REPORT

STATUS OF STONE CRUSHERS IN PUNE, MAHARASHTRA

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Chapter 1. Introduction

Background

India faces huge challenges due to an escalating population, rapid industrialization and uneven urbanization. While general pollution issues have increased manifold, in this report we will deal with air pollution issues specifically.

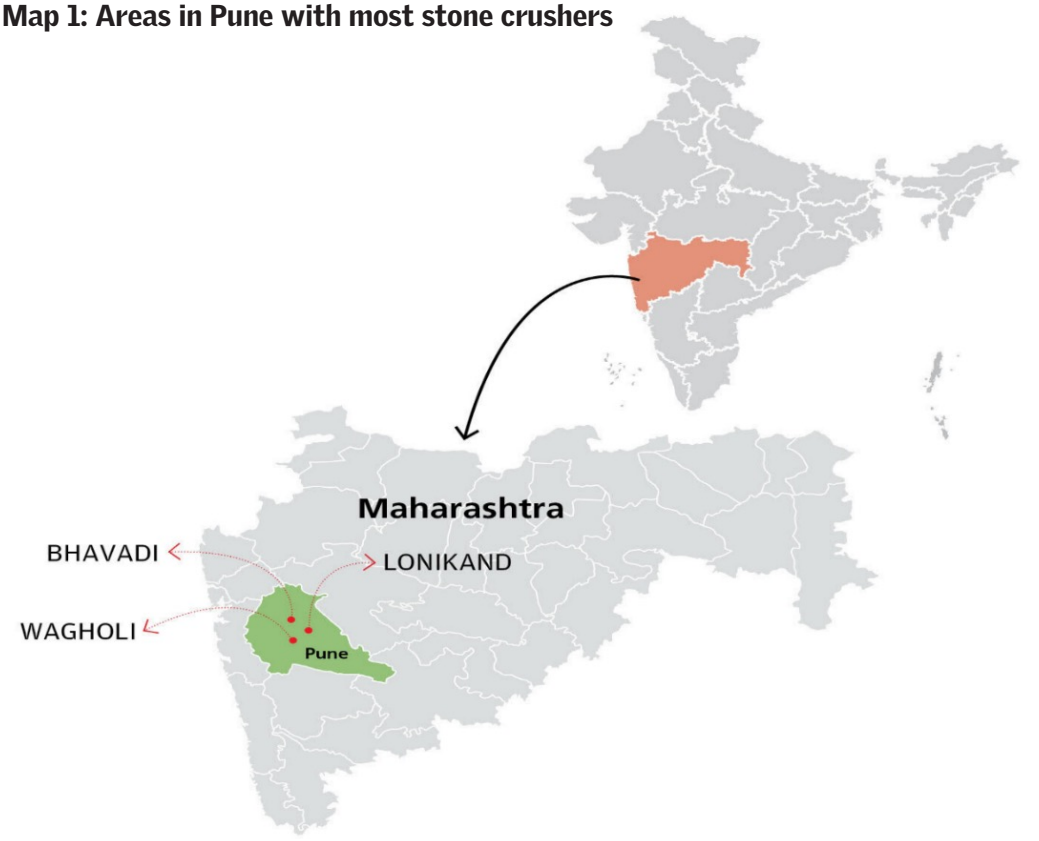
To solve the problem of severe air pollution plaguing many parts of India, the Government of India (GOI) launched a long-term, time-bound, strategic programme, known as the National Clean Air Programme (NCAP), in the year 2019. The programme aims to reduce the amount of $PM_{2.5}$ and PM_{10} in cities by 20 to 30 per cent by the year 2024.

Under NCAP, the Central Pollution Control Board (CPCB) identified 122 cities (initially there were 102 cities, and 20 cities were added later on), on the basis of air quality data obtained between the years 2011–15. These were non-attainment cities which exceeded the permissible national ambient air quality standards.[1] In addition to this, ten more cities with populations of more than 1 million were added to the list. So, in total, there are now 132 cities that are covered under NCAP. All these cities were directed to devise Clean Air Action Plans in consultation with their respective state pollution control boards (SPCBs) and the Central Pollution Control Board (CPCB).

Maharashtra is the state with the highest number of non-attainment cities (18). Pune is the second largest city after Mumbai in Maharashtra. Over the years, pollution in Pune has shot up and the city has entered the spotlight. The primary cause of air pollution in the city is its rapid expansion and the secondary contributors are dust emissions from activities such as mineral grinding, construction and stone quarrying.[2]

Stone-crushing industries are highly polluting and generate a huge amount of fugitive emissions. The majority of stone crushers in Pune district are located in Wagholi, Lonikand, and Bhavadi villages of Haveli Taluka. The action plans prepared for non-attainment cities focus only on control measures for stack emissions while entirely overlooking fugitive emissions. While stack emissions are considered major contributors to industrial air pollution, fugitive emissions also play a crucial role in the ambient air pollution of an area and hence need immediate attention.

Map 1: Areas in Pune with most stone crushers



These stone crushers in Pune have been in the public eye because of the various cases filed against them in the National Green Tribunal (NGT) for flouting environmental norms and causing air pollution. Although considered small-scale, this sector is in the limelight for causing vast quantities of air pollution, causing severe discomfort to the residents in their vicinity and degrading the environment. NGT has pulled up the crushing industries in Pune from time to time by sending closure notices, cutting down the electricity supply and imposing penalties.

In one of the cases, NGT asked CPCB and Maharashtra Pollution Control Board (MPCB) to form a joint committee and carry out a cumulative impact and ambient air quality assessment study in Wagholi, Londikand and Bhavadi.

The issues of stone crushing have also been reported multiple times in the media and several orders have been passed against stone crushers by NGT (see *Figure 1: Media reports on stone crushers and air quality in Pune*). The potential sources of fugitive emissions in stone crushing units are blasting of stones from quarries, transportation of material through trucks on unmetalled roads, unloading of

Figure 1: Media reports on stone crushers and air quality in Pune

Stone-crushing units, vehicles 'worsen' air in Pune's fringes

NEHA MADAAN / TNN / Updated: Mar 23, 2017, 13:18 IST

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Pune: Air pollution in the city's fringe areas is possibly taking a turn for the worse because of the prevalence of stone crushing units and heavy traffic movement on poor quality roads.

Pune: Final decision on Wagholi stone crushers likely this week

The affidavit has put the onus on the unit operators of the 107 stone quarries of villages Wagholi, Bhavadi, Lonikand and Perne.

Written by Nisha Nambiar

Pune | Updated: October 17, 2016 12:06:53 am

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Pune: Maharashtra Pollution Control Board's (MPCB) decision to shut 106 stone crushing plants located on city's fringe areas is expected to bring relief to Wagholi residents, who had for long been battling clouds of dust engulfing area.

There is relief for residents living in and around Wagholi area who had been battling against clouds of dust rising from stone crushing activity. Maharashtra Pollution Control Board (MPCB) has shut down 106 stone crushers located on city's east fringes for violating various environmental norms.

Pollutants released from Maha stone crushing units 100 times the safe limit

Mumbai News

Published on Jan 05, 2017 11:57 AM IST

All the 47 stone crushing units at Haveli taluka of Pune district, responsible for maximum supply of crushed sand and stone dust to Maharashtra and parts of Gujarat are flouting pollution norms, found central and state pollution control boards...

Maharashtra: SEIAA says no to new stone quarries, cite NGT rules

The SEIAA took note of this observation and has decided not to give permission for any site.

By: Express News Service

April 15, 2016 6:30:45 am

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The State Environmental Impact Assessment Authority (SEIAA) is clear that they would not give any clearance for any stone quarry in the district. According to the SEIAA, it has stopped issuing any clearance for the stone-crushing units in the district.

"After the NGT had stated that there would not be any stone-crushing unit operating, the SEIAA too has decided not to give any permission," said a member.

LIVE BLOG

Three places in Pune report 'poor' air quality

Pune News

Published on Nov 06, 2022 11:38 PM IST

Out of 10 places in Pune, three have reported 'poor' air quality as of Sunday evening and four are in the 'moderate' air quality index (AQI), according to the System of Air Quality and Weather Forecasting And Research (SAFAR) observations

raw materials, the processing of raw materials and storing of raw materials and finished products in open space.

