comprehensive industry document on stone crusher). Stone crushers crush large size of stone from quarries in the 250 – 400 mm range into smaller sizes, usually 6,12, 25 mm. mining is one of the largest economic activities in many developing countries. Any mining operation, no matter how big or small, leaves behind enormous quantities of dust and other pollutants. Construction industry demand has led to a rapid growth in the mine and stone crushing industries in India. Considering future plan to develop infrastructure such as buildings, roads and canals that will help to enhance country's development. It is also expected to grow further. The number of stone crushing in India is estimated at around 12000, providing direct employment to about 500,000 rural migrant workers and unskilled laborers. However reliable statistics are lacking for this industry.

Fig -1: Stone crusher

Several of these crushing industries emit particulate matter $PM_{2.5}$ and PM_{10}, nitrogen oxides and sulphides that poses health hazards by impairing visibility and causing breathing difficulties. Lung cancer is caused by excessive exposure to workers in these crushing industries (Mathur and Choudhry 1996). To understand its bad effects on human health, we need to determine the size of those dust particles.

STUDY AREA

The experimental site was located in bilaua which is 25 km outskirt of Gwalior district to the southeast of Gwalior city. During the experiment, there were 47 crushing operating very closely together near the quarry side, with an average crushing capacity of 40 tons a day. The experimental site where the crushing units were running was major a source of high level of generation of dust in crusher's site as well as in the communities residing nearly. Network of Ambient quality consisting of 8 sampling sites (where high-volume sampler records the observation) were employed to continuously inspect the respirable particulate matter concentrations (PM_{10}). This area covers approximately six square kilometer for both quarrying and stone crushing operations. The residential areas which were populated locating near experimental sites were Bilaua Village with a population of around nearly 13000 people located in the east direction at 1000 m apart; Beragarh with a population of around 2500 people located northeast from crusher which is

3000 m apart; and Lakhanpura with a population of around 1500 people in the southwest at a distance of 1500 m from the boundary of stone crushing. Beragarh, Chiruli, Lakhanpura and Tekanpur are residential areas or preliminary locations within the impact of crushing. This area consists of primary schools, colleges and hospitals to provide basic facilities to these community areas.

FIELD VISITS AND QUESTIONNAIRE SURVEY

A random sampling technique was used for the collection of data in this study with a sample size of 100 workers. The concept of simple random sampling states that all object have an equal chance of being chosen. Our data was collected from small and large size of stone crushing unit across the market. The questionnaire consists of the following sections;

Demographic information: Age, gender, marital status, qualifications, number of family members, etc. were part of this survey.

Sr. No.	Demographic information	Classes	People (%)
1.	**Age group**	15-30 31-45 >45	28 49 23
2.	**Marital status**	Single Married	13 87
3.	**Qualification**	Illiterate Primary Matric Intermediate	39 31 21 09
4.	**Family size (Member per family)**	≤ 4 5 6 7 ≥8	11 16 30 14 29

Table-1 demographic information

Health effects of industry: according to questionnaire survey, it was noted that industrial pollution had various effect on laborers, as shown in fig-2, which discuss as the effect of the stone crushing industry on workers health. The problems which are common health problem among workers caused by crushing industry was Respiratory problems. Significant number of workers suffering from respiratory problems including asthma, cough, throat infection, chest pain, etc.

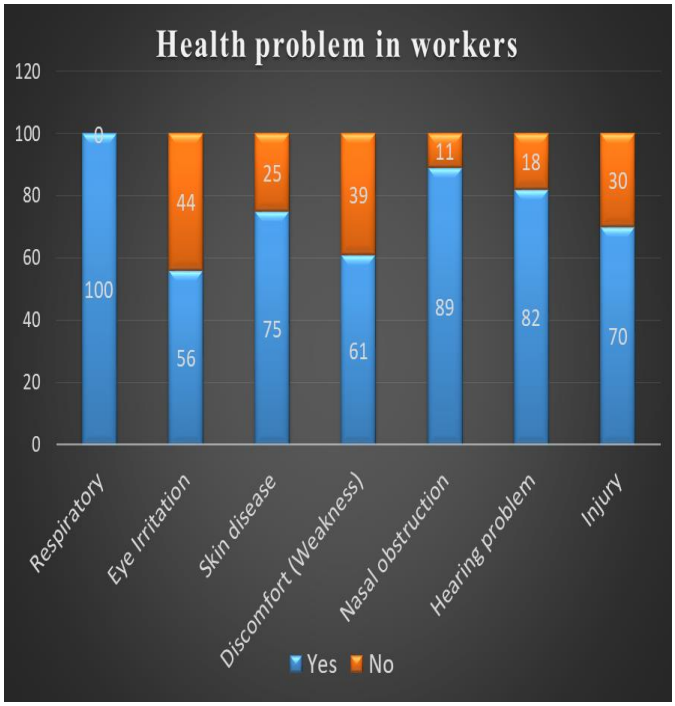

Fig-2: Health problems in workers caused by the stone crushing industry

Stone crushing industry workers were found to be have respiratory problems due to exposure to silica dust (Iftikhar et al., 2009). About 61% of workers complained of fatigue and weakness. The second most common health issue was a nasal problem, which 89% of people reported. There was also evidence that 75% of the workers had skin diseases. Eighty-two percent had hearing problem, which was caused by loud sound and have no cure. This condition is called tinnitus. About 70% (or 7 out of 10) of the targeted workers were injured because of accidents suffered while working in the stone crushing industry due to high noise levels generated by crushing machines, blasting and hammering. About 56% workers were suffering with eye irritation.

