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ऑचलिक कार्यालय (मध्य), भोपाल
केन्द्रीय प्रदूषण नियंत्रण बोर्ड
(पर्यावरण एवं वन मंत्रालय, भारत सरकार)

ऑ.का.भो./मिनी सीमेंट प्लांट/2012–13/ 483

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प्रति

सदस्य सचिव
केन्द्रीय प्रदूषण नियंत्रण बोर्ड
परिवेश भवन
पूर्वी अर्जुन नगर
दिल्ली–110 032

विषयः लघु सीमेंट इकाइयों में वायु प्रदूषण नियंत्रण की स्थिति ।

महोदय

वार्षिक कार्य योजना वर्ष 2011–12 के अनुपालन में इस कार्यालय द्वारा मध्य अंचल में स्थित लघु सीमेंट इकाइयों में वायु प्रदूषण नियंत्रण की स्थिति ज्ञात करने हेतु अध्ययन किया गया । प्रतिवेदन अवलोकनार्थ संलग्न है ।

भवदीय

(आर. एस. कोरी)
अपर निदेशक एवं
ऑचलिक अधिकारी

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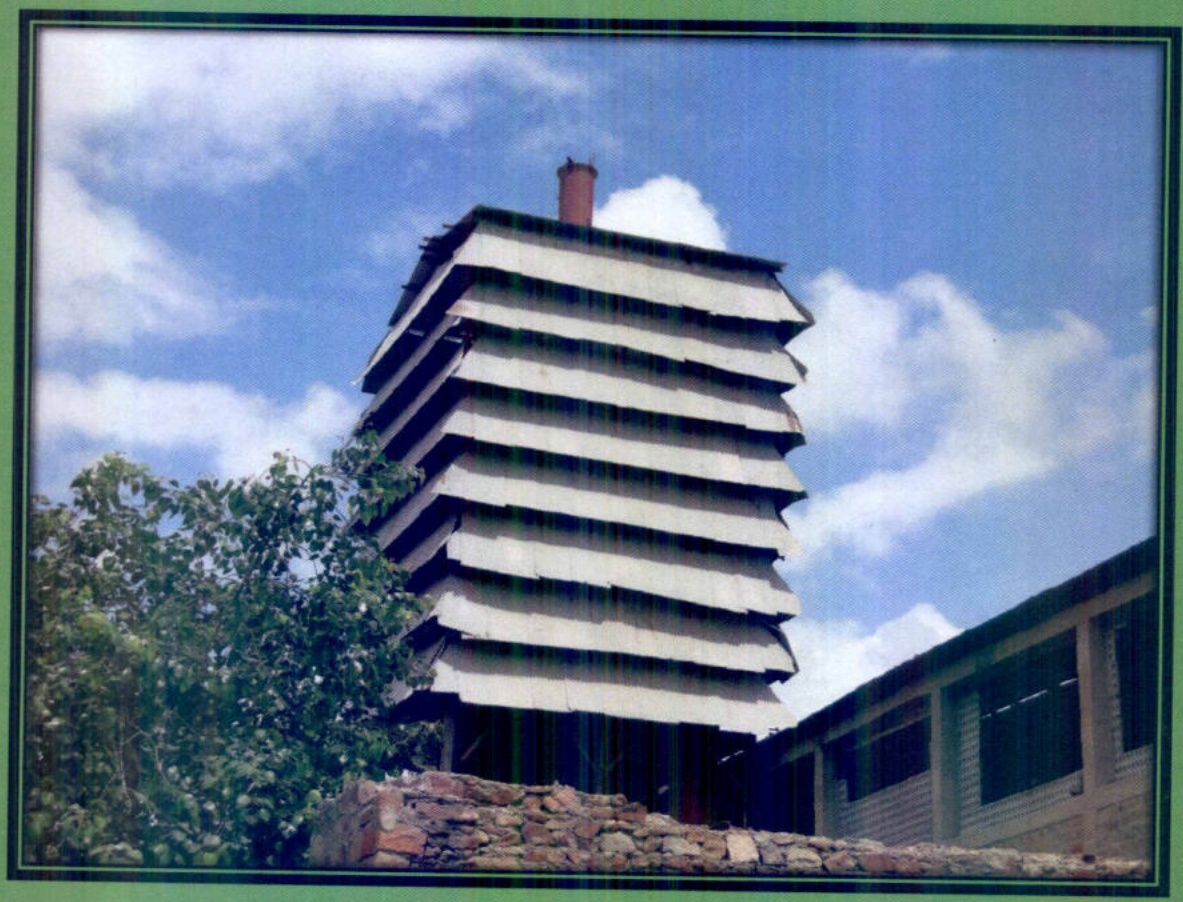
लघु सीमेंट इकाइयों में वायु प्रदूषण नियंत्रण की स्थिति

STATUS OF AIR POLLUTION CONTROL IN MINI CEMENT PLANTS



2011-12

ZONAL OFFICE
CENTRAL POLLUTION CONTROL BOARD
BHOPAL

Central Pollution Control Board
Central Zonal Office
Bhopal

REPORT

ON

STATUS OF AIR POLLUTION CONTROL IN MINI CEMENT PLANTS

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Central Pollution Control Board
Central Zonal Office
Bhopal
INDEX

S.NO.	REPORT	PAGE
01	Executive Summery	4
02	कार्यकारी सारांश	7
03	Introduction	11
04	Historical Background	12
05	Cement Manufacturing Process	13
06	General Observations	20
07	Results and Discussions	24
08	Recommendations	26
09	Photographs	52

LIST OF ABBREVIATIONS

- VSK - Vertical Shaft Kiln
- OPC - Ordinary Portland Cement
- PPC - Pretoria Portland Cement
- PM - Particulate Mater
- SPM - Suspended Particulate Mater
- RPM - Reparable Particulate Mater
- SO_2 - Sulfur Dioxide
- NO_X - Nitrogen Oxides
- COD - Chemical Oxygen Demand
- BOD - Biochemical Oxygen Demand
- TSS - Total Suspended Solid
- TS - Total Solid
- SO_4 - Sulphate
- pH - Potyange Hydrogen
- CV - Calorific Value

Executive Summery

Vertical Shaft Kiln (VSK) technology based mini cement plants are becoming popular in small limestone deposits areas in central India due to their less capital investment as well as less land area (01 hectare) requirement. At the same time lot of public complaints are also received with respect to air pollution from mini cement plants and moreover the stack emission limit with respect to PM was prescribed as 250mg/Nm^3 in some plants. As per the SPCBs available information, 64 mini cement plants are located in Rajasthan and 12 in Madhya Pradesh in which 90% of them are not in operation due to less demand & huge competition with large cement units. Chhattisgarh state does not have any mini cement plants.

To know the status of air pollution control Zonal office, Bhopal has taken up a project on "Status of air pollution control in mini cement plants in central zone" under AAP 2011-12. As a part of the project the list and address of mini cement plants is collected from SPCBs and prepared a questionnaire and sent to mini cement plants for obtaining the information. The collected information is compiled and field visits/ monitoring conducted in three phases between September 2011 to February 2012 under Jodhpur, Bikaner, Kishangarh, Alwar, Kotputli & Behror regions in Rajasthan and Dhar region in Madhya Pradesh.

In most of the units Saboo Technology based Vertical Shaft Kilns are being used, majority of kilns are of 50TPD capacity. Most of the units are manufacturing OPC & PPC of grade 53 & 43.Few units are bringing clinker from large cement units and doing job works like grinding & packaging. For control of air pollution only few units have the wet scrubbers & bag filters whereas interlocking of process equipments with pollution control devices was not seen in any unit. In crushing, milling &

packaging area exhaust fans are provided whereas none of the units has fugitive emission control arrangements. Stack emission monitoring facility is yet to be developed in many units. Overall housekeeping in these units is very poor. No occupational health safety measure applied in any of the units.

Ambient Air Quality monitoring results shows that NOx level ranging between 09$\mu g/m^3$ to 47$\mu g/m^3$, RPM values between 31$\mu g/m^3$ to 82$\mu g/m^3$. Stack emissions monitoring carried out in three mini cement plants shows the PM emission between 141 mg/Nm^3 to 232 mg/Nm^3, SO_2 emission ranges 2.61mg/Nm^3 to 8.11mg/Nm^3 and NO_2 emission between 307mg/Nm^3 to 429mg/Nm^3. In majority of the units the prescribed limit of stack emission for PM is given as **250mg/Nm^3.**

Fugitive emission were monitored in three mini cement plants and SPM concentrations were found at lime stone crusher area-11994 $\mu g/m^3$, raw mill area-2,543 mg/m^3, vertical shaft kiln area-2,496 mg/m^3, clinker yard area-2,263 $\mu g/m^3$, cement mill area-2,748 $\mu g/m^3$ and packaging plant area-1,685 $\mu g/m^3$. The noise level was recorded between 64.4 to 80.1 dB(A) in day time.

It is observed that the mini cement plants having capacity less than or equal to 50TPD are struggling for economical sustenance and taking least interest in installation of adequately designed air pollution control equipment. The existing units should make efforts for effective control of the source & fugitive emission i.e. to install wet scrubbers & bag filters at stack and telescopic chutes at dumping/loading area to control the fugitive emission units, dust suppression/extraction systems & close conveyer systems at material transfer points. The SPCBs may conduct studies for requirement of revision of source emission limits along with the development of the fugitive emission guidelines. Separate energy meter shall be installed for record of electricity consumption in operation of pollution control devices. Proper stack emission monitoring facilities needs to be developed. Occupational safety provisions

should be adopted by all units to reduce the risk of health of workers. To maintain the good housekeeping in plant premises and internal roads should be cemented. The wet scrubber discharge water should be used in dust suppression etc. Therefore, it is recommended that a study may be conducted to evaluate the techno-economical and commercial viability of mini cement plants w.r.t. their production capacity.

कार्यकारी सारांश

केन्द्रीय प्रदूषण नियंत्रण बोर्ड, ऑचलिक कार्यालय (मध्य), भोपाल के अन्तर्गत आने वाले मिनी सीमेंट प्लांट में वायु प्रदूषण नियंत्रण की वर्तमान स्थिति को ज्ञात करने हेतु राजस्थान प्रदेश में स्थित मिनी सीमेंट प्लांटों का प्रबोधन तथा वस्तुस्थिति जानने के लिए दो चरणों में दौरा किया गया । प्रथम दौरा दिनांक 12/09/2011 से 18/09/2011 तथा द्वितीय दौरा दिनांक 04/02/2012 से 06/02/2012 तक किया तथा मध्य प्रदेश में स्थित मिनी सीमेंट प्लांटों का दौरा दिनांक 05/11/2011 से 06/11/2011 तक किया गया तथा परिवेशीय वायु गुणवत्ता, चिमनी प्रबोधन, फिजिटिव इमिशन प्रबोधन, ध्वनि प्रबोधन तथा स्क्रबर से निकलने वाले वाहित जल की गुणवत्ता जांच तथा संबंधित राज्य प्रदूषण नियंत्रण बोर्ड से उनके राज्य में स्थित मिनी सीमेंट प्लांटों से संबंधित अन्य जानकारियां एकत्रित की गई ।

- मिनी सीमेंट प्लांट की उत्पादन प्रक्रिया में होने वाले वायु प्रदूषण नियंत्रण को जांचा गया । उत्पादन प्रक्रिया निम्नलिखित है :–

1. सबसे पहले चूना पत्थर पीसा जाता है जिससे बड़े–बड़े पत्थरों के टुकडों का आकार लगभग 40–60 मिलीमीटर तक हो जाता है उसके बाद इस आकार के टुकडे, हैमर मिल में जाते हैं जिससे इन टुकडों का आकार 20 मिलीमीटर के आकार का हो जाता है फिर ऐलीबेटर द्वारा इन चूना पत्थरों को साइलो में इकट्ठा कर लेते हैं । जो क्रेसर से कोयला और मिट्टी को पीस कर साइलो में इकट्ठा करते हैं । इस प्रक्रिया में हैमर मिल से होने वाले वायु प्रदूषण को बेग फिल्टर लगा कर नियंत्रित करते हैं । बेग फिल्टर फटे हुये तथा सही तरीके से लगे हुये नहीं पाये गये । एलिबेटर में भी फ्यूजिटिव एमिशन पाया गया ।