CSE decided to conduct a detailed study on stone crushers in Pune, especially in Wagholi and Lonikand, to judge their environmental performance as well as the status of implementation of the recommendations given by the joint committee of CPCB and MPCB for stone-crushing units. Since the sector will always be in demand considering the growth of the cities, the operational practices of the sector need to be strengthened and the state board guidelines should be strictly implemented on the field.

NGT case against the stone crushers in Pune

Stone crushers are a small-scale industry which have been in the spotlight over the years as there has been a regular flow of NGT orders which highlight the illegality and non-compliance of various units. Time and again, NGT had to intervene in and ask the state pollution control boards to form joint committees and carry out ambient air quality monitoring studies to prepare adequate remedial plans for at-risk areas.

It could be observed from the different court proceedings that state pollution control boards are good at drawing up consent conditions but weak at ensuring their proper implementation. This is clear from the grievances in court against illegal stone crushers that are not following the guidelines and causing massive air pollution.

Making sure that this sector complies with environmental standards has always been a major challenge. The issue of environmental damage by stone crushers is not limited to Pune city but extends all over the country. With such high impacts, this industry cannot be allowed to operate in the current fashion under the pretext of being a small-scale sector. If the crushers continue to operate as they currently do, they will have deadly consequences on human health and the environment.

Despite the guidelines in place for the stone-crushing sector, various petitioners have filed complaints with the NGT for illegal operations, infringement of environmental norms, and complete disregard for siting guidelines by the project proponent. Taking note of the pollution and understanding the gravity of the situation, NGT said that the *"Right of citizens to breathe fresh air cannot be denied and the right of operating stone crushers cannot get preference over and above the right to life".*[3]

From the NGT case discussed below, it can be inferred that despite the pollution caused and flouting of environmental norms by the stone-crushing units in Pune, MPCB's behaviour towards them was found to be reluctant.

NGT order regarding the closure of quarries and stone crushers in Pune, Maharashtra, 7 April 2016[4]: The complaint was filed in the NGT regarding the massive air pollution caused by the stone crusher units in Wagholi, Bhavadi, Perene and Lonikand villages of Haveli Taluka in the Pune district.

The NGT asked for a complete list of stone crushers and quarries operating in the above villages, along with the particulars of their consent to operate. In the affidavit filed by the Sub-Regional Officer (SRO), Pune, the list of 165 stone crushers was given, but it did not give the correct number of all the stone crushers being run in all the villages.

The affidavit filed by MPCB mentions that stone crushers are causing severe damage to the environment resulting in an adverse impact on health and consequently resulting in degraded living conditions in the area, but no strict action was taken by the MPCB.

NGT was unsatisfied with this behaviour of the MPCB and issued a show cause notice to the state board, asking it to explain reasons why no stringent action was taken against the polluting stone crushers. After the show cause notice issued by the NGT, MPCB issued a closure notice to 88 out of the existing 165 stone crushers. It has also given direction to the executive engineers of the electricity board to disconnect the electricity supply.

The NGT asked the Regional Officer, Pune, to refile the affidavit and list out the stone crushers being run in all the villages, and mention the date from which they were running, whether consent has been granted to them, if not, whether they have applied for consent, etc., and the nature of pollution caused.

The tribunal censured the MPCB and said that simply passing closure orders or disconnecting electricity will not be enough. The board should ensure the implementation of the closure orders as well. The tribunal was disappointed by the Joint Director (MPCB) allowing certain non-complying stone-crushing units to run, thus ignoring the tribunal's order.

Later on, MPCB issued an unconditional apology to the tribunal and filed an affidavit dated 22 March 2016, listing the status of all 165 stone crusher units.

Formulation of a joint committee by the NGT

To confirm that polluting stone crushing units were shut down in Pune, the NGT Pune Bench order dated 26 September 2016 directed the MPCB to conduct joint monitoring of 56 stone crushing units with CPCB and submit the cumulative impact assessment report. The NGT also directed the committee to carry out ambient air quality monitoring in the nearby areas where stone crushers are located and identify the possible sources of pollution.

Findings of the joint committee of CPCB and MPCB

1. There was no water sprinkling taking place through sprinklers and foggers on the road during the survey conducted by the joint committee.

2. Out of 56 units visited, seven were closed and one was not operational. Out of the operating 48 units, five did not have valid Consent to Operate (CTO) forms from the MPCB.

3. The wind-breaking walls provided by most of the units were inadequate in terms of direction, spacing, as well as height.

4. The material from the conveyor belt is transferred at a height higher than the height of the wind-breaking wall in most of the units.

5. Material transfer points are not equipped with a chute system to discharge material at a height lower than the height of the wind-breaking wall in most of the units.

6. Gaps were seen between the adjacent tin sheets used for breaking walls as well as at the bottom of the sheets.

7. The extent of pucca roads is hardly up to a few meters from the main gate in many units. Pucca roads are not visible or identifiable because of the deposition of mud.

8. Scanty plantation was observed along the periphery of many units. Only a few units have a proper green belt with dense coverage on certain sides.

9. Conveyor belt enclosures were not found satisfactory in most of the units and conveyor belts were only partially covered. Some units have used green synthetic clothes for covering openings on conveyor belts.

10. At a distance of between 3–10 m from any process equipment, the value of the suspended particulate matter (SPM) should be around 600 μg/m^3. None of the monitored units were found to be compliant with this standard. The monitored concentration of SPM varied from 770 (minimum) to 56,617 μg/m^3 (maximum).

11. Most of the units were not maintaining records about material received, production, usage of power and water, green belt development, etc.

Results of ambient air quality monitoring done by the joint committee

The joint committee selected ambient air quality monitoring stations at Wagholi, Bhavadi and Lonikand because these areas have stone quarries and crushers with human settlements in the neighbourhood.

During the study, the ambient air quality was monitored continuously for 24 hours, during the operational as well as non-operational periods of stone crushers.

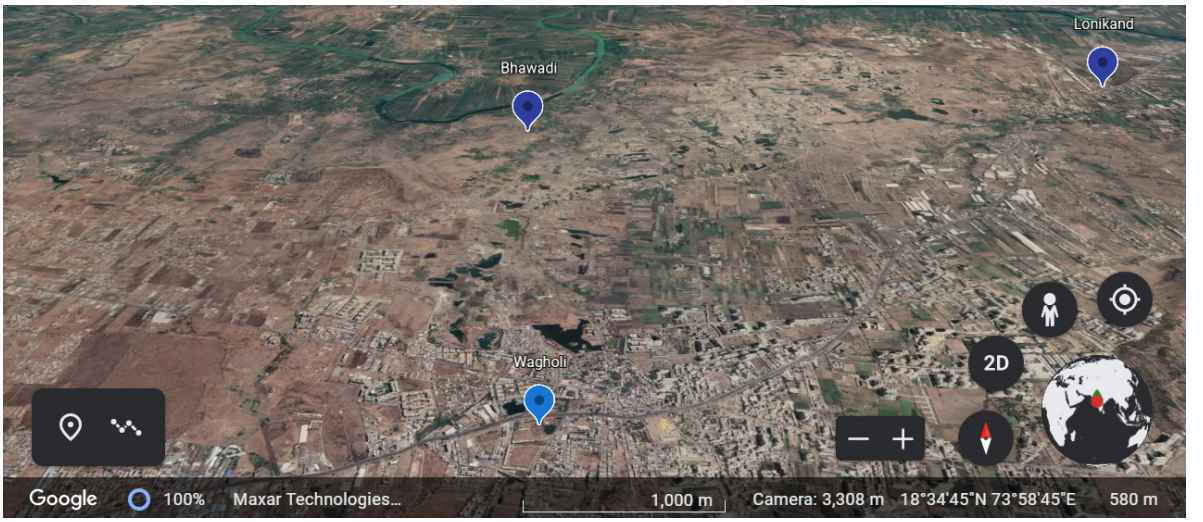
The ambient air quality in Wagholi, Bhavadi and Lonikand has completely deteriorated. At all five monitoring locations, the level of PM_{10} and $PM_{2.5}$ has exceeded the permissible limit both on working as well as non-working days (see *Table 1: Ambient air quality at Wagholi, Bhavadi and Lonikand*).

Wagholi, Lonikand, and Bhavadi villages have urban settlements around them in close proximity, and most of the stone-crushing units and quarries are scattered in these areas (see *Map 2: Google Earth image of Wagholi, Bhavadi and Lonikand*). The dust from the stone crushers and quarries is carried away by the winds to the nearby areas and affects the ambient air quality there.