Management's vigilance: This included questions regarding what are the measures are taking by managements towards solving this problem due to this stone crushing dust. The result of the analysis says that 89% of the people being protected with personal protective equipment while 11% have denied ever receiving such from the management. The survey shows that 66% of the respondents are not using the protective equipment provided for them; thus, a low rate of 34% of respondents affirmed the use of protective equipment while risking their health. In the survey ,92 percent of the respondents responded "YES" when asked whether they received health education, and 55% said "NO" when asked whether they received pre-employment or frequent medical assistance , whether 45% respondents said they enjoy such services.

MATERIALS AND METHODS

AIR QUALITY MONITORING

Using high volume samplers operating at a flow rate of 1.1-1.3 m^3/min., dust was collected on whatman GF/A filter paper (size 25.4 cm × 20.32 cm) made of glass fiber. Rotameters (attached part of APM 410 samplers) were used to measure volumetric flow rate. We carried out dust monitoring by means of an ambient air quality monitoring network compressed of 8 sampling sites (figure-3). The location of sampling sites was determined by the weather, the number and spacing of stone crushing units, and the available crusher area.

Fig–3: Map showing locations of stone crushing units as well as monitoring stations for source/ambient air quality

Ambient air quality monitoring (AAQM) was carried out during month of July and August for 56 days on a 4 h basis (16 h in a day: 12 a.m.-4 a.m.; 6 a.m.-10 a.m.; 12 p.m.-4 p.m.; 6 p.m. -10 p.m.) And the concentrations were averaged for 24 h to compare the values with values in Indian standards. To measure long term effect of stone crushing industry on ambient air quality we have carried out test for 7 days at every station. The difference in weight of the filter paper between before and after the collection of sample was used to calculate dust concentration.

RESULT AND DISCUSSION

S. No.	Sampling Location	Distance (m)	PM_{10} (µg/m^3)		
			Min.	Max.	Avg.
(a)Source: Upwind					
1	Near Crusher 1	75	158.19	461.08	317.90
2	Near Crusher 2	50	149.02	432.22	299.81
(b)Source: Downwind					
3	Near Crusher 3	80	432.85	1351.6	847.12
4	Near Crusher 4	65	362.48	1208.9	861.98
(c)Residential: Upwind					
5	Lakhanpura	1190	24.55	44.913	34.230
(d)Residential: downwind					
6	Bilaua Village	653	57.78	220.97	135.52
7	Beragarh	913	65.98	124.35	98.01
(e) Non-residential: downwind					
8	Bilaua Tiraha	1415	41.38	109.50	72.81

Table-2 PM_{10} concentration from source & vicinity area

Following are the results of measuring PM_{10} concentrations in stone crushers. Among these crushing unit, the highest PM_{10} concentrations were found near Crusher 3 (1351.675 µg/m3) at night time (12 a.m. – 4 a.m.) as given in table-2. Because at this time maximum number of crusher are active and minimum concentration at this location is (432.856 µg/m3) at evening time (6 p.m. – 10 p.m.) because at this time crusher activity were stopped and only transport activity active. Average PM_{10} at this location was found to be 847.124 µg/m3. Among these crushing unit, the lowest PM_{10} concentration were found near Crusher-2 (149.024 µg/m^3) at evening time (6 p.m. – 10 p.m.) and this concentration occur due to movement of vehicle and other activity like filling of aggregate etc. At this time crushers were not working. In vicinity residential area highest concentration of PM10 found at Bilaua village (220.972 µg/m^3) and average (135.527 µg/m^3) which exceeds permissible value given by CPCB norms. The average concentration of PM10 at Lakhanpura which situated at upwind side area was 34.230 µg/m^3 which also show natural air quality not affected by stone crushing industry.