2. उपरोक्त कच्ची सामग्री इकट्ठा होने पर तुला गाड़ी में एक निश्चित् अनुपात में इस कच्ची सामग्री को लेकर हॉपर में डालते हैं । हॉपर के ऊपर उचित तरीके से बैग फिल्टर नहीं लगे हुये थे ।

3. हॉपर से मिक्स हुई यह कच्ची सामग्री रॉ–मिल में जाती है जिससे पिसाई पश्चात् एक बारीक पावडर बन जाता है । रॉ–मिल के अंतिम भाग के ऊपर बैग फिल्टर लगा है। अधिकतर कारखानों में फटे हुये तथा उचित तरीके से बैग फिल्टर नहीं लगा था ।

4. उपरोक्त बारीक पावडर एलीबेटर से ब्लैंडिंग में जाता है जिससे ब्लोअर से इसे मिक्स किया जाता है उसके बाद ये स्टोरेज साइलो में स्टोर होता है । इस प्रक्रिया में काफी मात्रा में फ्यूजिटिव एमिशन पाया गया ।

5. स्टोरेज सायलो से स्क्रू कन्वेयर द्वारा ऊपर लगी भट्टी पर जाता है वहां नोडूलायजर में पानी से मिक्स हो कर गोलियां बनती हैं । स्कू कन्वेयर में कई जगह से फ्यूजिटिव एमिशन पाया गया । नोडूलाईजर से निकलने वाले फ्यूजिटिव को रोकने के लिये नोडूलाईजर को कपडे ढक देते है इसके उपरान्त भी फ्यूजिटिव निकलता पाया गया।

6. ये गोलियां भट्टी के ऊपरी बर्निंग जोन पर गिरती हैं जहॉ का तापमान 1200 से 1300 डिग्री सेंटीग्रेड होता है व नीचे से कोयला तथा हवा जाती है जिससे ये गोलियां पक जाती हैं । पकी हुई गोलियां नीचे से निकलती रहती हैं जिसको क्लिंकर कहते हैं । इस प्रक्रिया में चिमनी द्वारा निकलने वाले वायु प्रदूषण को रोकने के लिये डस्ट सैटलिंग चैम्बर या वेट स्क्वर लगे हैं जो कि उचित तरीके से काम करते हुये नहीं पाये गये ।

7. इस क्लिंकर को ठंडा करने पर क्रेशर द्वारा 5 प्रतिशत जिप्सम के साथ ग्राइंडिंग करते हैं । ग्राइंडिंग क्लिंकर हॉपर में जाकर स्टोर होता है । वहां से ये सीमेंट मिल में जाता है । इस मिल द्वारा क्लिंकर व जिप्सम को पीस कर पावडर बनाया जाता है जिसको सीमेंट कहते हैं । यह सीमेंट एलीबेटर द्वारा सीमेंट ब्लेंडिंग साइलो में जाता है यहां हवा द्वारा ब्लैंडिंग होती है तत्पश्चात् ऑटोमेटिक पैकिंग मशीन द्वारा इसको बैग में भरा जाता है । सीमेंट मिल में वायु प्रदूषण को रोकने के लिये रिवर्स जैट बैग फिल्टर, साईक्लोन बैग फिल्टर तथा बैग फिल्टर लगे हैं, जो कि उचित तरीके से काम करते हुये नहीं पाये गये ।

8. प्रतिदिन प्रत्येक एक घंटे के अंतराल से कच्ची सामग्री तथा सीमेंट को प्रयोगशाला में चैक किया जाता है जिससे इसकी गुणवत्ता की पूर्ण सन्तुष्टी होने पर फैक्ट्री से बाहर निकाला जाता है ।

उपरोक्त उत्पादन प्रक्रिया में वायु प्रदूषण नियंत्रण के लिए मिनी सीमेंट प्लांट में बैग फिल्टर, वैट स्क्रबर, रिवर्स जैट बैग फिल्टर, साइक्लोन बैग फिल्टर तथा डस्ट सैटलिंग चैम्बर का ठीक तरीके से उपयोग नहीं हो रहा है । उपरोक्त प्रक्रिया में फ्यूजिटिव इमिशन बहुत ज्यादा हो रहा है । अतः मिनी सीमेंट प्लांट में वायु प्रदूषण नियंत्रण से संबंधित सभी उपायों को काफी गंभीरता के साथ लागू किया जाना चाहिये ।

- अधिकतम मिनी सीमेंट प्लांट में सिर्फ क्लिंकर खरीद कर ग्राइन्डिग कर रहे हैं तथा अधिकतर वी.एस.के. बंद पाये गये।
- मिनी सीमेंट प्लांट में जल प्रदूषण नियंत्रण के लिये वेस्ट वाटर कलैक्शन पिट, सैटलिंग टैंक, उत्पादन प्रकिया में पुनःर्चक्रण तथा पौधो में डालते है।

- सभी मिनी सीमेंट प्लांट में साबू वी.एस.के. लगा हुआ है तथा इसकी क्षमता 50 टी.पी.डी. से 100 टी.पी.डी तक हैं । अधिकतर प्लांट के अन्दर ओ.पी.सी. सीमेंट बनाते है जो कि 43 या 53 मानक का होता है।
- प्लाट में सीमेंट तथा अन्य सामग्री की गुणवत्ता जांच के लिये प्रयोगशाला स्थापित है ।
- प्लांट के अन्दर हाउस कीपिंग काफी खराब है ।
- ईंधन के रूप पैटकोक, कोल, कोलडस्ट तथा कोकडस्ट का उपयोग होता है ।
- अधिकतर प्लांट के अन्दर मजदूरों को सेफ्टी मास्क, ग्लब्स तथा हैलमेट आदि उपलब्ध नहीं कराये जाते हैं ।
- स्टेक मॉनिटरिंग किट की उपयुक्त सुविधा उपलब्ध नहीं है ।
- फ्यूजिटिव इमिशन तथा स्टेक इमिशन को रोकने के लिये साईक्लोन बैग फिल्टर, बैग फिल्टर तथा वेट स्क्रबर का उचित तरीके से प्रयोग नहीं किया जा रहा है ।
- क्लिंकर स्टोरेज क्षेत्र में फ्यूजिटिव इमिशन को रोकने के लिये टेलीस्कोपिक पाईप का प्रयोग किया जाना चाहिये ।
- कारखाने के 33 प्रतिशत क्षेत्र में वृक्षरोपण किया जाना चाहिये ।
- वायु प्रदूषण नियंत्रण डिवाइस के लिये अलग से ईलेक्ट्रिक मीटर लगाया जाना चाहिये ।
- फिजिटिव इमिशन को रोकने के लिये कन्वेयर वेल्ट लगाये जाने चाहिये।
- कारखाने के अन्दर सीमेंट या कांक्रीट रोड बनाई जानी चाहिये ।
- राजस्थान राज्य प्रदूषण नियंत्रण बोर्ड ने नये कन्सेंट जारी करना बन्द कर दिया है क्योंकि सभी मिनी सीमेंट प्लांट में ऑलाईन मॉनिटरिंग सिस्टम नहीं लगाया गया है ।

Central Pollution Control Board
Central Zonal Office
Bhopal

STATUS OF AIR POLLUTION CONTROL IN MINI CEMENT PLANTS

1. Introduction:

Cement is an essential component of infrastructure development and important element in construction industry, particularly in the government's infrastructure and housing programs. The Indian cement industry is the second largest producer of cement in the world.

The cement plants which are having 10000 T to 15000 T clinker production capacity per day are known as large cement plants and the plant capacity is in between 200 -250 t/h is known as mini cement plant.

The Indian cement industries are a combination of mini(More than 300 units) and large capacity cement plants, where majority of the production of cement (94%) in the country is by large plants. The conventional method of cement manufacturing used by large plants (Rotary Kiln) needs high capacity, huge deposits of lime stone in its vicinity, high capital investment and long gestation period. Hence mini cement plants based on Vertical Shaft kiln technology, suiting the small deposits of limestone are becoming popular as these plants require less investment and area. One of the other defining features of the Indian cement industry is that the location of limestone reserves in selected states has resulted in its

evolving in the form of clusters. The proximity of coal deposits also another important factor in cement manufacturing.

The cement industry is energy intensive and power cost is the most critical component in cement manufacturing which is about 35% of the total cost of production. Cement industry has a significant role in the climate change and sustainable development. The cement industry produces 5% of global man-made carbon dioxide. The environmental challenges being faced by cement industries are using of natural resources as a raw materials& fossil fuel and releasing of oxides of nitrogen, sulphur dioxide, particulate matter and carbon dioxide in to the environment.

2. Historical Background:

Ever since civilization first started to build the world has sought a manmade bonding material that would bind stones into a solid, formed mass. During the Paleolithic Age, men used to enjoy adequate shelter provided by nature. The Bronze Age witnessed the use of building materials from a clay based mixture and air hardening lime. The Egyptians advanced to the discovery of lime and gypsum mortar as a binding agent for building such structures as the pyramids. The Greeks made further improvements and finally the Romans developed cement that produced structures of remarkable durability. The secret of Roman success in making cement was traced to the mixing of slaked lime with pozzolana. A volcanic ash from Mount Vesuvius. This process produced cement capable of hardening under water. During the middle Ages this art was somehow lost.

In the 18th century, big efforts started in Europe to understand why some limes have hydraulic properties. John Smeaton often referred to as father of civil engineering in England concentrated his work in this field and made the first modern concrete by adding pebbles as a coarse aggregate and mixing powered brick into the cement in 1759. A number of discoveries followed. It was in 1817 that Louis vicat conducted work on the hydraulic nature of the lime-volcanic ash mixture. He was the first person to accurately determine the proportions of limestone and silica required to make the mixture of cement. He published the results of his research. But did not apply for a patent .Finally in 1824 Joseph Aspdin patented the basic process of slower-setting cement. He addressed this as Portland cement due to the fact that in

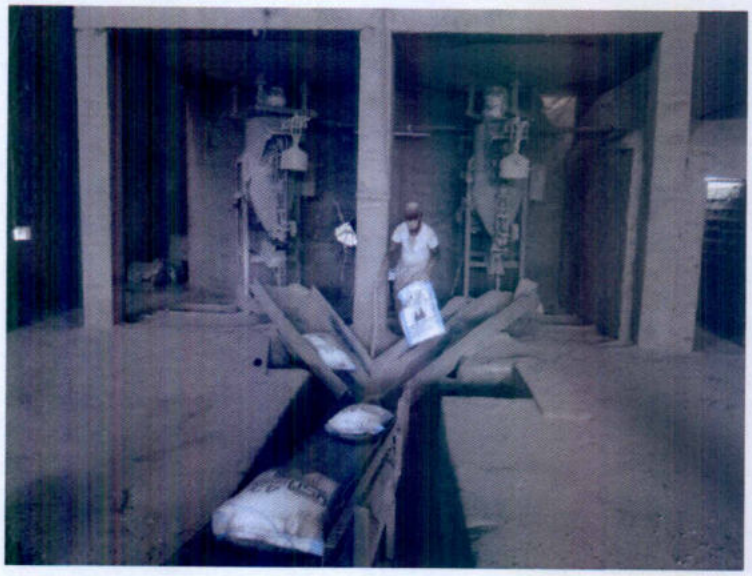
appearance and hardness, it resembled the upper Jurassic rock found in the region of Portland in southern England (Lafarge 2004).

The attempt to produce cement in India dates back to 1889 when a Calcutta firm attempted to produce cement from Argillaceous (Kankar). But the first organized effort on mass scale to manufacture Portland cement commenced in Madras (Washermanpet) in 1904 by south India Industries Limited (cement manufacturers Association 1964 Gadhok 2000) The factory could not succeed hence it failed. However, it was in 1914 that the first commissioned cement manufacturing unit in India was set up by India cement company Limited at Porbandar, Gujarat. With an installed capacity of 10,000 tones and production of 1000 tones. Subsequently two plants one at Katni (M.P.) and another at Lakheri (Rajasthan) were set up. The First World War gave positive stimulus to the infant industry. The following decades saw increase in number of plants, installed capacity and production. This period can thus be called the Nascent Stage of Indian cement industry.