Table 1: Ambient air quality at Wagholi, Bhavadi and Lonikand

Location	Working days		Non-working days	
	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)
Location 1	227	65	178	131
Location 2	225	212	324	77
Location 3	213	403	153	126
Location 4	136	133	115	108
Location 5	220	112	222	74
Standard (μg/m^3)	100	60	100	60

Map 2: Google Earth image of Wagholi, Bhavadi and Lonikand



Recommendations by the joint committee

After monitoring 56 stone crushing units, the joint committee gave phase-wise recommendations with the broader aim of improving the environmental management of stone crushing units and the air quality of the surrounding areas. The committee also mentioned that these recommendations should be technically observed and applied to all the stone crusher units of the state.

Table 2: Joint committee recommendations for stone crushers

Consent management	1. Stone-crushing units should maintain and keep a copy of the consent issued by MPCB within their premises for reference at all times. 2. A uniform approach and terminology for product types should be adopted (say 20 mm, 10 mm, 5 mm, etc.), and their respective production capacities should be mentioned (either on a per month, per annum or per day basis). 3. The condition of the standard permissible limit of 600 µg/m^3 for SPM measured between 3–10 m from any process equipment of the stone crushing unit is required to be incorporated in all consent forms. 4. Actual consumption of water for sprinkling/fogging/wetting and green belt development is required to be incorporated in the consent forms.

Dust suppression and sprinkling arrangements for stored materials	1. Silos for all materials should be fabricated along with a telescopic chute arrangement at the conveyor belt node. 2. Crushed sand should be stored in the silos and a proper mechanical chute should be installed. 3. The height of finished goods should be kept lower than the height of wind-breaking walls. 4. Proper sprinkling arrangement should be provided all around the material heaps. The sprinkling system should have full operational control of location-wise installed sprinklers and separate records should be maintained in this respect for optimal usage of water.
Wind-breaking wall	1. Wind-breaking wall should be higher than the free fall height of finished good discharge from the conveyor belt nodes if an adequate arrangement of the chute has not been made to discharge the material at a lower height from the conveyor. However, adequate water sprinkling is required in both cases. 2. No gaps should exist in between and at the bottom of the wind-breaking walls. Strong structural base and framing should be provided for the wind-breaking wall to withstand strong wind conditions.
Internal pucca roads and road cleaning mechanisms/arrangements	1. Units should have pucca roads for all the stretches in the premises where regular movement of vehicles is desired. The cleaning mechanism of the internal road should be such that the blacktop or concrete top of the road is recognizable. 2. Arrangements should be made for water spraying and wetting of ground on the premises. A scientifically designed water sprinkling system needs to be incorporated with full operational control for effective dust suppression by utilizing an optimum quantity of water. 3. Excessive usage of water and marshy conditions should be avoided by the units.
Green belt development	1. A green belt should be developed with a scientific approach with respect to the selection of species, spacing, location, direction and numbers. 2. The green belt should be developed by units with an adequate number of rows on the periphery, keeping the sole objective of a green belt in mind for stone crushers in particular.

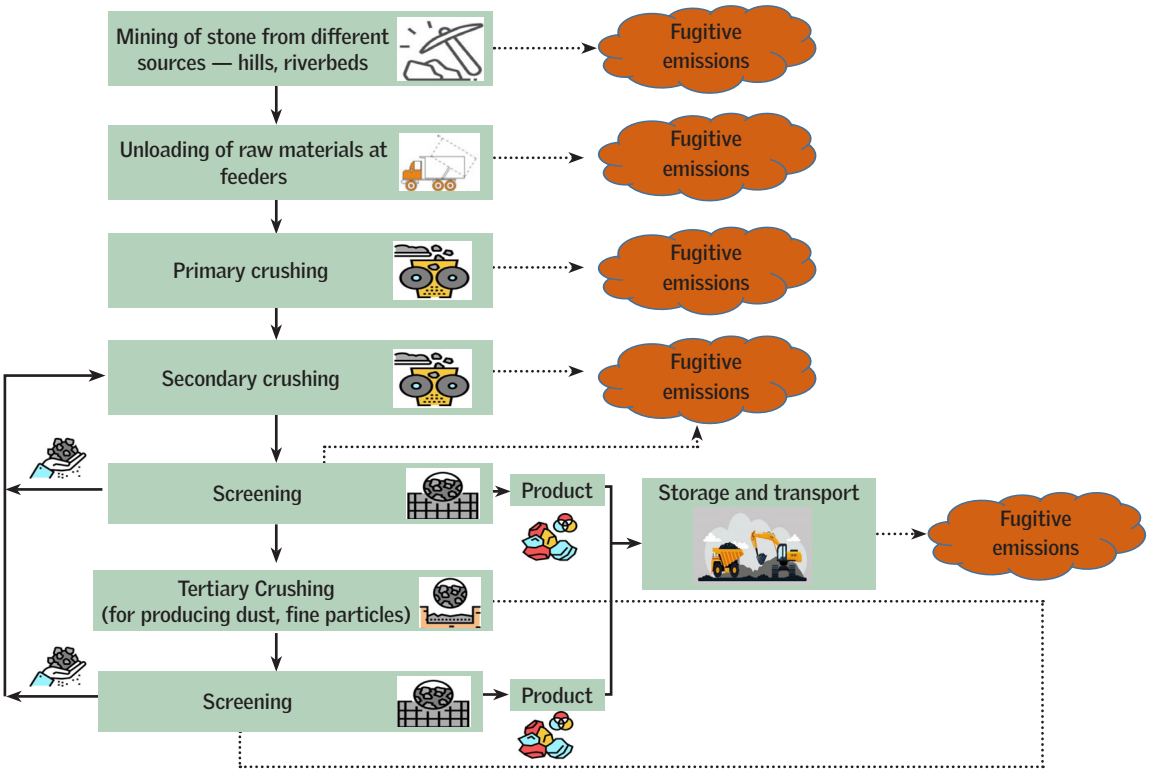
Dust suppression and water sprinkling arrangement at the crushing system	1. All the hoppers should be properly enclosed from three sides and the roof should be provided along with a water sprinkling arrangement. 2. All the crushing and sieving (screens) equipment should be fully enclosed with proper door arrangements and an approach ladder. Scientifically designed sprinklers should be provided all along the containment enclosure. 3. The vibrating screen should be properly and completely enclosed except for the conveyor belt opening. The conveyor belt opening should be provided with a rubber flap. The water sprinkling system should have pipes that can withstand fixed pressure. A pressure measurement system with full operational control is also required. 4. The sprinkler and fogger network should be scientifically designed for the crushing system for optimal usage of water. The dust should be consolidated at the nearest possible point of source and fogging or sprinkling system should be installed accordingly.
Enclosures for conveyor belts	1. All the conveyor belts should be covered from node-to-node adequately, without side gaps in the enclosure and belts. 2. Adequate rubber flap or fogger/sprinkler arrangement should be made at the nodes of the conveyor belts to suppress the dust emission from the material transfer.
Fugitive emissions and compliance with work zone ambient air quality	1. All units are required to take necessary measures for control of suspended particulate matter in the work zone. 2. All workers should be provided with adequate personal protective equipment (PPE) while on the job.
Management of ambient air quality in residential areas	1. Concerned local authorities are required to make necessary fund allocations and develop pucca roads in these areas to minimize dust pollution. 2. All the trucks and dumpers carrying crushed stones, sand and other building material from the area should have a proper cover so that fugitive dust from loaded material can be entrapped at the source itself. 3. Local authorities should also take suitable measures to develop a regular road cleaning mechanism. Regular wetting of roads may be considered a temporary measure to improve the air quality. 4. Awareness programs for stone crusher units, transporters, drivers and local stakeholders may be arranged from time to time.

Chapter 2. Stone crushers: Manufacturing process and sources of emissions

The stone-crushing industry is a vital sector in the country which provides raw materials for construction activities (houses, buildings, bridges, canals, dams, etc.). The major process in stone crusher units remains the same, with variations in the number of crushing and screening steps depending on the size of the unit and the requirement of the final product.

The products from these units generally include fine dust and stones of sizes 6 mm, 10 mm, 20 mm and 40 mm. A different size of stone can also be produced as per the demand by changing only the size of the screen mesh. Fugitive emissions are generated from different processes in a stone-crushing industry (see *Figure 2: Manufacturing process and sources of emissions).*

Figure 2: Manufacturing process and sources of emissions



i. **Mining of stone:** Mining is the initial step to get the raw material from different sources like local hillocks, open-cast mines, riverbeds, cliffs and other miscellaneous sources. Usually, small-sized stone crushers source their raw materials from local hillocks, riverbeds or from mine owners in the vicinity, while medium- and large-sized units source their raw materials from leased or owned open-cast mines. During stone mining at quarries, a huge amount of fugitive emission is generated and clouds of dust can be seen.

