INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 3)
Available online at: www.ijariit.com

Reduction of environmental pollution while stone crushing

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ABSTRACT

Stone crushing industry is an important industrial sector in the country engaged in producing crushed stones of various sizes depending upon the requirement which acts as raw material for various construction activities such as the construction of roads highways bridges buildings and canals etc. It is estimated that there are over 12000 stone crushing units in India. The number is expected to grow further keeping in view the future plans for the development of infrastructure for the overall development of the country. This industry is estimated to have an annual turnover of RS.5000 corers. Along with increasing economic benefits, there are some pollution problems that are increasing rapidly. These problems are causing very harmful effects on human health and the surrounding environment and thus needed to be controlled within time. Thus an overall assessment or analysis is performed here.

Keywords— *Stone crushing units, Pollution, Costs analysis, Control measures, Health effects, Environmental effects*

1. INTRODUCTION

Stone crushers are very useful for the construction industry but there is no denying that it adds to various problems such as additional costs and various environmental and health problems. We will first understand the working of the stone crushers and then we will identify the cause of the problems and provide the solution according to the economics of the industry. We will also try to perform the cost analysis that is required in terms of additional costs to apply the control measures that are required to minimize or reduce the effects of the stone crushers. Then we will compare the stone crushing units in India too with that of the developed countries and then we will find the problems that occur in their application in our country. We also did a detailed study of the crushing industry.

According to the; International Journal of environment and pollution research, central environmental authority, Baththaramulla, Srilanka and, the centre of environmental studies and sustainable development, they suggest that" Dust control measures are not significant enough recommend." This is the limitation of the study. We are going to perform the cost analysis of the initial investment of the plant and the additional costs required for the implementation of the control measures as they are necessary. In the process, we found that the implementation of the measures was not only affected by the extra costs but also due to the local problems prevailing in any area.

2. OBJECTIVES OF PROJECT

The project was undertaken with the following objectives:

- Identify the environmental problems for stone crushing industries
- Review the Pollution Prevention policies Control standards for Stone Crushers
- Enlist the problems according to their sources of generations
- Control the emission of air pollutant by improving the mining activity
- Provide the possible solution to the transportation of material Evolving improved advanced design
- Implementation of advanced techniques and methods to reduce pollution during crushing operation
- To prepare a Comprehensive Industry Document for Stone Crushers.

3. REVIEW OF LITERATURE

A. C. Choghule, P. A. Choughule, C. K. Kumbhoj have presented a paper on Effects of stone crushers on Ambient Air Quality in International Research Journal OF Engineering and Technology and they suggest that As there increase in demand of construction material there is highly increment in use of coarse and fine aggregates. The coarse aggregates and artificial fine aggregates are crushed in stone crusher. Stone crusher creates a lot of noise and it emits dust particles in the environment. Because of more concentration of dust particles in the environment (air), it creates pollution. This pollution creates diseases in human and animal's life like asthma, skin diseases, eye irritation etc. and its effects on vegetation. Measurements of different air quality parameters were carried out at Jaysingpur stone crusher site and analysis was done on the basis of the central pollution control board (CPCB). Control measures:

(a) Construction of wind breaking walls by using cloth curtains around premises.
(b) To reduce the drop height of dusty material.
(c) Construction of paved road within the premises.
(d) Provide dust masks & ear plugs to the workers.
(e) Fine dust powder in the crushing area should be periodically removed.
(f) Provide green belt over the premises (Rigorous plantation thought the border of premise).

R. Simacouver, R. Jayabalou, S. Swarnalatha and K. Balakrishnan presented a paper on Particulate Matter From Stone Crushing Industry in Journal of Environmental Engineering it suggests that, A cluster of 50 stone crushing units located at Pammal, in suburban Chennai, the capital of Tamil Nadu State, India, is a source of high levels of dust generation in the vicinity of the crushers and in the communities surrounding them. Ambient air quality network consisting of 26 sampling locations were operated to continuously monitor the total and respirable particulate matter concentrations TSP and PM10. The daily average ambient concentrations of TSP and PM10 varied from 342 to 2,470 and 90 to 1,200 g/m3, respectively, near the source, while the average concentrations varied from 86 to 257 and 39 to 138 g/m3 in ambient air. The average PM2.5 concentration varied from 41 to 388 g/m3 at the source, whereas the concentration varied from 17 to 48 g/m3 in ambient air. Personal samplers were also employed to quantify the TSP and RPM in the work environment and they varied from 22.5 to 80.5 and 13.5 to 53.7 mg/m3, respectively. Control Measures- Emissions from stone processing are considered to be fugitive when the sources are not vented to a baghouse or contained in an enclosure with a forced air vent or stack Hesketh and Shobokshy 1985. Water sprinkling at dust discharge points wets the dust particles and augments settling. The other control measures for reducing dust emission should include the following good housekeeping practices

(a) All SCUs should conform to the design developed and demonstrated by the National Productivity Council of India NPC 1995.
(b) Covering open operations to prevent dust entrainment by the wind.
(c) Construction of wind breaking walls.
(d) To reduce the drop height of dusty material.
(e) Regular cleaning and wetting of the ground within the premises.
(f) Establishment of a green belt along the periphery of the crushing area and roads to arrest the spread of particulate matter arising from vehicular movement inside the area.