After all these initiatives, the sales increased along with more plants. In 1936 eleven companies, except Son Valley Portland cement company Limited merged to form Associated cement Company Limited (ACC). In 1937 Dalmiya Jain Group set up five factories with installed capacity of 575000 tones and ACC added four more plants.

3. Cement Manufacturing Process

Lime stone, coal/coke and earth stored in different silos in the raw mill hoppers for proper grinding as per the required size and then the raw mix will beefed in to the kiln through screw conveyor &bucket elevator after forming nodulizer in the nodulizer for clinkerisation. The clinker will be discharged through triple air lock system to the clinker storage yard for cooling. After cooling about 5 to 6% of gypsum added with the clinker and grinded in the cement



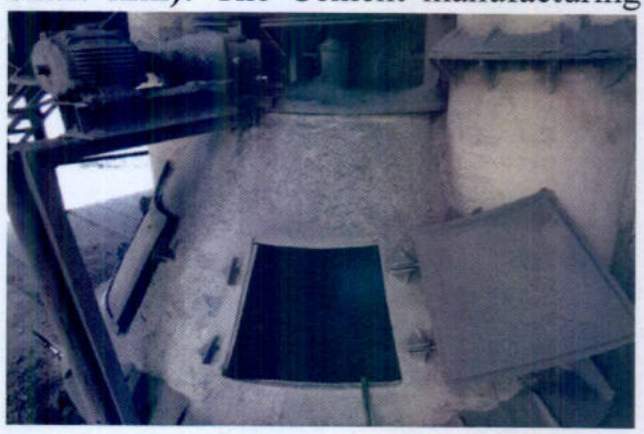
mill and the grinded material is packed for selling in the market. The major raw material and its composition being used in mini cements are given at **Table1.**

a. Technologies: The various technologies which have been tried in mini cement plant are:

1) Fluidized Bed Process (Fuller Pyzel)
2) Reba Process
3) Travelling Grate (Lurgi sinter grate)
4) Vertical Shaft Kiln:
   - CRI–MVSK (Cement Research Institute of India-modern vertical shaft kiln).
   - RRL-VSK (Regional Research laboratories–Vertical Shaft Kiln).
   - Saboo-VSK (Saboo Vertical Shaft kiln)

There are 64 mini cement plant in Rajasthan and 12 in Madhya Pradesh in which 90% of the plants are not in operation. Chhattisgarh state has no mini cement plants. Except few plants majority of the kilns are 50 TPD or less 50 TPD capacity and all are Saboo Technology based VSK (Saboo Vertical Shaft kilns) being used for cement manufacturing. The list of mini cement plants exist in Rajasthan & MP are given at **Annexure-I.**

Saboo-VSK (Saboo vertical Shaft kiln): The Cement manufacturing process by using Saboo V.S.K technology is very simple. The lime stone is transported by Trucks from quarries and manually fed into jaw crusher, the material is further crushed in Hammer mill &conveyed with the help of belt conveyor then it is stored in the storage bins with the help of totally enclosed bucket elevator, similar storage silos for clay, coke breeze and laterite is also installed. The requisite quantity of raw materials composition is extracted from silos in a trolley mounted with weighing machine. This raw mix is then fed in to ball mill with the help of bucket elevator & hopper for further grinding. This ground raw meal is then brought in to blending silos, where with the help of compressed air it is homogenized. After analyzing the raw meal, it is subjected to nodulizer for



formation of specific size nodules. Nodules thus formed are charged into kiln through a rotary chute.

- The Vertical shaft kilns are generally 1.7 meter in diameter and 7 meter in height. Positive displacement blower will blows the air at 3PSI pressure from bottom while the clinker travels downwards in counter direction.

- The exhaust gases escapes from the top of the kiln after wet scrubber at 50°C to80oC temperature and are vented through stack in to the atmosphere, the clinker is discharged through a hydraulically operated triple air lock gate and transported manually to a clinker crusher. The crushed clinker is stored in a hopper& certain amount of gypsum is added to the hopper as per requirement. The gypsum mixed clinker is then fed to cement mill where it is subjected to fine grindingupto170 mesh.

- This cement is then brought to cement blending silos for homogenization with the help of compressed air before bagging of cement is done.

b. <u>Sources of pollution in mini cement plants</u>

Portland cement is a hydraulic binding material which fulfils the relevant Standard requirements and is manufactured by pulverizing and mixing calcareous and argillaceous material (i.e. silica, alumina and iron oxide bearing minerals), burning the homogenized mix at a temperature of approx. 1,450°C, cooling the result is cement clinker. Ordinary Portland cement is manufactured by mixing together and grinding clinker and gypsum.

To prevent the dust escaping into the environment installation of proper high efficiency pollution control devices like wet scrubbers, cyclones, dust settling chambers, pulse jet bag filters are very much essential. Moreover the adequacy of air pollution control devices and it location plays vital role in controlling the pollution in mini cement plants.

During the visit it was observed that majority of plants were not installed scrubbers at kiln for controlling the flue gases and bag filters/ dust settling chambers at the material handling & transfer points as a result lot of fugitive emissions and leakage of dust and raw materials observed. The mini cement plants can be divided into three sections comprising of raw mill section, kiln

section &cement mill section. These sections contribute lot of air pollution which could further be categorized into source emissions and fugitive Emission. If proper care is not taken in housekeeping and water recycling there could be water and solid waste problem too. The major chemical composition of dust generated from the above sections of the mini cement plant is given at **Table 2.**

c. **Source Emissions:** The only source emission from mini cement plant is from kiln stack which is usually 30m height from the ground level, discharges the kiln off gases into the atmosphere. The main pollutants emitted from the stack are particulate matter,SO_2, $NO_2$and small amounts of carbon monoxide. However this should be avoided to the extent possible as it causes excess fuel consumption. The exhaust gas temperatures normally in the range of 60-80°C except for poking periods when it could go beyond 300°C.It was informed that in the absence of any air pollution control devices the PM values will be in the range of 3000 mg/Nm^3 to 5000 mg/Nm^3 in case of improper operating conditions and in normal conditions with proper wet scrubber arrangement the PM values will be in the range of 300 to 500 mg/Nm^3.But during the field visits source emissions were monitored in three mini cement plants and the PM values found in the range of 141 mg/Nm^3 to 232 mg/Nm^3, SO_2 values 2.61 mg/Nm^3 to 8.11 mg/Nm^3 and NO_2 values 307mg/Nm^3 to 429mg/Nm^3. RSPCB has given PM limit of 250mg/Nm^3 for old plants and 150mg/$Nm^3$for new plants.

- **Control Measures:** As the cement manufacturing process in VSK kilns is semi dry process, i.e., the raw mix is converted to small pallets before firing and the flue gases contain lot of moisture as a result of burning process hence it is difficult to clean this gas with a dry bag filters. Therefore the wet scrubbers are the simplest and economical solution for cleaning the moisture laden dust i.e. particulate matter commonly called dust is the primary emission in the manufacturing of cement.

- **Wet Scrubbers:** The dust laden gases coming out from Vertical shaft Kiln exhaust at a temperature of 120°C (max) entering to a Wet-Scrubber

System for scrubbing the dust laden gases. The system comprises of Wet-Scrubbers with manual damper, droplet/moisture separator, and seal tank as the core components. The dust laden gas passes through the water column, where dust particles are trapped by water and recycled to the Nodulizer after passing through the settling tank. The water saturated gases then pass through the moisture separator. The water droplets are removed in to the separator and the emissions are discharged into the atmosphere through the main stack. The overflow outlet of the seal tank is connected to a water re-circulation tank from where the water (with max2% solid) is pumped back in to the scrubber. Due to evaporation there is need of little bit makeup water (1.5-2% approx.) to be added in the re-circulation tank. The pressure drop across the scrubber is maintained at 350 mm WC by adjusting the position of throat flap damper manually.

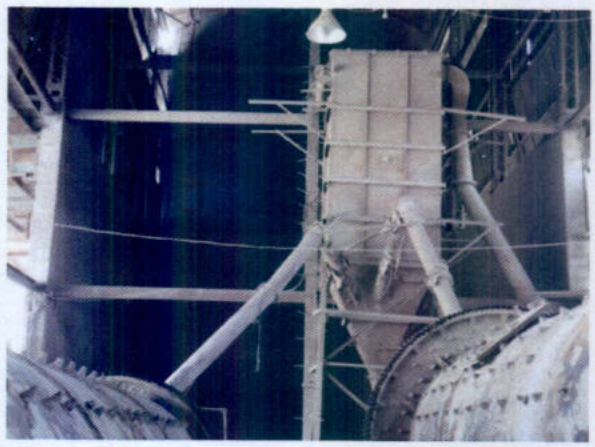
- The particulate emissions from the kilns stack can be brought down to stipulated limits (250 mg/Nm^3) by installing scrubber. Water has been used for scrubbing of waste gases in the scrubbers and thus removes the dust particles. The wastewater after clarification is recycled in scrubbing of gases as well as in the nodulizer thus eliminating fresh water requirement of the nodulizer. The sludge from the system does not give rise to any solid waste generation as it utilized in nodulizer as a raw material. In few units this type of scrubbers are already installed & in operation. But most of the unit's scrubbers are not installed and in some units scrubber are not properly located and water connection given through sintex tanks as a temporary arrangement. It was observed that the wet scrubbers provided are not designed properly as a result they are not efficient. Only wide mouth space provided at the kiln out let which connect to the stack. Proper platform were not provided to stand and observe the working of scrubbers.

- RSPCB has directed to all the mini cement plants to install wet scrubbers at the kiln out let to control the air pollution in the mini cement plants and bag filters at the crushers & raw material transfer points etc. Therefore the suggested APCDs as given at **Table 3**, are required to install in mini cement plants to control the stack and fugitive emissions to meet the norms.

d. **Fugitive Emissions:** The mini cement plants supposed to install the pollution control devices to control fugitive emissions from loading & unloading points, material handling areas & transfer points etc. in majority of plants installed single cloth filter and dust settling chambers as a pollution control devices but majority of the plants are not installed requisite pollution control devices and none of the plants are attached air pollution control devices at the material transfer points etc for controlling the fugitive emissions.

- Fugitive dust emissions generates from material handling areas i.e. raw material unloading & storage areas, crushing, transfer points, clinker storage and cement loading areas etc. the contribution of fugitive emission of the SPM concentration in ambient air outside the factory boundary would be more than the prescribed limits. However during the field visits fugitive emissions were monitored at distance of about 10m from source of dust generation in three mini cement plants at five locations covering all the sections for 4 hours duration at each location by using HVS and the SPM values were found as lime stone crusher area-11994 mg/m^3, raw mill area-2543 mg/m^3, vertical shaft kiln area-2496 mg/m^3, clinker yard area-2263 mg/m^3, cement mill area-2748 mg/m^3 and packing plant area-1685 mg/m^3. The highest value observed at lime stone crusher area and lowest value at packing plant area. SPCBs has not prescribed any limits for fugitive emission.

- **Control Measures:** There were no concrete measures taken for controlling fugitive emission in mini cement plants. As a result the levels of fugitive emissions are much more in older plants than new plants therefore utmost care is required to keep fugitive emissions to the minimum and also conserve the input resources



for which bag filter should be installed at material transfer points like, raw mill silos, ball mill silos, crushers, packing plant etc and the dust collected in bag filters should be recycled into the process.

- **Bag Filters**: it was observed that in very few plants installed pulse jet bag filters at crushers and cement mill for controlling fugitive emissions, these pulsejet bag filters are capable of filtering dust laden air through a filter media. The dust laden gas enters the dust collector through the module inlet. A buffer plate distributes the gas uniformly throughout the housing and drops out heavy particles into the hopper. The dust-laden air then passes upward and approaches the filter bags and gets passed through to the module outlet at the top. To maintain a moderate pressure drop of around 100 mm wc , the cleaning cycle for the filter bags is employed to provide continuous cleaning of the filter bags. The cleaning system consists of a differential pressure switch, a solid-state sequential timer and a set of pilot solenoid activated diaphragm operated valves. Generally compressed air of 5-6 Kg/cm^2 is used for cleaning the bags. The collected dust is re-cycled into the process through material handling devices.

e. Water Pollution: There was no wastewater generation from the cement manufacturing process by using Saboo VSK Technology. The wastewater generates from the scrubber outlet has been reused for making nodules and ultimately finds its way out in the form of moisture through stack and does not cause any water pollution.

f. Solid Wastes: The process does not generate any solid waste. The major raw materials used for the process are lime stone and coal. Only gases are generated in the kiln exhaust and plant will not generate any solid wastes.