Image 1: Stone mining

ii. **Transportation of raw materials:** Mined stones from various sources are transported to stone-crushing units via trucks, trailers and automatic dumpers. While transporting raw materials to the crushing sites, these vehicles generate a huge amount of dust emissions because the roads are mostly unmetalled and uncemented.

Image 2: Raw materials transported in trucks

2a. Trucks carrying material to crushers

2b. Trucks creating fugitive emissions

iii. **Unloading of raw materials at feeders:** Raw material is transported to stone crushers through various vehicles, most of which have hydraulically operated tilting arrangements for easy and quick unloading of stones at the crusher sites. The unloading of raw materials is done at feeders or hoppers. In the course of unloading raw materials at hoppers or feeders, dust emissions are generated.

Image 3: Unloading of raw material into feeders

3a. Trucks unloading the raw material

3b. Unloading of material through trucks in feeders

iv. **Primary crushing:** Size reduction is done in the process of primary crushing. Large stones and boulders are crushed into stones of 100–140 mm. Crushed stones are conveyed to stockpiles to further transfer them to secondary crushers via conveyor belts. During primary crushing, the finer dust particles enter the air and escape as fugitive emissions.

Image 4: Primary crushing and emissions released from it

v. **Secondary crushing:** After primary crushing, stones are further crushed to sizes ranging from as large as 40–60 mm to 10 mm or even smaller. Stone-crushing units use different types of crushers for secondary crushing. The granulator is most commonly used in non-engineered units (with basic design) while engineered units use a cone crusher for this process. A lot of fugitive emissions are generated during secondary crushing as well.

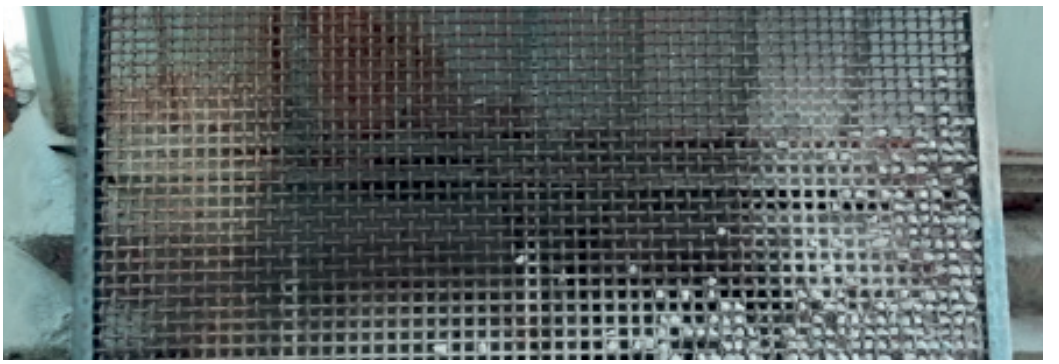
Image 5: Secondary crushing section

5a. Emissions at secondary crushing

5b. Cone crusher for secondary crushing

vi. **Screening:** Screening is the process of separating groups of products of various sizes through several screens of different mesh sizes which are aligned one below the other and each screen is connected to a separate conveyor belt to discharge products of different sizes. The size of the screen mesh depends on the size of the final product required.

Image 6: Screen in a stone crusher unit



The screening process is the source of the highest fugitive dust emissions. As the material from secondary crushers is conveyed to the screens, the screen vibrates and thus separates the material into different categories. This vibratory action causes large amounts of fugitive dust accompanied by a high degree of noise. Shed and water sprinklers are made available to combat dust but sprinklers are not operated frequently. A few units have adopted the practice of complete shed coverage for the process.

Image 7: Screening area covered with sheds, sprinklers not working

vii. Tertiary crushing: After the first round of screening, stones are ground further to get fine dust. Large quantities of fugitive emissions are generated during this process. The emissions can be observed in the shed and even escaping into the environment if the machine is not fully covered.

viii. Product storage and loading: After tertiary crushing, the products are transferred through chutes, and direct disposal of the product onto the stockpile generates high amounts of fugitive emissions (see *Image 8a. Fugitive emissions generated during the transfer of product*). After the product is transferred through chutes onto the stockpiles, it is loaded onto vehicles for transportation. During the loading of the product onto trucks, a lot of fugitive emissions are generated (see *Image 8b. Fugitive emissions generated at the time of loading of product*). It has been observed that, more often than not, trucks carrying such fine sand neither provide any cover on the top nor make the sand wet to prevent fugitive emissions.

Image 8: Fugitive emissions released during product storage and loading

8a. Fugitive Emissions generated during the transfer of product

8b. Fugitive emissions generated at the time of loading of product

Chapter 3. Compliance status of stone crushers

The CSE team visited around 15 stone crusher units in Wagholi and Lonikand in Pune district with the objective of determining the implementation of the recommendations given by the joint committee of MPCB and CPCB in 2016 and also to check on the environmental performance of the stone crushers.

Despite the fact that the sample size of the survey is small because several plants denied entry into their premises, it is sufficient to present an insight into the current practices prevailing in the units and the status of implementation of the joint committee's recommendations. The selection of stone crusher units in the different villages was random and some site visits were arranged by the MPCB.

This section of the report highlights and illustrates the observations of the field visit, based on which an environmental performance rating will be given to the stone crushers. During the study, the CSE team found that most of these units are not environmentally compliant. The various parameters considered to assess the environmental performance of the stone-crushing units are discussed in detail below.

Wind-breaking walls: Wind-breaking walls are generally used to prevent dust from spreading far and to effectively reduce the average wind speed, thereby preventing fugitive emissions. In the stone crusher units, wind-breaking walls serve the purpose of dust suppression.

As per the survey conducted by the CSE team, it was found that around 97 per cent of the stone-crushing units have gaps in the wind-breaking walls, which also do not have a strong structural base and are not adequately designed. Gaps or spacing between the wind-breaking walls allow the dust to pass outside the unit, from where it spreads to farther locations. The wind breakings walls were welded with steel rods, joined with steel wires, and had a shallow depth of foundation. As discussed with the owners and workers of the stone crusher units, during bad weather conditions, these wind-breaking walls often topple down.

In order to resist the wind load and reduce the risk of structural damage from wind, it is necessary to reinforce the existing walls or build a strong structural base. In addition to this, most of the wind-breaking walls were inadequately designed,

i.e., the height of the wind-breaking walls was less than the highest tip of the conveyor belt.

Only 3 per cent of the surveyed units had proper wind-breaking walls. These units had a strong foundation for wind-breaking walls, had no gaps or spacing in between the walls, and the height of the walls was higher than the highest tip of the conveyor belt.

Image 9: Conditions of wind-breaking walls

9a. Gaps between wind-breaking walls

9b. Wind-breaking wall of inadequate height

Conveyor belts: Conveyor belts are an important part of the stone crusher unit as they transfer the raw materials and crushed material from one end of the unit to the other. During the transfer of material from one location to another, a significant amount of dust is generated, especially when the wind speed is high. Therefore, these belts should be fully covered from node to node to reduce fugitive emissions.

As per the survey conducted by the CSE team, it was found that only 31 per cent of the units are fully covered from node to node and the remaining 69 per cent of the surveyed units have partially covered (open at some locations) conveyor belts.

In addition to this, suitable location of water sprinklers at the conveyor belts and the correct timing of their operation can also help in decreasing fugitive emissions in stone-crusher units. However, during the survey, the CSE team observed that water sprinklers in 73 per cent of the units were not in working condition during the survey period and only 27 per cent of units had water sprinklers in working condition installed at the conveyor belts.