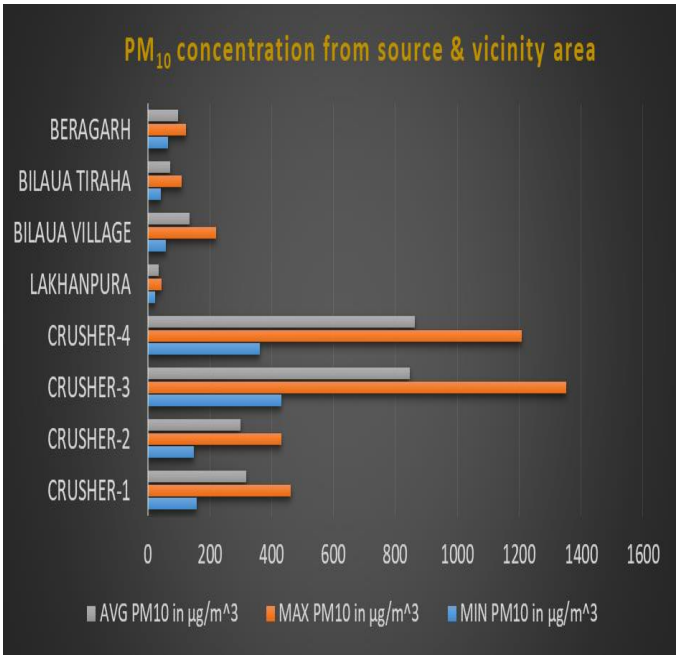

Fig-4 PM_{10} concentration from source & vicinity area

CONCLUSION

Owners and workers of the crushing unit do not follow the proper safety measures and prevent work which can prevent the movement of dust particles. Their crushing site is not being wetted before work begins and the crushed aggregates are also being dropped at an elevation greater than 3m, which is against CPCB regulations. The dust produced by stone crushing is hazardous to health since it contains particulate matters. In addition to respiratory infection, skin diseases, hearing loss gastrointestinal problems, and eye defects, dust particles caused a lot of discomfort to man when consumed, absorbed or inhaled. Among the environmental pollutants, stone crushing dust is one of the most harmful. The discharging of stone crushing dust into environment can effect water supply, plants, and atmosphere soil and agricultural materials. Health training and enforcement of regulation should successfully be used to make certain that results and managed in the work environment.

SUGGESTION TO LOCAL ATHORITY

1. All CPCB norms for stone crushing industry should be followed and continuous monitoring whether norms follow done regularly and record of such monitoring should kept.
2. NGO local residents should be involved in spot checking.
3. The workers not using safety measures shall be identify and make aware about the harmful consequences.
4. The awareness program as nearby residential area shall be conducted regularly. NGO may be use such type of activity.
5. Regular medical camp shall be organised for early deduction of dust related diseases.
6. Working hour of labour shall be reduced to exposure.
7. Worker who are not following safety measure shall be black listed.
8. Regular checking of vehicles transporting material shall be done to check that whether the using tarpaulin cover.

REFERENCES

[1] R.Sivcoumar add ET all, "Particulate Matter from Stone Crusher Industry: Size Distribution and Health Effects." journal of Environmental Engineering, vol.132 (3), 2006.

[2] Y. Saini, N. Bhardwaj, R. Gautam, "Effect Of Marble Dust On Plants Around Vishwakarma Industrial Area (VKIA) In Jaipur, India", J Environ Biol., 32(2):209-12, 2011.

[3] G. S. Gupta, A. Gupta, M. K. Gupta, "Assessment Of Ambient Air Quality Of Stone Crusher Industries And Its Impacts On Human And Vegetation In And Around Bharatkoop Region, Chitrakoot (U.P.)", 3rd World Conference on Applied Sciences, Engineering & Technology, 27-29 September 2014.

[4] S. B. Sharma and B. Kumar, 'The Effect Of Stone Crushing Dust Pollution On The Growth Performance And Yield Status Of Gram", International Journal of Current Microbiology and Applied Sciences Vol 4 (3) pp. 971-979, 2015.

[5] R. Amitshreeya and R.B.Panda, "Dust Pollution In Stone Crusher Units In And Around Balasore, Orissa, INDIA", Jr. of Industrial Pollution Control 28(1), pp 41-44, 2012

[6] A.C. Chougule add et all, "Effect of Stone Crusher on Ambient Air Quality." journal of Environmental Engineering , vol. (4), July 2007

[7] Central Pollution Control Board (CPCB), (1984). "Dust pollution from stone crushers," PROBES/21/1983-84, New Delhi, India

[8] Central Pollution Control Board (CPCB), (2009). "National ambient air quality standards.

[9] M. N. Rao, H.V.N. Rao, "Air Pollution", Khanna Publishers.

[10] Central Pollution Control Board (CPCB), (1984). "Dust pollution from stone crushers," PROBES/21/1983-84, New Delhi, India.

[11] Central Pollution Control Board (CPCB), (1984). "Comprehensive Industry Document Stone Crushers ".

[12] Jay Singh Rajput, A. K. Saxena, U. P. Singh," Application of Mathematical Modelling for the Prediction of NOx Concentration due to Vehicular Emission and Model Performance in Gwalior City, (M.P.)".

[13] Aja, Josiah Nwadibia. and Chukwu, Emmanuella N.," Investigative Effect Of Stone Crushing Dust On The Health Of Workers Of Quarry Industry At Umuoghara Community Of Ezza-North Local Government In Ebonyi State".