4. General Observations

The officials from zonal office, Bhopal visited the mini cement plants in Rajasthan and Madhya Pradesh in three phases during September 2011, November 2011 and February 2012 to know the status of air pollution. Mini cement plants do not exist in Chhattisgarh state. During the visits most of the plants were found closed. Collected the list of cement plants from RSPCB and related information through questionnaire & field visits. As per the information collected from SPCBs there are 64 mini cement plant in Rajasthan and 12 in Madhya Pradesh in which 90% of the plants are not in operation due to low demand of cement produced from mini cement plants and unable to compete with large cement plants. In almost all the units Saboo Technology based VSK (Saboo Vertical Shaft kilns) are being used for cement manufacturing and majority of them are 50 TPD kilns. The industry specific observations were provided in the **Annexure-II** and the general observations made during the visit are as follows.

- It was told that minimum one hectare land is required for the establishment of 50 TPD capacity mini cement plant and it consists of hammer mill, jaw crusher, bucket elevator, raw material silo, raw mill hopper, conveyor belt, cement mill (ball mill), blending silo, screw conveyor, nodulizer, VSK kiln, packing machine and manual weighing machine (Taraju) etc.

- Rajasthan State Pollution Control Board has stopped issuing/renewing the consents under Air & Water Acts to mini cement plants in some areas for not installing the scrubbers for treatment of kiln gases. RSPCB is also issued letters to all the mini cement plants to install continuous monitoring system for stack emission as well as ambient air quality as per the notified standards.

- Cement manufacturing in mini cement plants is based on wet process because use of water in nodulizer for making granules for manufacturing of clinker but no wastewater generated from the process.

- The mini cement plants are not maintaining the records of water consumption and some plants are not even taken permission from central ground water authority for drawing the water. Poor plantation was observed around the mini cement plants especially in Rajasthan.

- It was found that almost all the mini cement plants are manufacturing OPC and PPC of 53&43 grade cements. The quality of product is poor because they are mixing other materials like fly ash in unknown ratio but the plant officials claims the cement quality is much better than the branded cement quality and meeting all the BIS specifications. The information collected during the visit regarding the Chemical Composition of Clinker, Cement &gypsum and compressive strength of clinker &cement is given below at the **Table 4 & 5.** The BIS specifications for OPC and PPC are also provided at **Table 6.**

Air Pollution Control

- Most of mini cement plants are installed Saboo make VSKs but they are not in operation because unable to compete with large cement plants in the open market. Few plants are bringing clinker from large cement plants & doing job works like grinding & packing. As per the discussion with the owners of one of the plant that generally the mini cement plants are being operated only six months in a year.

- All the plants have state electricity board connection for power supply to run the plant & machinery. In some unit's acoustic enclosures and proper stack height was not provided for the DG sets to control of noise & air pollution.

- None of the plants were interlocked the process equipment with pollution control devices and separate energy meters not installed for cross checking the operation of pollution control devices. During the visit in some plants air pollution control equipment were installed but found not in operation.

- The mini cement plants required to install the pollution control devices to control the stack emissions and fugitive emissions from loading & unloading points, material handling areas & transfer points etc. in few plants scrubber, cyclone, cloth filter and dust settling chambers are installed as a pollution control devices but majority of the plants are not installed requisite pollution control devices and none of the plants are attached air pollution control devices at the material transfer points etc. for controlling the fugitive emissions.

Raw materials and product handling

- For one tonne of clinker production aabout72%-75% of Lime stone, 10% - 12% of coal/ pet cock, 9%-10% of pond clay and 3%-5% laterite required. Approx 1780 Kgs of raw mix will converts into 1000 Kg clinker in the kiln. After clinkerisation 5-6% of gypsum will be add in clinker and grinded in the ball mill for making the cement. The percentage of raw materials very and depend upon the quality.

- Petcock, coal dust and coal are being used as a fuel in mini cement plants. Oil soaked cotton has been used for igniting kiln (VSK) during kiln start up.

- Compound oil is being used for lubrication & smooth working of machineries in the mill. Due to improper storage and spillages at machineries causing oil pollution in the premises.

- It was found that the raw materials like coke breeze/ coal dust etc. are being stored openly to make it dry and some plants stored in covered area to prevent exposure from rain etc.

- It was found that few plants are purchasing clinker and manufacturing cement in their cement mill and packed in bags manually after weighing.

- In most of the plants are having own packing machine and the sizes of the cement bags are generally 50kgs. The packed bags are sold in the open market in the name of branded company.

Fugitive emission control measures

- The housekeeping in and around the mini cement plants was very poor.
- Provided exhaust fans in crushing area, milling area and packing areas to provide fresh air but in some plants due to non-availability of exhaust fans lot of suffocation observed.
- Fugitive emission control devices are not installed in cement packing areas of mini cement plants.

Environment Monitoring facility

- All the units are established small quality control laboratory for assuring the quality of raw materials & cement. The following instruments were found available in laboratories i.e. muffle furnaces, oven, hot plate, water bath, burette, physical balance, spectrophotometer, compressing strength testing machine, vibrating machine, leach ability instrument, autoclave and thermometer.
- Stack emission monitoring facilities like easy ladder, platform, port hole & power points were not provided in some plants and monitoring equipment's & analysis facilities are not developed.

Safety measures

- Safety devices like mask, helmet, gloves &ear plugs were found weared in none of the mini cement plants by the workers except in M/s Metro Cement Plant, Pipar city, Rajasthan. As per the workers the safety measures were not provided to them and more over they were not convenient to them to wear during working.

- In one unit the VSK platform constructed with wooden plates and it is unsafe to work.

Following suggestions are given by the owners of mini cement plants for improving & smooth functioning of the mini cement plants.

- At least 50% consumption of cement from the mini cement plants should be made compulsory in NREGA works.
- Loan facility for the working capital should be given and state government should give subsidy on interest of the loan amount.
- Captive Individual mines should be allotted to mini cement plants.
- Removing the mini cement plants from VAT (Value Added Tax) list for paying of 14% VAT to Rajasthan Government. The present system is both types of cement plants (mini & large cement plants are paying 14% VAT).
- Health records of the workers were not being maintained. It was told that there is no regular employees only contract labours works that to it is very difficult to get the labours.

5. Results and Discussions

- **Ambient Air Quality Monitoring:** The ambient air quality was monitored in two mini cement plants and the SO_2 levels found as BDL & NO_2 levels are in the range of 09 $\mu g/m^3$ to 47 $\mu g/m^3$ and the RPM values are in between 31$\mu g/m^3$ to 82 $\mu g/m^3$. During the monitoring period the weather was cloudy and there was slight rain in the third shift. All the monitored values are with the ambient air quality limits. The detailed AAQM results are given in the **Table7**.

- **Source Emission Monitoring**: Stack emissions were monitored in three mini cement plants i.e. M/s Metro Cement & Mines Limited & M/s Teesta Cement in Rajasthan and M/s Polyport Cement Pvt Ltd in Madhya Pradesh. It may be seen from the monitoring reports that the emission levels of PM were found in between 141 mg/Nm^3 to 232 mg/Nm^3. The SO_2 concentrations in the stack gas was detected in the range of 2.61 mg/Nm^3 to

8.11 mg/Nm^3 and NO_2 values observed as 307mg/Nm^3 to 429mg/Nm^3.The RSPCB has given PM limit of 250mg/Nm^3 for old plants and for new plants it is 150mg/Nm^3. Limits for SO_2 and NO_2 were not given in the consent. The detailed stack monitoring results are given in the **Table 8**.

- **Fugitive Emission Monitoring:** Fugitive emission were monitored for 4 hours duration at each location by using HVS in M/s Metro Cement & Mines Ltd, Pipar city, M/s Prime Cement Ltd, Behror and M/s Tirupati Cement Pvt. Ltd, Behror in Rajasthan. Covered all the dust generating sections of mini cement plants and the SPM concentrations were found as lime stone crusher area-11994 mg/m^3, raw mill area-2543 mg/m^3, vertical shaft kiln area-2496 mg/m^3, clinker yard area-2263 mg/m^3, cement mill area-2748 mg/m^3 and packing plant area-1685 mg/m^3. The highest value observed at lime stone crusher area and lowest value at packing plant area. SPCBs has not given the limits for fugitive emission limits. The detailed fugitive emission monitoring results are given in the **Table 9**.

- **Monitoring of wastewater from the flue gas wet scrubber:** The wastewater samples collected from the flue gas scrubber out let for knowing the concentration of effluent being recycled 100% in the process for making of nodules & in wet scrubber itself by M/s Teesta Cement, Kotputli, Rajasthan and the values of pH -7.40, BOD - 25 mg/L, COD - 201 mg/L, TSS - 26 mg/L , TS - 2924mg/L, Cl-1325 mg/L and SO_4 - 186 mg/L were found which are less than the general effluent discharge norms. The detailed analysis report is given in the **Table 10**.

- **Ambient & machinery Noise level Monitoring:** The noise levels were measured for 10 minutes in each location during day mode only by using Cygnet noise level meter at M/s Metro Cement Mines Limited, Pipar city in Rajasthan. All the measured values are in dB (A). Plant & machinery noise levels were measured and the values recorded as near raw material loading hopper-80.1, vertical shaft kiln area-79.6, near scrubber-79.3. The ambient noise levels measured and the values recorded as at guest house-64.4 and residential colony-67.1.Noise levels are exceeded the prescribed ambient noise levels for day mode at all the locations. The detailed monitoring report is given in the **Table 11**.

6. Recommendations:

1. Telescopic chute may be installed for controlling the fugitive emission at clinker discharge/ loading points from the hoppers.
2. The bag filters should be replaced after recommended designated time, properly tightened at joints and regular maintenance should also be done to control fugitive emission and prevent leakages at various transfer points and material handling areas.
3. Closed conveyer belts systems should be used for control of fugitive emission.
4. Fugitive emission control devices should be installed at cement packing area to control emission.
5. Dust suppression & dust extraction systems should be provided at all material transfer point for controlling of fugitive emissions.
6. At least 33% of the total industrial area shall be covered & maintained under plantation.
7. Mini cement plants have to provide necessary infrastructural facilities for the monitoring of stack emission for safe monitoring.
8. The stack height attached to all emission sources should be proper so as to disperse the emission of flue gases over a greater area and thereby reduce the concentration of the pollutants.
9. Separate energy meter shall be installed for record of electricity consumption during operation of pollution control devices.
10. The DG set installed should be as per the norms and adequate measures may be provided for the control of noise & air pollution.
11. Domestic wastewater shall be disposed-off through septic tank& soak pits.

12. To assess the human health risk due to cement dust and its effects to respiratory system.
13. Safety equipment should also be provided to all workers and visitors for minimizing risks and accidents.
14. All the roads inside the factory premises should be cemented or concreted.
15. The industries should not discharge the effluent from wet scrubber and recycle 100% in process.
16. To maintain good housekeeping in the plant premises.
17. The interlocking mechanism should be developed with the pollution control devices and process equipment.
18. The industry should get necessary permissions from central ground water authority for drawing the ground water through bore wells. Maintain the records pertaining to water consumption and wastewater generation etc.
19. To install air pollution control devices for source emission control and fugitive emissions control and operate them properly to meet the prescribed norms.
20. To renew /obtain the consents under Air and Water Acts by individual plants.
21. To submit the application for obtaining the hazardous Waste authorizations for using of waste oil/used oil as a lubricant. Hazardous waste (Oil & Grease) should be stored as per the CPCB guide lines.
22. Boundary wall with tall trees should be developed to prevent escaping of dust and to act as a noise barriers.
23. The government should allot the captive lime stone mines to mini cement plants and provide loan facility on working capital and remove VAT.
24. The cement from the mini cement plants should be used in government schemes by the concerned state governments.
25. Less than 100TPD capacity mini cement should not be allowed.