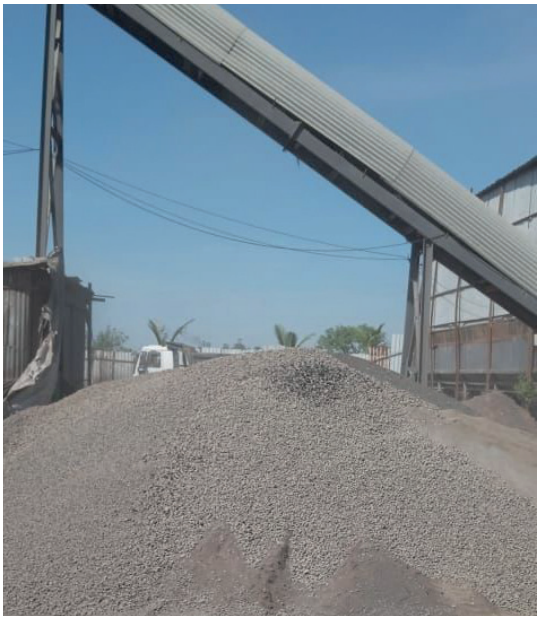
Stone crushing units tend to avoid the usage of water sprinklers as excess water usage results in the jamming of conveyor bearings and other parts, which results

in the need to conduct regular maintenance of the machines. In addition to this, excess water impacts product quality. Therefore, stone-crushing units are reluctant to use water sprinklers during the various processes.

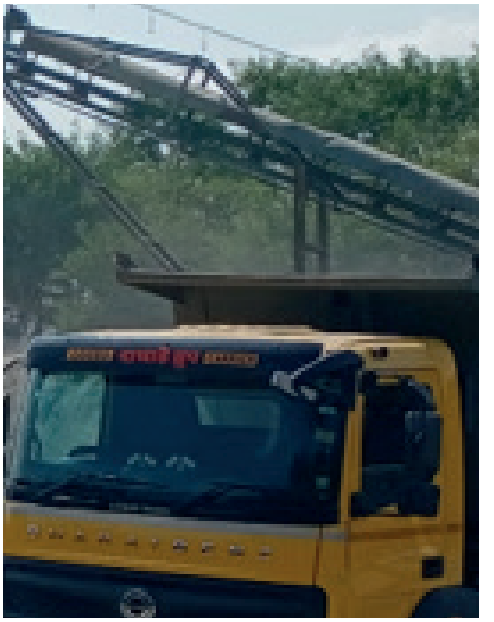
Image 10: Conditions of conveyor belts and water sprinkling system

10a. Partially covered conveyor belts

10b. Uncovered conveyor belts



10c. Fully covered conveyor belts



10d. Sprinklers not working at belt

Water sprinkler near the heaps: During the unloading of raw materials such as big boulders from trucks, or storing and transferring the finished product such as aggregates and sands of different grades, a lot of fugitive emissions are generated. Usually, when the material is transferred through the chute, the amount of fugitive emissions is lesser than when the products are directly disposed onto the stockpile. The emission is also higher at the dust stockpiles than at stone piles of 10–20 mm in size. Therefore, to suppress those dust emissions water sprinklers are provided in the stone crusher units near the material heaps.

As per the survey conducted by the CSE team, it was found that around 47 per cent of the units do not have water sprinklers around the heaps, in 40 per cent of units they have installed water sprinklers but they were not in working condition and only 13 per cent of the units had sprinklers which were in working condition.

Image 11: Water sprinklers near the heaps

11a. Sprinkler not working near dust heap

11b. Sprinkler not working near aggregate

11c. Fugitive emissions near heaps

11d. Water sprinkler not working at heaps

Enclosed hoppers with water sprinklers: Big boulders along with loose soil fall from the dumpers into the hopper of the primary crusher and generate huge amounts of fugitive emissions. Therefore, it is important to provide a dust-containment system at this point also. The system can be provided with some flexible opening mechanisms to ease the unloading process, covering at least three sides around the hopper along with an adequate water sprinkling arrangement.

The survey revealed that many of the stone-crushing units have installed water sprinklers in the hopper section, but they were not operational. It was also found that 7 per cent of the units do not have any covering around the hoppers, in 73 per cent of the surveyed units the hoppers are partially covered and have water sprinklers, and only 20 per cent of the units have fully covered hoppers with M.S. or G.I. sheets and have proper water sprinkling arrangements.

Image 12: Highlights of hoppers in a stone crusher unit

12a. Hopper at stone crusher unit

12b. Water sprinkler not working at hoppers

Crushing and screening equipment with proper door arrangement and water sprinklers: At the crushing sections, the larger boulders are crushed into stones of finer shapes and sizes. The amount of fugitive emission is higher in secondary and tertiary crushing as compared to primary crushing. In order to reduce fugitive emissions, the crushing sections should be fully covered from all sides with M.S. or G.I. sheets and should be provided with water sprinklers. Doors should be provided for the purpose of maintenance.

As the material from secondary crushers is conveyed to the screens, the screen vibrates and thus separates the material into different categories and it has been observed that the greatest fugitive dust emissions come from the screening section at the stone crusher unit. The screening section of the stone crusher unit should

adopt the practice of complete shed coverage with M.S. or G.I. sheets for the process, with doors provided for the purpose of maintenance.

During the survey conducted by the CSE team, it was found that around 7 per cent of the units do not have any covering on the screen section, in 73 per cent of the surveyed units screen equipment is partially covered with sheets, and only about 20 per cent of the units have fully covered screens with M.S. or G.I. sheets and proper door arrangement for maintenance.

Image 13: Highlights of the screening section at stone crusher units

13a. Screen with door arrangement

13b. Screen with inadequate covering

Silos for storing the product and telescopic chute arrangement at the conveyor belt node: After crushing and screening, the final product is transferred to a conveyor belt that delivers it into different stockpiles depending on the size of the product. The conveyor belts have chutes attached at the delivering position in order to streamline the fall of products and reduce emissions. It is recommended that the final products should be stored in silos and released through chutes with water sprinklers in order to reduce fugitive emissions.

Silos are used for storing the final product after crushing and the purpose of the chute is to reduce the dispersion of the crushed product while releasing it from the discharge point and allowing linear fall. During the release of the product, a huge amount of fugitive emission is generated.

During the survey conducted by the CSE team, it was found that none of the units are storing the material in silos and they do not have telescopic chute arrangements

Image 14: Highlights of the products stored at stone crusher units

14a. Product stored in open spaces

14b. Fugitive emissions at product release

for releasing the products from the discharge point. The final product, such as aggregates of different sizes and dust, was being stored in open spaces.

Road infrastructure: The development of metalled and cemented road infrastructure is crucial to reduce fugitive emissions in stone crusher units. Compared to good metalled roads, unpaved roads generate a large amount of dust. The state guidelines clearly mention that all the approach roads to the stone crusher unit should be metalled. The main reason for roads getting damaged in areas with stone crushers is the heavy vehicular movement. In addition to this, it has also been observed that the units do not regularly clean and wet their ground within the premises and it leads to fugitive emissions.

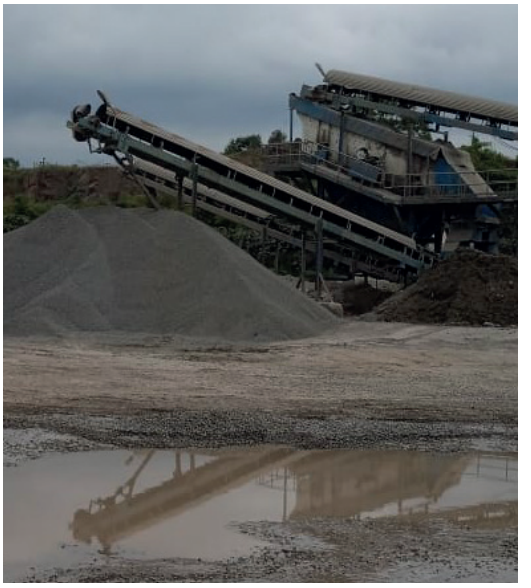
In order to curb fugitive emissions, all the units should have pucca roads in their premises where regular movement of vehicles is desired. Regular cleaning and maintenance of these roads should be done.

With regard to road infrastructure within and outside the crusher zone, the condition in Wagholi as well as in Lonikand village was questionable or worse. During the survey, the CSE team found that many stone crusher units did not have adequate road infrastructure. It was found that none of the units have a regular mechanism for cleaning the roads, and the black concrete top of the roads was not visible due to being covered with dust, which highlights the scale of fugitive dust emissions generated in a stone crusher.

In addition to this, it was also seen that heavy vehicular moment has damaged the road infrastructure and there is no maintenance. It can be seen that the guidelines and recommendations are not being implemented on the ground.