Shashi Bhushan Sharma and baidyanath Kumar have presented a paper on stone crushers and they suggest that There are over 12000 stone crusher units operating in India (Patil, 2001). Clusters of stone crushing and sizing units are located at Pakur district, Jharkhand. The stone crushing industry and the associated traffic in this area generate a number of air pollutants which exceed the air quality standards, particularly during day time. The stone crushing industry at Pakur District includes two main operations: quarrying or mining operations and crushing operations. But, there is a lack of environmental governance in both quarries and the crushers which have resulted in considerable degradation of the environment surrounding the locations where the stone crushing industry is established (ES, 1998).

The suspended particulate matter (SPM) released due to stone crushing, remain in the air for varying length of time. Those larger than 10µm in size settle under the force of gravity on the vegetations and soil but the smaller ones remain suspended in the air for longer periods of time, get dispersed and diffused by wind, and eventually deposited on various surfaces including foliar ones (Rao, 1971; Rao, 1985). Control Measures- Patna is the capital of Indian state Bihar. Its total area is approximately 3202 km² and is situated at altitude 53m, 25°36′40″North latitude, 85°08′38″East longitudes. The climate is generally dry and humid with four distinct seasons, viz. summer, rainy, winter and spring. The maximum and minimum temperatures recorded during summer and winters respectively are 42°C and 50°C. The annual rainfall is about 1450mm and the maximum relative humidity is 90% during the rainy season. The present work was carried out in the Biochemistry research laboratory, Dept. of Biotechnology, College of Commerce, Patna from November 2014 to December 2014 and infield from October 2015 to January 2016**. Control Measures:**

(a) The area where pulses crops are being grown.
(b) The area where cereal crops are being grown.
(c) The area where both cereal and pulses crops are being grown.
(d) The area where vegetable crops are being grown.
(e) The area where oil-yielding crops are being grown

4. METHODOLOGY

A basic field survey was conducted to obtain firsthand information and an overall situation of this area. Measurements were done in the selected locations. The distances from the factory and the availability of secondary data of the locations were considered in selecting measuring points.

(a) Noise levels were measured while metal crushers were being operated. Residual noise levels were measured when the metal crushers were not in the operation by using a Rion Integrated Sound Level Meter.

(b) The study of conventional types and sizes of different stone crushers was conducted and the overview of environmental impacts of the crushing operations was studied in details.
(c) The adoption of innovation and recent technologies in stone crushing industry by the developed countries were analyzed and proposed to be implemented in our country also to prevent environmental hazards.
(d) The hindrance in the implementation of advanced technologies in stone crushing industries due to local environmental laws and guidelines were studied.

5. OBSERVATIONS AND RESULTS

We visited two sites of the stone crushing unit at Yewalewadi in Kondhwa region in Pune named "Aniket Stone Metal Company" and "Tanuj Stone Crusher" and the former provided us with the information of their pollution and it is as follows:

Table 1: Results of air pollution

S. no	TSPM	RSPM	SO_2	NO_2
1	471.69	122.64	10.88	8.90
2	416.66	324.07	9.86	9.10
3	739.27	435.64	8.16	9.40
4	694.44	521.24	5.95	10.20
5	555.55	243.18	11.56	12.00
6	537.05	342.59	14.45	15.20
7	1928.10	1663.39	7.82	6.10
8	2165.12	1987.65	6.63	7.40
9	2152.24	1968	1.03	8.90
10	1176.66	943	15.98	13.25

Table 2: Measurement of noise level

S. no	Daytime	Night time
1	58	25
2	56	28
3	62	35
4	65	29
5	75	30
6	67	24
7	70	39
8	73	19
9	70	34
10	68	36

5.1 Project Pictures (Site Visit)

Fig. 1: Site 1

Fig. 2: Conveyor Belt

Fig. 3: Site 2

As we visited the site we came to know as a result that due to the extra investment needed most of the control measures were not implemented and most of the labour was unskilled and lacked technical knowledge so we did an analysis to minimize cost and pollution.

Table 3: National Ambient Air Quality Air Standards

S. no.	Time-weighted average	Concentrated ambient air for residential and rural area	Concentrated ambient air for ecological and sensitive areas	Pollutants
1	Annual 24 hrs	50 80	20 80	SO_2
2	Annual 24 hrs	40 80	30 80	NO_2
3	Annual 24 hrs	60 100	60 100	RSPM
4	Annual 24 hrs	70 100	40 100	TSPM

Table 4: National Ambient Air Quality Standards With Respect To Noise

S. no.	Zones	Day time	Night time
1	Industrial	75	70
2	Commercial	65	55
3	Residential	55	45
4	Silence	50	40

6. CONCLUSION

The dust generated from stone crushing activities contains a significant amount of fine inhalable matter. The effect of fine particulate matter can be disproportionately large even though it constitutes only a small fraction of total suspended particulate matter. The presence of a high percentage of silica in the dust and the particle size distribution further such as that the occupational environment of the workers and surrounding areas may be hazardous the human health. Air quality and health survey conducted at the site indicate that the observed dust may be producing significant damage to respiratory health. The study through a combination of extensive air quality assessment and a need for a comprehensive occupational and environmental health management strategy for this type of essential small scale industries.

The associated processes of aggregate manufacturing like mining work, aggregate blasting, cutting, hauling processing and transport of aggregate are the main cause of dust pollution. The dry climate, lack of plantation and strong winds favour the formation of dust as observed during recent years. The aggregate production rate is also high which adds a large amount of dust matter in an open environment. It causes air pollution, water hardness indirectly affects on human health.

Some of the local problems faced in the implementation of control measures are: huge investment cost, a huge quantity of water is used, lack of knowledge to the handlers of stone crushers and financial constraints

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