Table 1: Chemical Composition of Lime Stone, Coal, Clay and Iron Dust

Chemical	Coal	Clay	Lime Stone	Iron dust
LOI	66.00 %	13.40 %	41.60 %	-
SiO_2	13.66 %	54.00 %	2.02%	6.20 %
Al_2O_3	10.26%	17.96%	1.84%	-
Fe_2O_3	4.10%	4.40%	1.00%	91.20 %
CaO	3.09 %	7.02 %	51.98 %	-
MgO	1.82%	2.02%	061%	-
TC	-	-	95.2	-
MgO_3	-	-	1.34	-
$CaCO_3$	-	-	93.86	-
VM.	12.00 %	-	-	-
Ash	34.0%	-	-	-
C.V.	3932 KCal	-	-	-

Table 2: Chemical Composition of Dust From The Mini Cement Plant

Component	Raw mix %	Kiln dust %	Cement %
Major Chemical Composition of dust			
Loss of ignition	35.43	23.95	00.25
Silicon dioxide	11.30	15.90	22.00
Aluminium oxide	05.60	03.75	05.60
Iron oxide	01.80	02.60	03.50
Calcium oxide	43.60	34.40	64.90
Magnesium oxide	01.00	00.80	01.00

Table 3: Suggested APSDs should be installed in mini cement plants

S.No.	Section	Type of dust collectors
1.	Crushing and Raw Materials handling	Bag filter
2.	Raw Mill	Multi cyclone / Bag filter
3.	Homogenizing Silo	Bag filter
4.	Noduliser	Multi cyclone/ Bag filter
5.	VSK	Cyclone & scrubber with proper stack height and monitoring facilities.
6.	Clinker Crusher	Bag filter
7.	Cement Mill	Bag filter
8.	Packing House	Bag filter

Table 4: Chemical composition of Clinker, Cement & Gypsum

1. 2. Chemical	Clinker	Cement	Gypsum
LOI	0.22 %	1.98 %	12.40 %
IR	0.56 %	2.96 %	12.90%
SO_3	0.26 %	1.58 %	32.00%
SiO_2	21.94 %	20.38 %	14.40 %
Al_2O_3	5.48%	5.60 %	6.88%
Fe_2O_3	4.40%	4.30%	3.80%
CaO	64.06 %	60.13 %	13.77 %
MgO	1.62%	1.82 %	2.02%
Chloride Contents	-	0.050	-

Table 5: Compressive Strength of Clinker & Cement (In MPA)

Days	Clinker	Cement
3 DAYS	27.5	29.0
7 DAYS	38.0	39.0
28 DAYS	53.0	55.0

Table 6: BIS Specifications for OPC and PPC

Specification	OPC			PPC
	53 grade	43 grade	33 grade	Fly ash
BIS code	12269-1987	8112-1989	267-1987	1489-1991
Chemical				
LSF	0.8 to 1.02	0.66 to 1.02	0.66 to 1.02	-
Mgo(%) (Max)	6	6	6	6
SO_3(%) (Max)	3	3	3	3
LOI(%) (Max)	4	5	5	5
Physical				
Specific surface (m^2/Kg) min	225	225	225	300
Soundness				
Leachate (mm)	10	10	10	10
Autoclave (%) Max	0.8	0.8	0.8	0.8
Setting time (minutes)				
Initial (min)	30	30	30	30
Final (Max)	600	600	600	600
Compressive strength (MPA)				
72±1 hour (3 days) min	27	23	16	16
168±2 hour (7 days) min	37	33	22	22
672±4 hour (28 days) min	53	43	33	33
Drying shrinkage (%) max				0.16

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Bhopal

Table 7: Ambient Air Quality Monitoring at M/s Metro Cement Limited, Pipar City, Rajasthan
(Date of monitoring: 13.09.2011 to 14.09.2011)

S. No.	Time	U/W Direction			D /W Direction			Weather
		SO_2	NO_2	RPM	SO_2	NO_2	RPM	
1.	2 am to 6 am	BDL	11	31	BDL	25	77	Cloudy
2.	6 am to 10 am	BDL	09		BDL	47		
3.	10 am to 2 pm	BDL	09	47	BDL	27	82	Rain in third shift
4.	2 pm to 6 pm	BDL	10		BDL	28		
limits		120	120	100	120	120	100	

Note: All values are in $\mu g/m^3$
BDL-Below Detection Limit

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Table 8: Stack monitoring data of mini cement plant

S. No.	Date of monitoring	Name of industry	Loca-tion	PM (mg/Nm^3)	SO_2 (mg/Nm^3)	NOx mg/Nm^3)
1.	13.09.2011	M/s Metro Cement Mines Limited, Pipar city, Rajasthan	VSK stack	170	8.11	429
2.	04.11.2011	M/s Poly Port Cement Pvt. Limited, Pithampur, M.P.	VSK stack	232	2.61	307
3.	05.02.2012	M/s Teesta Cement, Kotputli, Rajasthan	VSK stack	141	07	384
Prescribed Limits				250	-	-

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Table 9: Fugitive emission monitoring data of mini cement plant

S. No.	Date of monitoring	Name of industry	Location	SPM ($\mu g/m^3$)
1.	13.09.2011	M/s Metro cement mines limited, Pipar city, Rajasthan	Clinker yard Area	2263
			Lime stone crasher area	11994
			Raw mill (02) Area	2543
2.	04.02.2012	M/s Prime cement limited, Behror, Rajasthan	Near to VSK	2496
3.	05.02.2012	M/s Tirupati Cement Pvt limited, Behror, Rajasthan	Cement Packing Area	1685
			Cement mill	2748

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Bhopal

Table 10: Scrubber out let of M/s Teesta Cement, Kotputali, Rajasthan
(Date of monitoring: 05.02.2012)

S. No.	Location	pH	TSS	TS	COD	BOD	Cl	SO_4
1.	Scrubber out let	7.40	26	2924	201	25	1325	186
Prescribed limits		5.5 to 9.0	100	-	250	30	-	-

Note: All values are in mg/l except pH

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Table 11: Noise Monitoring At M/s Metro Cement Mines Limited, Pipar City, Rajasthan
(Date of monitoring-13.09.2011)

S. No.	Location	Category	Time	Lmax	Lmin	Leq	Limit
1.	Near to loading hopper	Industrial	10.04	83.7	78.0	**80.1**	**75**
2.	Near to kiln	Industrial	10.01	82.6	77.9	**79.6**	**75**
3.	Near to scriber	Industrial	10.04	83.2	77.6	**79.3**	**75**
4.	Near to raw conveyer belt	Industrial	23.23	81.3	67.7	**71.3**	**75**
5.	Near to guest house	Residential Area	10.01	76.1	53.1	**64.4**	**55**
6.	Near to lab	Industrial	10.39	76.1	54.6	**63.8**	**75**
7.	Near to time gate	Industrial	10.01	79.2	54.4	**62.7**	**75**
8.	Near to colony	Residential Area	10.51	83.4	62.4	**67.1**	**55**

Annexure-I

List of Mini Cement Plants in Rajasthan and Madhya Pradesh

S. No.	Name of unit	Address	RO	Status	Scale	Production Capacity
1.	M/s Sharawan Cement Pvt Ltd.	E-5 RIA Behror Distt. Ajmer	Alwar	Operating	Small	Cement 50 TPD
2.	M/s A.K. Engineering Works	G1/145, RIA, Behror Distt. Alwar	Alwar	Operating	Small	Cement 50 TPD
3.	M/s Anita Cement Private Limited	F-74-82 RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 50 TPD
4.	M/s Astha Cement P. Ltd	G-1-140 RIA, Behror Distt. Alwar	Alwar	Operating	Small	Cement 100
5.	M/s Bhatnagar Cement	District Alwar	Alwar	Closed	Small	Cement
6.	M/s Bhiwadi Cement Private Limited	District Alwar	Alwar	Closed	Small	Cement
7.	M/s Chirage Cement	District Alwar	Alwar	Closed	Small	Cement
8.	M/s EnkeyUdyogpvt Ltd	124-125 Km Stone NH-8 Kolila	Alwar	Operating	Small	Cement 50 TPD
9.	M/s Gauri Cements Private Limited	A-19 RIA Behror Distt. Alwar	Alwar	Operating	Small	Clinker Grinding 50 TPD
10.	M/s Geekey Cement Private Limited	Behror Distt. Alwar	Alwar	Close	Small	Cement
11.	M/s Gemini Cement private Limited	Behror Distt. Alwar	Alwar	Close	Small	Cement
12.	M/s GopalJi Cement Pvt .Ltd	A-20 (B) RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 200 TPD

000038

13.	M/s Gunjan Cement Private Limited	59-61A RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 50TPD
14.	M/s Jay Shree Kripa Cement Pvt ltd	G-1,27F RIA Sotanala Distt. Alwar	Alwar	Operating	Small	Cement 15000 TPA
15.	M/s JCL Cement P.Ltd	F-67 &68 RIICO Industries Area Behror	Alwar	Operating	Small	Cement 150
16.	M/s Jindal Rajshree Cement Pvt Ltd	G-1-101-103 & F-55-57 RIA Behror Distt.	Alwar	Operating	Small	Cement 50 TPD
17.	M/s Jyoti Cement Private Limited	F-68 B-70 RIA Behror, Distt. Alwar	Alwar	Operating	Small	Cement 50 TPD
18.	M/s Kapsons Cement (P) Ltd.,	Behror Distt. Alwar	Alwar	Close	Small	Cement
19.	M/s Khemka Cement Private Limited	Behror Distt. Alwar	Alwar	Close	Small	Cement
20.	M/s Madhu Cement private limited	Behror Distt. Alwar	Alwar	Close	Small	Cement
21.	M/s New Shivani Cement Private Limited	Behror Distt. Alwar	Alwar	Close	Small	Cement
22.	M/s Premier Texto Trade Pvt Ltd	F-62-64&G-93-95 RIA, Behror Distt. Alwar	Alwar	Operating	Medium	Cement 50 TPD
23.	M/s Prime Cement Private Limited	E-107, RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 50 TPD
24.	M/s Rajdhani Associated Ltd	A-22,(B) RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 20 TPD
25.	M/s Sailesh Cement Pvt Ltd	A-21 B, RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement1500
26.	M/s Saluja Cement (P) Ltd	Behror Distt. Alwar	Alwar	Close	Small	Cement

000039

27.	M/s Shree Modi Cement (Raj) Pvt Ltd	E-6&9 RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 50 TPD
28.	M/s Thukral Cement	A-20(B) E-33&34 RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 200TPD
29.	M/s Tirupati Cement Private Limited	E-37 RIA Behror, Distt. Alwar	Alwar	Operating	Small	Cement50 MTD
30.	M/s Vijeta Cement P.Ltd	E-104 RIA Behror Distt. Alwar	Alwar	Operating	Small	Cement 50TPD
31.	M/s Nokha Cement Pvt Ltd.	SP-1 (C) RICCO Industrial Area Nokha	Bikaner	Operating	Small	Cement 50 TPD
32.	M/s Sarvotam Cement Pvt Ltd.	Charkaara District Bikaner	Bikaner	Operating	Small	Cement 50 MTA
33.	M/s Tiger Cement Pvt Ltd	B-9 RIICO Industrial Bikasar District	Bikaner	Operating	Small	Cement 5MT
34.	M/s Anmol Cement Pvt Ltd.,	Chittorgarh Distt. Chittorgarh	Chittorgarh	Closed	Small	Cement
35.	M/s Saluja Cement (P) Ltd (2B-15)AP	Chittorgarh Distt. Chittorgarh	Chittorgarh	Operating	Small	Cement
36.	M/s Agam Cement Product (P) Ltd	Jaipur Distt. Jaipur	Jaipur	Operating	Small	Cement
37.	M/s Ashutosh Cement (P) Ltd	District Jaipur	Jaipur	Closed	Small	Cement
38.	M/s Birmwala Cement	Kotputali Distt. Jaipur	Jaipur	Closed	Small	Cement
39.	M/s Chandra Cement	Paniyala Mod Kaluhere Distt. Jaipur	Jaipur	Operating	Small	Cement200
40.	M/s Jobner Cement (P) Ltd (s)	District Jaipur	Jaipur	Closed	Small	Cement