Image 15: Conditions of roads in stone crusher zones

15a. Broken roads inside crusher unit



15b. Roads filled with water inside the crusher

15c. Dust emission due to heavy vehicles

15d. Broken roads due to heavy vehicles

Green belt development around the periphery: MPCB guidelines for stone crushers require each unit to have a tree plantation along the periphery inside the boundary of the unit, with a minimum width of 5 meters from all sides. The foliage of trees should cover an area of at least 20 meters in height.

The green belt in all the units should be developed with a scientific approach concerning the selection of species, spacing, location, direction and numbers, with an adequate number of rows on the periphery. In simple words, the green belt serves as a natural barrier to dust and should be made accordingly.

During the survey it was difficult to ascertain the percentage of green cover in the crusher units during the visits, but most of the units did not seem to have trees up to 20 meters in height and even the width of the trees was not adequate. The development of the green belt was not planned scientifically in most of the units. Some of the owners said that they recently planted the trees, which is why they are not of adequate height and width.

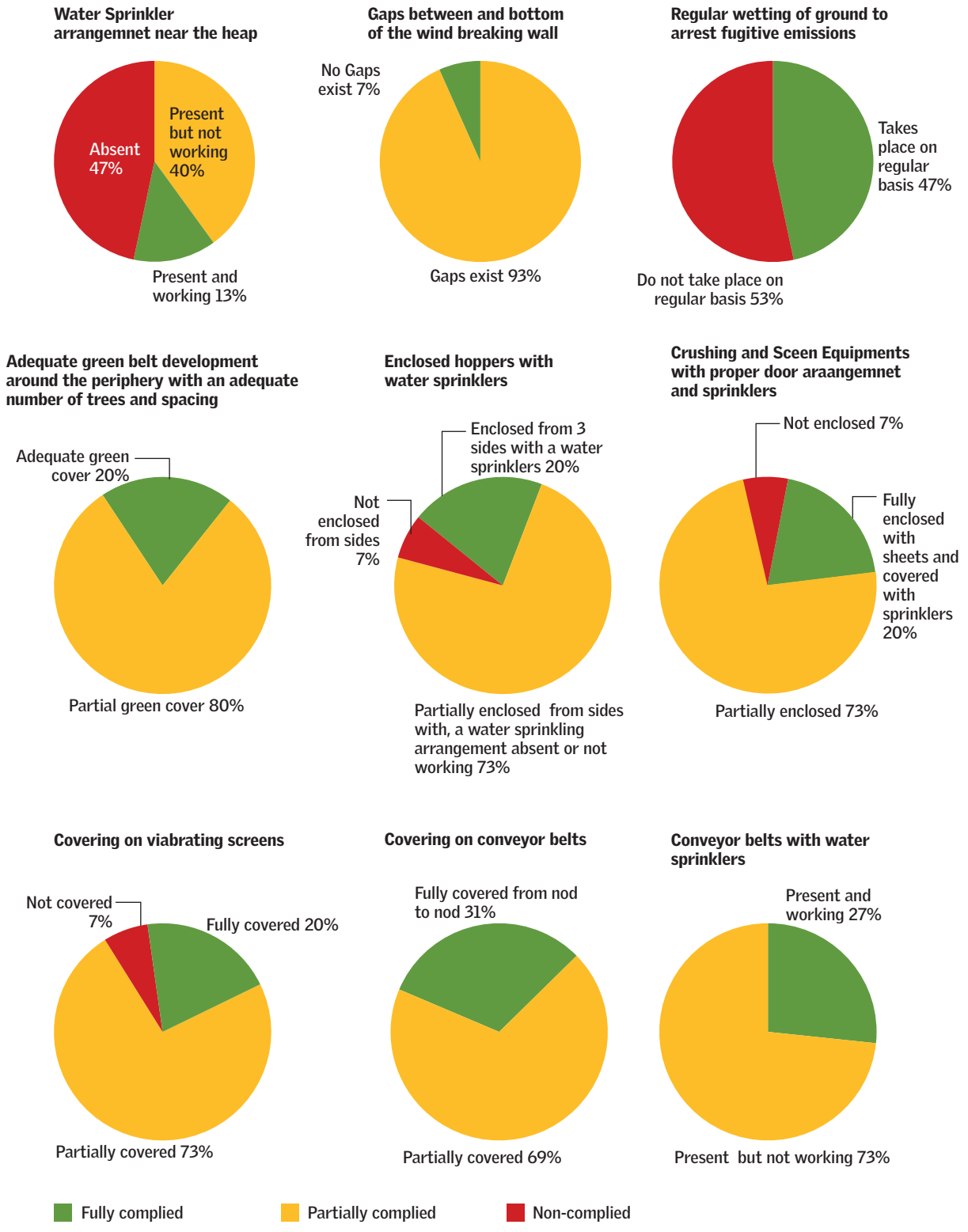
While conducting the survey, the CSE team found that only 20 per cent of the surveyed units have proper coverage of trees and the remaining 80 per cent of the surveyed units have a partial covering of trees of inadequate height around the periphery, which would not be able to act as a barrier against dust emissions.

Image 16: Green cover in stone crusher units

16a. Plantation without scientific planning

16b. Trees of inadequate height

Figure 3: Compliance status of stone crushers in Pune



Environmental performance rating of stone crushers

The environmental performance of every stone crusher unit has been evaluated on the basis of various indicators and a comprehensive rating has been given to them. Figure 3 presents a full picture of how stone crushers have performed with regard to the recommendations given by the joint committee of MPCB and CPCB.

The indicators used in the study are the water sprinkler arrangement near the heap, the structure of wind-breaking walls, the wetting of ground to reduce fugitive emissions, the development of a green belt around the periphery, enclosed hoppers with water sprinklers, crushing and sieving section with proper door arrangement, covered vibrating screen section, and covered conveyor with water sprinklers.

Quantitative ranking has been done separately for each surveyed stone crusher unit to understand the extent of the measures undertaken by these units to control pollution and reduce fugitive emissions (see *Table 3: Environmental performance rating of stone crushers* and *Annexure 1: Detailed rating sheet).*

Table 3: Environmental performance rating of stone crushers

Rank	Units	Score (%)	Rank	Units	Score (%)
1	Unit 6	44	5	Unit 9	31
2	Unit 1	41	5	Unit 10	31
3	Unit 2	38	5	Unit 15	31
3	Unit 3	38	6	Unit 14	28
3	Unit 11	38	7	Unit 5	22
3	Unit 12	38	7	Unit 7	22
4	Unit 13	34	8	Unit 4	16
5	Unit 8	31			

The highest score obtained is 44 per cent by Unit 6. The crusher had a wind-breaking wall with no gaps and a strong structural base. However, the unit did not have a water sprinkler around the material heaps. The unit does not have metalled roads within the premises for all the stretches. The unit has partially enclosed hoppers with sprinkler arrangements, fully covered screens with proper door arrangements for maintenance and fully covered conveyor belts from node to node, but water sprinklers on the conveyor belts were not working. In addition to this, vibrating screens were also fully covered with G.I./M.S. sheets.

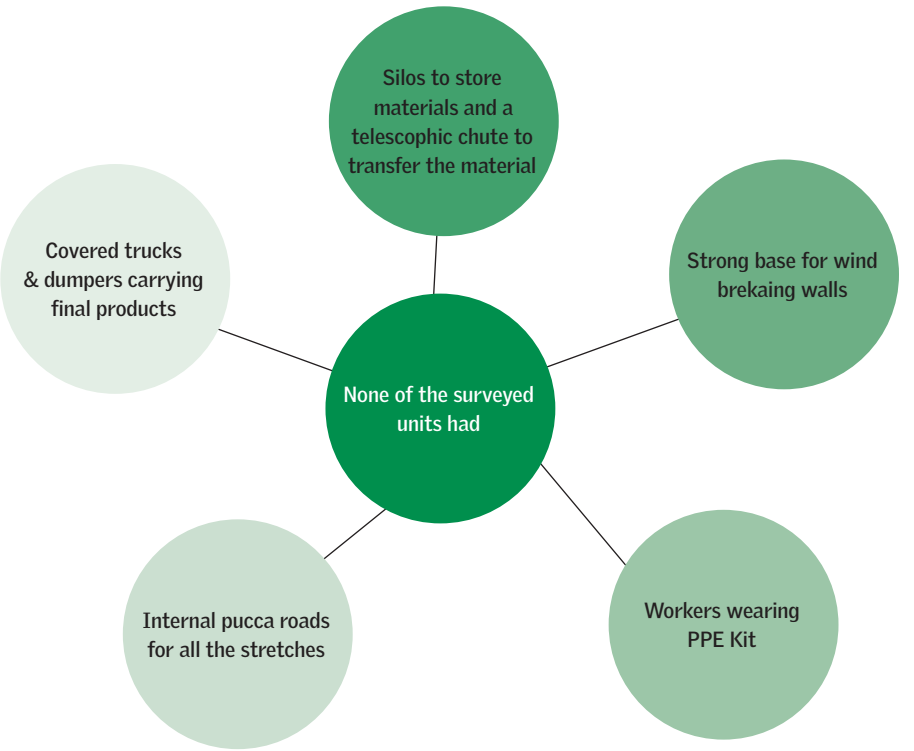
The second highest score obtained is 41 per cent by Unit 1. The crusher had a wind-breaking wall but it had gaps and did not have a strong structural base. The unit has a water sprinkler around the material heaps but that was not in working

condition. The unit does not have metalled roads on all the stretches within the premises. The unit has partially enclosed hoppers with sprinkler arrangements, fully covered screens with proper door arrangements for maintenance and fully covered conveyor belts from node to node, but water sprinklers on the conveyor belts were not working. In addition to this, vibrating screens were also fully covered with G.I./M.S. sheet