41.	M/s Kotputall Cement Works M/s Ankit Cement	District Jaipur	Jaipur	Closed	Medium	Cement
42.	M/s Namo Cement Cement Ltd	Sarund Distt. Jaipur	Jaipur	Operating	Small	Cement 50 TPD
43.	M/s Pankaj Cement Pvt Ltd.	Jaipur Distt. Jaipur	Jaipur	Closed	Small	Cement
44.	M/s Phulera Cement Pvt Ltd	E-26 RIA Phulera Distt. Jaipur	Jaipur	Closed	Small	Cement 50 TPD
45.	M/s Shri Modi Cement Pvt Ltd	Dable Road Sarund Distt. Jaipur	Jaipur	Operating	Small	Cement 50 TPD
46.	M/s Shri Salasar Cement	Dable Road Sarund District Jaipur	Jaipur	Operating	Small	Cement 50 TPD
47.	M/s Swift Finvest Pvt Ltd	Paniyala Mod Kalahera Distt. Jaipur	Jaipur	Operating	Small	Cement 200 TPD
48.	M/s Teesta Cement Pvt Ltd.	Pathradi Post Pragpura Distt. Jaipur	Jaipur	Operating	Small	Cement 50 TPD
49.	M/s Vishwakarma Cement	Kotputal Distt. Jhunjhunu	Jaipur	closed	Small	Cement
50.	M/s Chirawa Cement Ltd.	Chirawa Distt. Jhunjh	Sikar	Closed	Small	Cement
51.	M/s Chirawa Cement ltd	Chirawa Distt. Jhunjh	Sikar	Closed	Small	Cement
52.	M/s Gupta Cement p, ltd	Navalgarh Distt. Jhunjhunu	Sikar	Closed	Small	Cement
53.	M/s Sakambari Cement Pvt Ltd.	Jhunjhunu Distt. Jhunjhunu	Sikar	Operating	Small	Cement
54.	M/s Triveni Cement	Barwa Tehsil Nawalgarh Neem Ka Thana	Sikar	Operating	Small	Cement 50 TPD

000041

55.	M/s Bilara Cement pvt ltd	Kharia Distt. jodhpur	Jodhpur	Operating	Small	Cement
56.	M/s Metro Cement pvt ltd	Khasra No. 70 Jawasia Distt. Jodhpur	Jodhpur	Operating	Small	Cement 100 TPD
57.	M/s Balaji Kripa Cement Pvt Ltd	Khasara No 643 Pundlu Post Borunds	Kihsangarh	Operating	Small	Cement 50 TPD
58.	M/s Meera Cement (P) Ltd	Post Office Gotan Distt. Nagaur	Kihsangarh	Operating	Small	Cement 50 TPD
59.	M/s Agarwal Cement Pvt Ltd.	Gotan Distt. Ngaour	Kihsangarh	Operating	Small	Cement 500 TON
60.	M/s Bharosa Cement Pvt Ltd	Sp-1 RIA Neem Ka Thana Distt. Sikar	Sikar	Operating	Small	Cement135 TPD
61.	M/s Patodia Cement	Sikar Distt. Sikar	Sikar	Closed	Small	Cement
62.	M/s Solar Cement	Sikar Distt. Sikar	Sikar	Closed	Small	Cement
63.	M/s Sorabh Cement Pvt Ltd	Jhalara Distt. Sikar	Sikar	Operating	Small	Cement 200 TPD
64.	M/s Bhairaw Cement Pvt Ltd	E-12 Ambaji Ind. Area Abu Road	Pali	Closed	Small	Cement
65.	M/s Pluton Cement PVT.LTD.	Plot No.-52-54 A, Industrial Area No-III, Pithampur, Dhar, M.P	Dhar	Operating	Small	Cement
66.	M/s Abu Industry	Ratlam Road, M.P.	Dhar	Operating	Small	Cement
67.	M/s Polyport Cement Pvt. Ltd.	Plot No.-63, Industrial Area No-III, Pithampur, Dhar, M.P	Pithampur	Operating	Small	Cement
68.	M/s Rajat Cement Pvt. Ltd.	Sardarpur, Dhar, M.P.	Dhar	Operating	Small	Cement
69.	M/s Mohata Cement	Dhar, M.P.	Dhar	Operating	Small	Cement
70.	M/s Platinum Pvt. Ltd.	Trilla Village, Dhar, M.P.	Dhar	Operating	Small	Cement

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71.	M/s Sadguru Pvt. Ltd.	Jiradad, Dhar, M.P.	Dhar	Operating	Small	Cement
72.	M/s Nagouri Cement Pvt. Ltd.	Bagh, Tanda, M.P.	Bagh	Operating	Small	Cement
73.	M/s Natural Cement Pvt. Ltd.	Manawar, M.P.	Manawar	Operating	Small	Cement
74.	M/s Vandana Cement Pvt. Ltd.	Bagh, M.P.	Bagh	Operating	Small	Cement
75.	M/s Dev Shree Cement Pvt. Ltd.	Bagh, M.P.	Bagh	Operating	Small	Cement
76.	M/s Suvidha Commercial Cement Pvt. Ltd.	Rajgarh, M.P.	Rajgarh	Operating	Small	Cement

000043

Annexure-II
Industry specific observations

S. No	Name of the Plant	Capacity	Wastewater treatment facility	APCDs installed	Type of fuel	Observations
1	M/s Metro cement & mines Pvt. Ltd., Pipar city, Rajasthan	100 TPD	Wastewater collection pit	Wet scrubber, Bag filter	Pet coke	• Housekeeping was poor, • safety mask available, • stack emission observed, • Laboratory facility available
2	M/s Marru Minerals & Chemicals, Prithvipur, Jaitaran Pali, Rajasthan	50 TPD	Facility not available	Bag filter	Pet coke	• Housekeeping was poor , • Safety mask not available, • Bag Filter not properly attached, • Laboratory facility available
3	M/s Kharia Minerals & Chemicals, Jaipur Road, Kharia, Meethapur, Rajasthan	50 TPD	Settling tank, Reuse in process	Wet scrubber, Bag filter	Pet coke	• Housekeeping was poor , • safety mask not available, • Bag Filter not properly attached • Laboratory facility available.
4	M/s Meera Cement (p) Ltd, Post-Gotan, Rajasthan	50 TPD	Soak pit	Bag filter	Coal	• Housekeeping was poor, • Safety mask not available, • Bag filter not properly attached,
5	M/s Angira Cement Works (P) Ltd. Ajmer Road, Nagour, Rajasthan	50 TPD	Settling tank, Waste water reused in plantation	Wet scrubber, Bag filter	Pet coke	• Plant was not in operational from last 5 years.

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6	M/s Gajali Cement (P) Ltd. RansiGaon, Bilara, Rajasthan	50 +50 TPD	Facility not available	Dust settling chamber, Bag filter	Pet coke	• Plant is under re-commissioning stage
7	M/s Nokha Cement (P) Ltd. RIICO Industrial Area, Bikasar, Nokha, Bikaner, Rajasthan	50 TPD	Settling tank, Reused in process	Dust settling chamber, Bag filter	Coke dust	• Plant was not in operation from one week due to shortage of raw materials, • Housekeeping was poor, • safety mask not available, • In the same premises RCC pipes are also being manufactured by the same plant officials.
8	M/s Tiger Cement (P) Ltd.B-9, RIICO Industrial Area, Nokhamandi, Bikaner, Rajasthan	50 TPD	Facility not available	Dust settling chamber, Bag filter	Coal dust	• Plant was not in operation from 2 months, • Housekeeping was very poor, • safety mask not available, • 8 CCTV cameras installed in the plant premises, • Raw materials stored openly.

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9	M/s Sarvottam Cement (P) Ltd, Deganagarcharkara, Nokha, Rajasthan	50 + 50 TPD	Settling tank, Reused in process	Dust settling chamber, Bag filter	Coke dust	• Only grinding unit operated in whole year • Clinker purchased from M/s J.K. Lakshmi Cement and M/s Bangar Cement , • Housekeeping poor, • safety mask not available, • Bag filter not properly attached • Laboratory facility available.
10	M/s Hanumant Cement Pvt. Ltd, Mundwa, Jaguar, Rajasthan	50 TPD	Facility not available	Bag filter	Pet coke	• At the time of visit plant was not in operation and informed that is was closed from last 5 months, • Maximum time purchased clinker from M/s Ambuja cement & M/s J.K Laxmi Cement and grinded the clinker, • Housekeeping poor, • safety mask not available, • Bag filter not properly attached,
11	M/s Sumati Pvt. Ltd. Beramsar, Ratangard, Rajasthan	–	–	–	–	• Plant closed from 1994 and looking for sale out.

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12	M/s Swati Pvt. Ltd. Beramsar, Ratangard, Rajasthan	–	–	–	–	• Plant closed from 31.12.96 and looking for sale out.
13	M/S Suman Pvt. Ltd. Beramsar, Ratangard, Rajasthan	–	–	–	–	• Plants closed from last 16 years and looking for sale out.
14	M/s Balaji Kripa Cements (p) Ltd, Khasrano.-643, Village Pundlu, Merta City, Nagaur, Rajasthan	50 TPD	Facility not available	Dust settling chamber, Bag filter	Coal dust	• Housekeeping was poor, • safety mask not available, • Bag filter not properly attached, • Old name M/s Surana Cement Pvt. Ltd. • Maximum time grinding unit operated by purchasing clinker.
15	M/s Raj Cement Works, Gotan, Ditt.- Nagour, Rajasthan	50 TPD	Facility not available	Bag filter	–	• Throughout the year operated the grinding unit only by purchasing of clinker from M/s Ambuja cement, • Housekeeping was poor, • VSK Not operated from beginning.
16	M/s Mahadeo Cement Works(P) LTD., Bikaner Road, Gogelav, Nagour, Rajasthan	50 TPD	Settling tank and treated water used for plantation	Wet scrubber, Bag filter	Coke dust	• Housekeeping was poor, • safety mask not available, • Bag filter not properly attached, • Laboratory facility available, • Closed shed provided for collection of raw material, • Stack monitoring platform was found broken.

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17	M/s Astha Cement (P) Ltd.G-1-140 To 143,R IICO Industrial Area, Phase-I, Behror (Alwar), Rajasthan	100TPD	Facility not available	Dust settling chamber, Bag filter	Pet coke	• Throughout the year operated the grinding unit only by purchasing of clinker from M/s J.K. Lakshmi & Shree cement , • Housekeeping was poor, • safety mask not available, • Water used for domestic purpose.
18	M/s Prime Cement (P) Ltd.E-1-107, B-108 , RIICO Industrial Area, Behror, Alwar, Rajasthan	50 TPD	Facility not available	Dust settling chamber, Bag filter	Pet coke, Coke breeze	• Manly used the Grinding unit & purchased the clinker from J.K. Lakshmi, Shree cement & Mangalam Cement, • Housekeeping poor, • Filter not properly attached, • 40 KVA DG. Set installed
19	M/s Premier Infra (Unit of Thukral Cement Works PVT. LTD. E-33 & 34 , RIICO Industrial Area, Behror, Rajasthan	150TPD	Soak pit (Domestic)	Cyclone, bag filter	_	• Only grinding unit exist and VSK not installed, • Clinker purchased from M/s Shree Cement & M/s J.K. Laxmi Cement.
20	M/s Premier Texto Trade Pvt. Ltd, F-62 To 64 & G-93 To 95 , RIICO Industrial Area, Behror, Rajasthan	50 TPD	Soak pit (Domestic)	Cyclone, bag filter	Pet coke	• Throughout the year operated the grinding unit only by purchasing of clinker from M/s J.K. Lakshmi & Shree cement • Housekeeping poor, • safety mask not available, • DG Set of 125+125KVA available

21	M/s A.K. Engineering Works, G-1/145,RIICO Ind. Area, Behror, Alwar, Rajasthan	50 +50 TPD	Soak pit (Domestic)	Sleeve Bag House	–	• Only grinding unit exist and VSK not installed, • Clinker purchase from M/S Shree Cement & M/S Laxmi Cement.
22	M/s Madhu Cement (P) Ltd. E- 27-28 RIICO Ind. Area, Behror, Alwar, Rajasthan	–	–	–	–	• Plant closed from 1997.
23	M/s Jyoti Cement (P) Ltd. F- 68-70-86-88, RIICO Ind. Area, Behror, Rajasthan	25 +25 TPD	Soak pit (Domestic)	Cyclone, bag filter	Pet coke	• Throughout the year operated the grinding unit only by purchasing of clinker from M/s J.K. Lakshmi ,M/s Ambuja cement & Shree cement • VSK was completely closed, • Housekeeping was very poor, • safety mask not available, • Plant operated by M/s JCL Cement PVT. LTD.
24	M/s J.C.L. Cement (P) LTD.F—67 & 68A , RIICO Ind. Area, Behror , Rajasthan	75 +75 TPD	Soak pit (Domestic)	Bag filter	Pet coke	• Maximum time in a year purchased clinker from M/s J.K. Lakshmi, M/s Ambuja cement & Shree cement and grinded the clinker, • Closed VSK from one year, • Housekeeping was very poor, • Safety mask not available.

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25	M/s Gori Cement (P) LTD.A—19 , RIICO Ind. Area, Behror , Rajasthan	50 TPD	Facility not available	Bag filter	Pet coke	• Maximum time of throughout year purchase clinker from M/s J.K Lakshmi& Shree cement and grinded the clinker, • V.S.K. Closed from 2004, • Housekeeping very poor, • Safety mask not available.
26	M/s Gopalji Cement (P) Ltd. A—20 -B , RIICO Ind. Area, Behror, Rajasthan	72 TPD	Soak pit (Domestic)	Bag filter	_	• Only grinding unit existing, • VSK not installed • Clinker purchased from M/s Shree Cement & M/s J.K. Laxmi Cement.
27	M/s Sailesh cement Udyog (P) LTD.A—21-B, RIICO Ind. Area, Behror, Rajasthan	50 TPD	Facility not available	Bag filter	_	• Only grinding unit available, • No VSK exists, • Clinker purchased from M/s Shree Cement & M/s J.K. Laxmi Cement.
28	M/s Saluja Minerals Pvt. Ltd. A—24 -A, RIICO Ind. Area, Behror , Alwar, Rajasthan	30 TPD	Soak pit (Domestic)	Bag filter	_	• Only grinding unit exist, • VSK not installed, • Clinker purchased from M/s Shree Cement & M/s J.K. Laxmi Cement.
29	M/s Tirupati Cement Pvt. Ltd. E—37 , RIICO Ind. Area, Behror, Alwar, Rajasthan	50 TPD	Facility not available	Dust settling chamber, Bag filter	Pet coke	• Throughout the year purchased clinker from M/s J.K. Lakshmi & Manglam cement and grinded the clinker. VSK not operated & closed, • Housekeeping very poor, • Safety mask not available. • 200 KVA DG Set available

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30	M/s Great India Cement PVT.LTD.F—58, Phase-I, RIICO Ind. Area, Behror, Alwar, Rajasthan	50 TPD	Soak pit (Domestic)	Bag filter	_	• Only grinding unit exists, and VSK not exists, • Clinker purchased from M/s Shree Cement & M/s J.K. Laxmi Cement.
31	M/s Vijeta Cement PVT.LTD.E—104,RIICO Ind. Area, Behror, Rajasthan	50 TPD	Soak pit (Domestic)	Bag filter	Pet coke	• Maximum time in a year purchased clinker from JK Lakshmi & Shree cement and grinded the clinker, • VSK not operated from two years, • Housekeeping very poor, • Safety mask not available.
32	M/s Gunjan Cement PVT.LTD.59-61 A,RIICO Ind. Area, Behror, Rajasthan	50 TPD	Soak pit (Domestic)	Cyclone, bag filter	Pet coke	• Maximum time in a year purchased clinker from M/s JK. Lakshmi & Shree cement and grinded the clinker and not operated the VSK. • Housekeeping was very poor.
33	M/s Aditya Cement PVT.LTD.E-18, RIICO Ind. Area, Sotanala, Behror, Rajasthan	50 TPD	Soak pit (Domestic)	Bag filter	_	• Only grinding operated and VSK not exist in the plant , • Clinker purchased from M/s Ambuja Cement & M/s J.K. Laxmi Cement.
34	M/s Anita Cement PVT.LTD.F-74-82, RIICO Ind. Area, Behror, Alwar, Rajasthan	50 TPD	Soak pit (Domestic)	bag filter	Pet coke	• Maximum time during the year purchased clinker from M/s JK Lakshmi & Manglam Cement and grinded the clinker • V.S.K. Closed , • Housekeeping very poor.

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35	M/s Jayshree Krapa Cement PVT.LTD.G-1,F-27,18, RIICO Ind. Area, Sotanala, Alwar, Behror , Rajasthan	50 TPD	Soak pit (Domestic)	Bag filter	–	• Only grinding unit, • No VSK installed, • Clinker purchased from M/s Shree Cement & M/s J.K. Laxmi Cement.
36	M/s Namo Cement LTD. Kotputali, Sarund, Jaipur, Rajasthan	50 +50 TPD	Septic pit, Settling tank	Wet scrubber, Bag filter	Coal	• Housekeeping poor, • safety mask not available, • Bag filter not properly attached.
37	M/s Teesta Cement Private Limited, Kotputali, Rajasthan	50 TPD	Settling tank	Wet scrubber, Bag filter	Coal	• Housekeeping very poor, • Safety mask not available. • 200 KVA DG. Set available • I.D. Fan attached with stack was not properly working
38	M/s Abu industry, Ratlam Road, M.P.	10 +20 TPD	Soak pit	Wet scrubber, Bag filter	Pet coke	• Housekeeping poor, • safety mask not available, • Bag filter not properly attached.
39	M/s Pluton Cement PVT.LTD. Plot No.-52-54 A, Industrial Area No-III, Pithampur, Dhar,(M.P)	20 +20 TPD	Facility not available	Reverse jet bag filters, Suction blower with cyclone	Pet coke	• Housekeeping poor, • Safety mask not available.

40	M/s Polyport Cement Pvt. Ltd. Plot No.-63, Industrial Area No-III, Pithampur, Dhar, (M.P)	25 +25 TPD	Septic tank	Reverse jet bag filters, Suction blower with cyclone, Wet scrubber	Pet coke	• The industry have their own lime stone mines, • All the plant & machinery are and internal roads were made cemented floor, • Thick plantation developed in and around the plants boundary, • Easy ladder and port hole provided for monitoring of stack emissions.