More than 90 per cent of the surveyed units have scored less than 40 per cent in the environmental performance rating. This highlights the laxity in the ground implementation of the recommendations given by the joint committee. We can see that barely anything is being done to control fugitive emissions from stone-crusher units.

In none of the surveyed units were there silos to store raw materials, telescopic chutes to transfer the materials, covered trucks for carrying final products, a strong structural base for wind-breaking walls, internal pucca roads for all the road stretches, and workers wearing PPE kits. Therefore, stringent steps need to be taken both at the crusher level and the region and/or zone level to control fugitive dust from the sector.

Figure 4: Facilities that none of the surveyed stone crusher units have



BOX: BEST PRACTICES AMONG STONE CRUSHERS IN PUNE

In Mangrul village in Malwal Taluka of Pune district, there is a stone-crushing unit named *'Kakade Stone Crusher'* that strictly adheres to the guidelines laid down by the Maharashtra Pollution Control Board (MPCB) for stone crushers and works with best operating practices. The cherry on the cake is that the unit runs on solar energy and during closure or breakdown, it provides electricity to the Maharashtra State Electricity Board (MSEB).

The unit has two crushers with capacities of 200 tonnes per hour (TPH) each and another with a capacity of 300 TPH. In addition to this, the unit has a Ready-Mix Concrete (RMC) plant of 120 TPH capacity. Currently, the RMC is used for in-house purposes because they are making a storage plant to store final products in a closed space.

The unit has taken an excellent initiative for energy conservation by installing two solar plants with capacities of 1 Mega Watt (MW) each. One of the solar plants was installed in the year 2018 and the other was installed in the year 2021. These plants have been constructed over the stone quarry which was previously used by the unit. The cost of installing the solar plants was around Rs 6 crore and the plants generate around 15 lakh electricity units every year.

Maintenance of solar panels in the area surrounded by the crusher units and quarries is a tough task. Dust accumulates on the solar panels and hampers energy generation, but the industry leaves no stone unturned to maintain solar panels by regular washing and wiping.

Adherence to Maharashtra Pollution Control Board Guidelines

Even with such a huge capacity, the unit adheres to the MPCB guidelines and also takes some other good steps to save energy and reduce air pollution and fugitive emissions. The unit strictly adhered to the siting criteria set by the state board guidelines. The unit was 1 kilometre away from the national highway and 500 meters away from the state highway, schools, hospitals and human habitation.

During the survey conducted by the CSE team, it was observed that the conveyor belts in the stone crushers were covered with sheets to reduce fugitive emissions. Water sprinklers were made available at all the strategic locations such as loading, unloading, crushing, conveyor belt and entry points. It was also observed that all three crushing sections were covered with G.I./M.S. sheets.

Screen classifiers were fully covered with G.I./M.S. sheets and had proper door arrangements for maintenance. Water sprinklers were available at the screen classifiers to suppress fugitive emissions. The CSE team also noticed that there were water sprinklers at the entry and exit points of the stone crusher unit.

All the approach roads in the unit were either metalled or cemented. There was proper maintenance of roads from time to time to reduce fugitive emissions. It was also seen that the road was regularly wetted to reduce dust emissions.

There is a display board outside the stone crusher unit, illustrating the name of the unit. There is a boundary wall covering the entire unit and the height of this wall is around 10 feet.

During the visit, the CSE team also observed that the unit has a thick foliage of plants along its periphery. The trees were around 20 metres high and the green belt had a width of around 5 metres.

The stone crusher unit adheres to good housekeeping practices and cleaning is done regularly. It has helped the stone crusher unit to run smoothly which has further led to a reduction in the downtime of the unit. Good housekeeping practices have resulted in the reduction of fugitive emissions in the unit.

The stone crusher unit operates regularly from 7 AM till 6 PM in the evening, keeping in mind the noise pollution.

The above-mentioned case study should be highlighted and well documented and should be propagated to a wider group of audiences so that other units can learn from them.

A glimpse of steps taken by the unit

Parameters	Steps taken
Conveyor belts	Covered with G.I./M.S. sheets
Water sprinklers	Available at unloading, handling and loading sections
Primary, secondary and tertiary Crushers	Covered with G.I./M.S. sheets
Screen classifiers	Fully covered with G.I./M.S. sheets and with proper door arrangement for maintenance
Wetting of the road	On regular basis with sprinklers or pipe
Approach road	Metalled road
Display board	Available at the entrance of the unit
Boundary wall	All sides covered with 10 feet wall
Plantation	A thick foliage of plants along the periphery
Housekeeping	Daily
Operating time	7 AM to 6 PM

Image 17: Best operating practices in a stone crusher in Pune

17a. Cleaning of solar panels

17b. Covered Conveyor belts

17c. Regular wetting of the road

17d. Covered screen with door arrangements

17e. Thick foliage of plant along the periphery

17f. Covered secondary crushing units

Chapter 4. Conclusions and recommendations

The survey conducted by the CSE team highlights that stone crushers are blatantly violating the guidelines set by NGT, MPCB and CPCB. The main objective of the study was to check whether the recommendations suggested by the joint committee of CPCB and MPCB have been implemented. It was found that most of the surveyed units are not working efficiently, thus adversely impacting the ambient air quality of the city.

The CSE team also studied the guidelines for the stone crusher sector in Maharashtra and found that the guidelines are not process-specific, and not easily implementable on the ground. It is evident from the study that despite the guidelines in place, the stone crushers in the state are flouting environmental norms and generating a huge amount of dust and fugitive emissions.

The guidelines for the stone crusher sector should be process specific citing the control measures for each step and detailing the specific requirements for the control measures. In addition to this, they should be easily implementable on the ground so that it becomes easy for SPCB officials to conduct an inspection.

It has also been observed that state guidelines for the sector vary among the different states across the country, with some having stringent measures while others with vague requirements. To operate in an environmentally sustainable manner, this sector requires stringent guidelines along with strict on-ground implementation. Therefore, it is time for CPCB or MoEF&CC to pitch in and develop national-level guidelines for this sector.

To improve the environmental practices in the stone-crushing industry, we have given some recommendations for each process as well as some general measures that can be taken. These have been compared with the current MPCB guidelines so that their shortcomings can be understood easily.

Table 4: Guidelines for stone crushers

Process specific guidelines		
Process	MPCB guidelines	CSE's recommendation
Unloading	Crusher unit shall be covered and water sprinklers to be provided to suppress the dust generated due to unloading activity. However, it does not provide technical specifications in detail.	During the unloading of raw materials for storage: Temporary water sprinkling should be provided during the unloading process. During the unloading of raw materials into hoppers: Hoppers should be covered from three sides, and the top side should remain open for vehicular movement. In addition to this, water sprinklers should be provided on the approach roads.
Primary crushing Or Jaw crushers	The dust containment cum suppression system for the equipment should be provided at the jaw crusher unit. However, no technical specifications are mentioned.	The primary crusher should be enclosed by G.I. or M.S. sheets on top and all three sides. The height of the shed should be from the top of the crusher to the ground. One side can be kept open for movement/maintenance. In such cases, provision of movable sheet/door is to be provided for the open section. A water sprinkler shall be provided on the jaw crusher; a water mist system or spray nozzle should be provided on the top periphery of the shed.
Secondary crushing	Crusher unit shall install adequate pollution control measures including the erection of G.I. or M.S. sheets and sprinklers before the commencement of operations. However, the requirements at the secondary crushing process are not mentioned.	The secondary crusher should be enclosed by G.I. or M.S. sheets on top and all three sides. The height of the shed should be from the top of the crusher to the ground. One side can be kept open for maintenance and movement. In such cases, provision of movable sheet/door is to be provided for the open section. In addition to this, a dust extraction system connected with a bag filter or water mist system followed by the cyclone filter should be provided in the shed.
Screening	Screen classifier shall be adequately covered with G.I. or M.S sheets to prevent emissions into the atmosphere due to grading/screening activity. The provision is provided by the MPCB but it lacks technical specification.	Screen classifier should be enclosed by G.I. or M.S. sheets on top and all four sides. The length of the shed should be from the top of the crusher to the ground and a door should be provided for maintenance which should be kept closed during the operation. Dust extraction system connected with bag filter should be provided.

Process specific guidelines		
Process	MPCB guidelines	CSE's recommendation
Tertiary crushing	Stone crusher unit shall install adequate pollution control measures including the erection of G.I. or M.S. sheets and sprinklers before the commencement of operations. However, pollution control measures required for the tertiary crushing processes are not mentioned.	The tertiary crusher should be enclosed by G.I. or M.S. sheets on top and all four sides. The length of the shed should be from the top of the crusher to the ground. Door to be provided for maintenance which should be kept closed during operation. OR The dust extraction system should be connected to a bag filter OR Provision of a water mist sprinkling system in the shed
Discharge points	No mention of the pollution control measures to be adopted at the discharge points.	A flexible telescopic chute from the top of the discharge point to the ground should be provided for all products OR Elevated closed bunkers can be provided for stone dust or sand and a flexible telescopic chute from the top of the discharge point to the ground for remaining products.
Conveyor belts	All the conveyor belts should be adequately covered with G.I. or M.S. sheets.	MPCB guidelines effectively highlight the provision for installing conveyor belts.
Transfer points	Crusher unit shall be covered and water sprinklers to be provided to suppress the dust generated due to handling/loading activity. However, no technical specifications are mentioned.	Transfer points should be fully covered with the provision of a water mist system.

General guidelines		
General measures	MPCB guidelines	CSE's recommendations
Housekeeping	Regular wetting of the ground should be carried out within the premises to suppress the ground-level dust to control airborne dust emissions due to wind. Fine dust generated due to screening/ crushing/grading shall be disposed of scientifically.	The crusher should provide a rotating water sprinkling system/foggers to ensure that the entire premises of the crushing section is covered. Fine dust accumulated in the crushing area and the bag filter should be cleaned at the end of the day after the operation is completed. The collected dust should be stored in sacks for further selling or disposal in a scientific manner.
Type of roads	All the approach roads and ramps roads should be metalled.	MPCB guidelines effectively highlight the provision for laying out the roads in the stone crusher areas.
Wind-breaking wall	Construction of wind-breaking wall especially at the charging hopper and crushing place.	Wind-breaking walls of G.I. or M.S. sheets or bricks should be provided all along the periphery of the crusher. The height of the wall should be 3 ft higher than the highest node of the crusher.
Boundary wall	A curtain or wall is to be provided surrounding the unit.	The crusher area should be demarcated by providing boundary walls on all sides and the height of the boundary wall should be at least up to the height of the drop point of the chute at the conveyor to act as a wind-breaking wall.
Display board	A display board shall be provided at the entrance with the survey number, name and address of the owner	MPCB guidelines effectively highlight the provision for the display board. In addition to this, the date of issuance of CTE/CTO can also be mentioned on the display board.
Plantation	Plantation along the periphery inside the boundary of the stone crushers having a minimum width of 5 meters on all sides and the foliage of trees shall cover up to 20 meters in height.	MPCB guidelines effectively highlight the provision for the plantation. In addition to this, guidelines should mention that indigenous species of trees should be grown.

Annexure 1: Detailed rating sheet

Recommendation by the Joint Committee		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Dust suppression and sprinkling arrangement for stored materials	Silo for all the product material fabricated along with telescopic chute arrangement at the conveyor belt nod *Silo is present with a telescopic chute (1)* *Silo is absent but the telescopic chute is there (0.5)* *Both are absent (0)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crushed sand to be stored in silos *Stored in silos (1)* *Not stored in silos (0)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Proper sprinkling arrangement around the material heaps *The sprinkler is present and working (1)* *The sprinkler is present and not working (0.5)* *Absence of sprinkler (0)*	0.5	1	1	0	0	0	0	0	0.5	0.5	0.5	0	0.5	0.5	0

Recommendation by the Joint Committee		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Wind-breaking wall	No gaps should exist in between and at the bottom of the wind-breaking walls *No Gap present (1)* *Gap Present (0.5)* *Wind breaking wall is absent (0)*	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Structural base and framing for the wind-breaking wall *Strong structural base presents (1)* *Strong structural base absent (0)*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Green belt development	Adequate Green belt development around the periphery with an adequate number of trees and spacing *Present (1)* *Partially Present (0.5)* *Absent (0)*	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	1	0.5	0.5	1	0.5	0.5

Recommendation by the Joint Committee		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Internal pucca road & road cleaning mechanism	Internal pucca roads for all the stretches in the premises *Present (1)* *Absent (0)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Arrangement for water spraying and wetting of ground on the premises *Wetting of ground takes place (1)* *Wetting of ground does not take place (0)*	1	1	1	0	0	0	0	1	0	0	1	1	0	0	1
	Regular cleaning mechanism of the internal roads *Black concrete top is visible (1)* *The black concrete top is not visible (0)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green belt development	Adequate Green belt development around the periphery with an adequate number of trees and spacing *Present (1)* *Partially Present (0.5)* *Absent (0)*	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	1	0.5	0.5	1	0.5	0.5

Recommendation by the Joint Committee		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Dust suppression and sprinkling arrangement at the crushing system	Hoppers with water sprinkling system *Enclosed from three sides and along with the roof, a water sprinkling arrangement is present and working (1)* *Partially enclosed from the side and along with the roof, water sprinkling arrangement present/absent (0.5)* *Not enclosed from sides/ roof and water sprinkling arrangement is absent (0)*	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5	0.5	1	1	0.5	1	0.5	0.5
	Crushing and sieving (screens) equipment enclosed with proper door arrangements and sprinklers *Fully enclosed with sprinklers (1)* *Partially enclosed with sprinkler (0.5)* *Not enclosed (0)*	1	0.5	0.5	0	0.5	1	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5
	The vibrating screen should be enclosed *Completely enclosed (1)* *Partially enclosed (0.5)* *Not enclosed (0)*	1	0.5	0.5	0.5	0.5	1	0.5	0.5	1	0.5	1	1	1	1	0.5

Recommendation by the Joint Committee		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Enclosure for conveyor belts	Conveyor belts covered from the nod-to-nod points adequately without side gaps *Fully covered (1)* *Partially covered (0.5)* *Not covered (0)*	1	0.5	0.5	0.5	0.5	1	0.5	1	1	0.5	0.5	1	0.5	0.5	0.5
	Rubber flap or fogger/sprinkler arrangement at the nods of the conveyor belts *Present and working (1)* *Present & not working (0.5)* *Not available (0)*	0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1
Fugitive Emissions & Compliance with work zone ambient air quality	Workers are to be provided with adequate Personal Protective Equipment (PPE) while on the job *Wearing a PPE kit (1)* *Not wearing a PPE kit (0)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Management of Ambient Air Quality	Trucks & Dumpers carrying crushed stones, sand, and other building materials *Fully covered (1)* *Partially covered (0.5)* *Not covered (0)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		6.5	6	6	2.5	3.5	7	3.5	5	5	5	6	6	5.5	4.5	5
Percentage		41	38	38	16	22	44	22	31	31	31	38	38	34	28	31

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The stone-crushing industry is small-scale but the fugitive emissions it generates have a serious impact on the environment and human health. While stack emissions are considered major contributors to industrial air pollution, fugitive emissions also play a crucial role in the ambient air pollution of an area and hence need immediate attention.

This study has been conducted by CSE to judge the environmental performance of stone-crushing units in Pune and to check on the status of implementation of the recommendations given by the joint committee of CPCB and MPCB.

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