000053

View of VSK

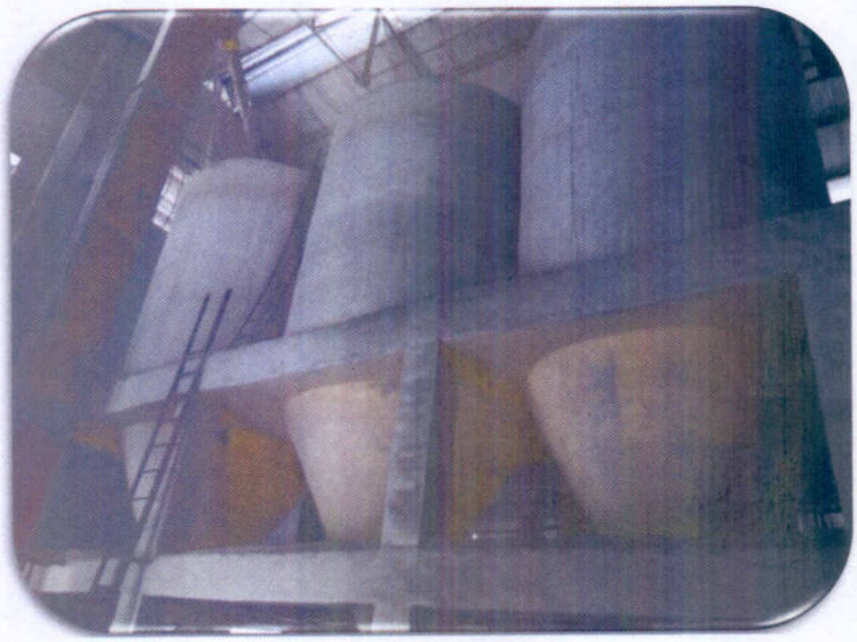
View of VSK

Lime Stone Crushing

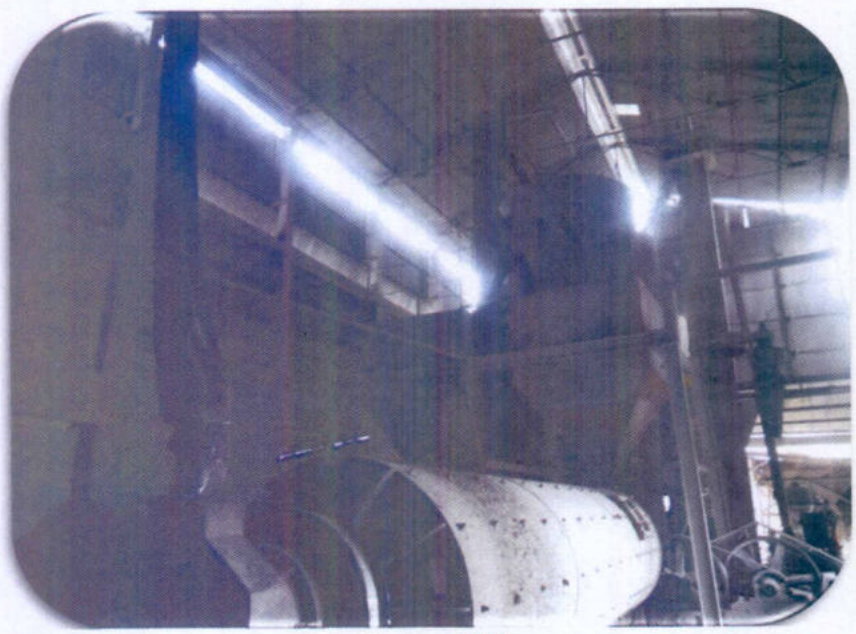
Lime Stone Crushing

Hammer Mill

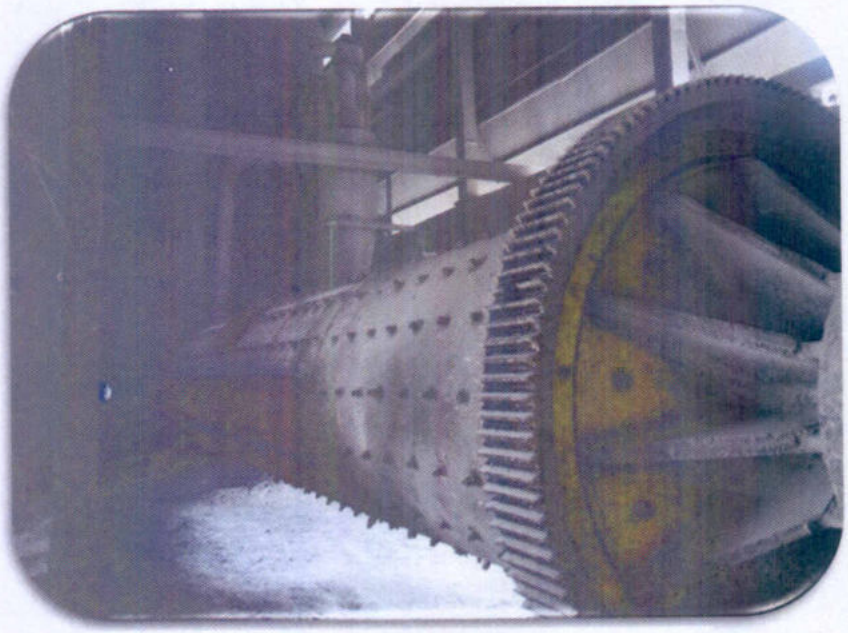
Weigh Feeder



Raw Material Silo



Raw Mill



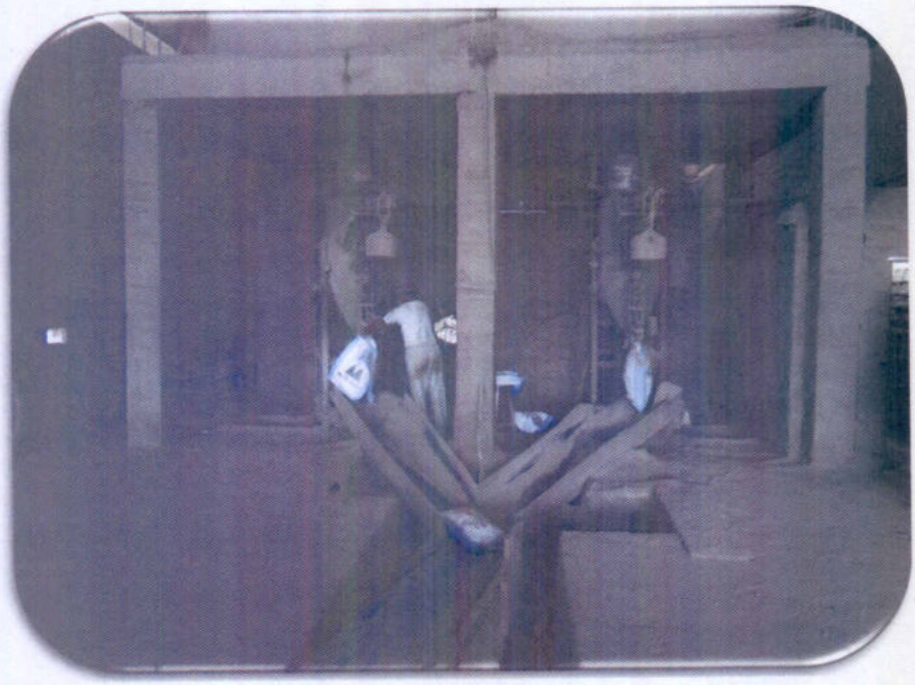
Cement Mill

Cement Mill Silo

Cement Packing Machine

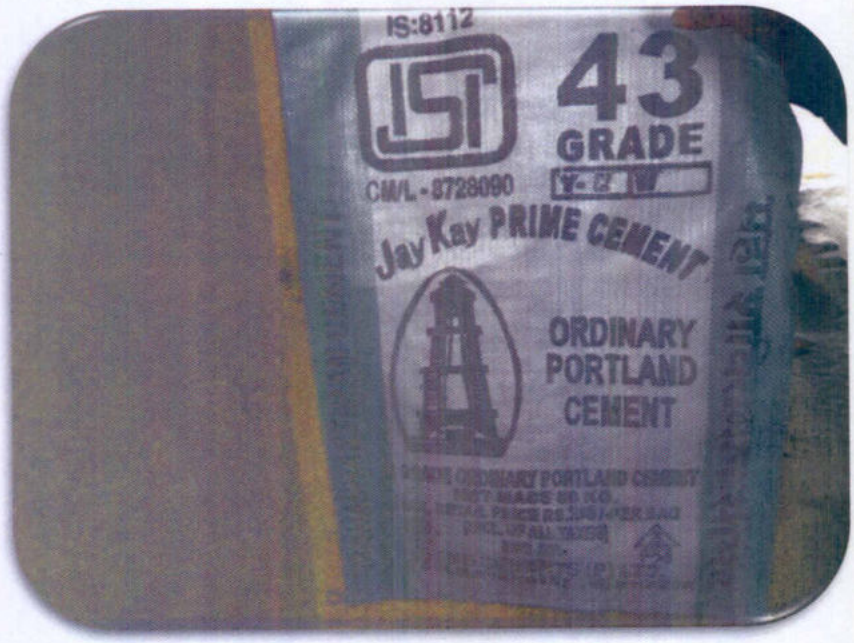
Cement Packing Machine

Cement Packing & Loading Section



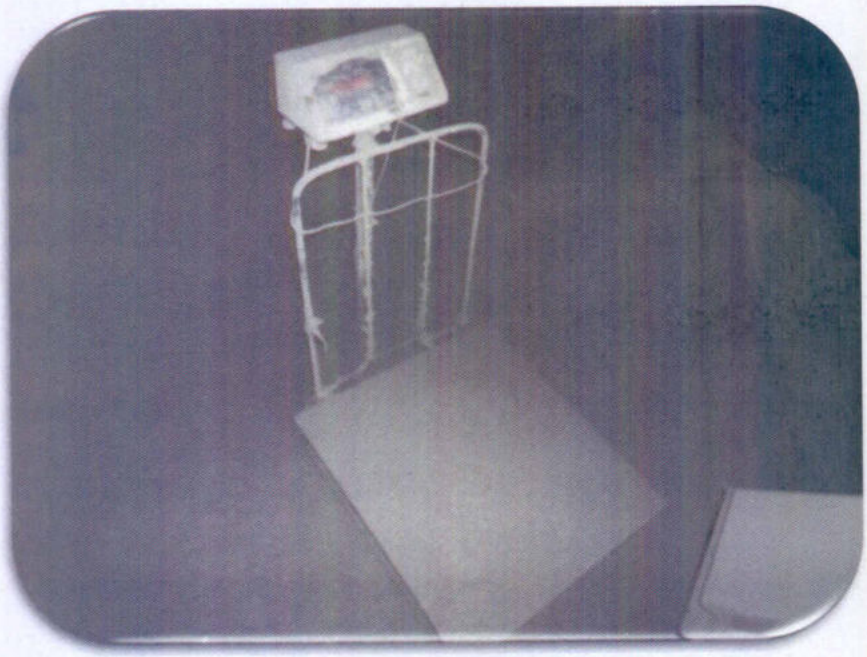
Cement Packing & Loading Section

Storage of Cement



Cement Packing Bag

Weighing Machine

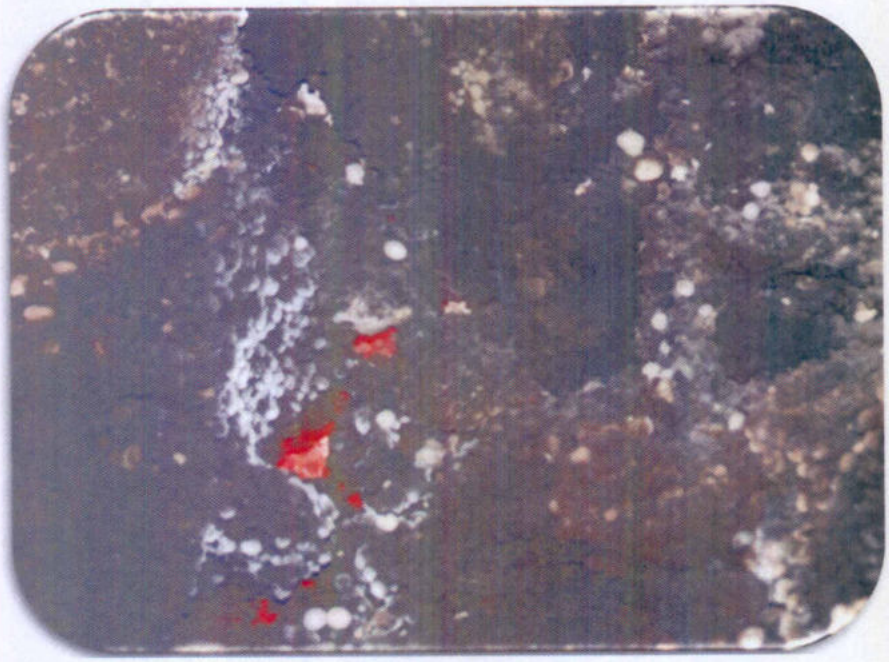


Weighing Machine

Laboratory

Laboratory

Clinker Formation in VSK



View of Clinker in VSK

Bag Filter Not Properly Attach

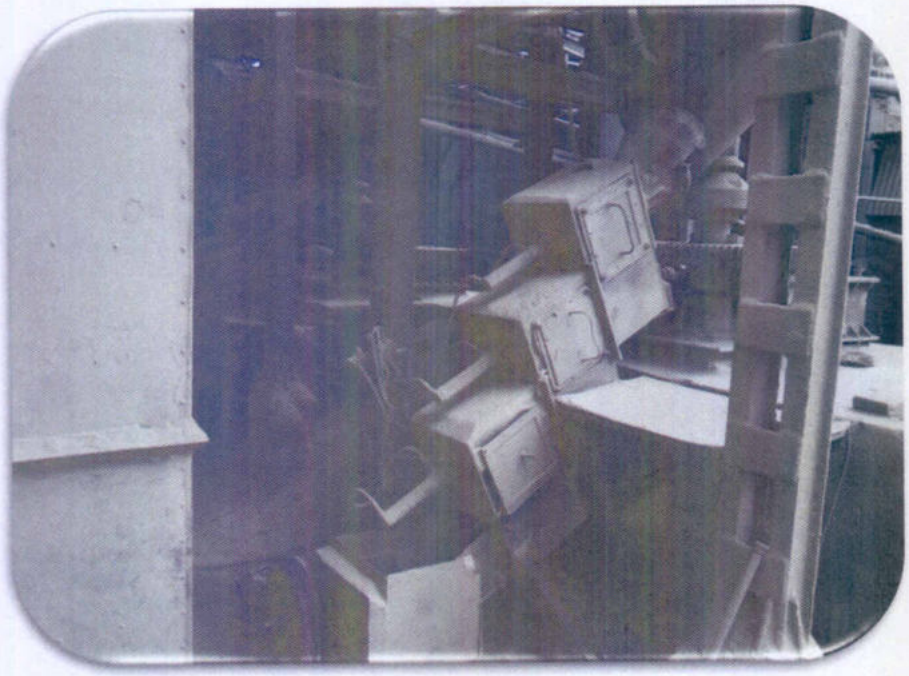
Bag Filter Properly Attach

Loader Use For Transportation

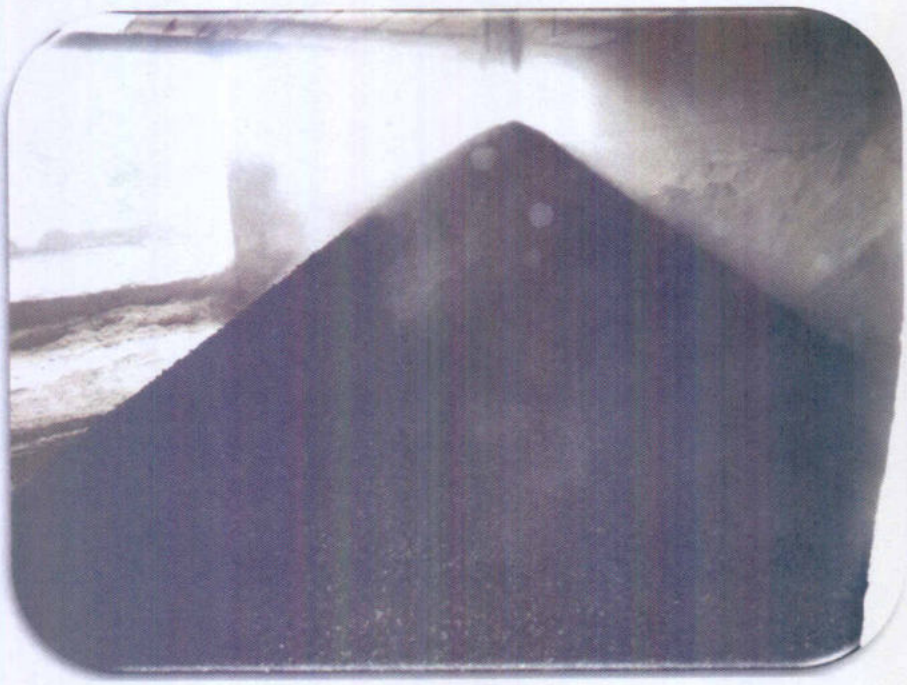
Loader Use For Transportation

Oil Used In Mill Pinion

Waste Oil



Triple Looking System For Clinker Storage



Storage of Clinker

Bag House & Cyclone

Bag House

D. G. Set

Plantation

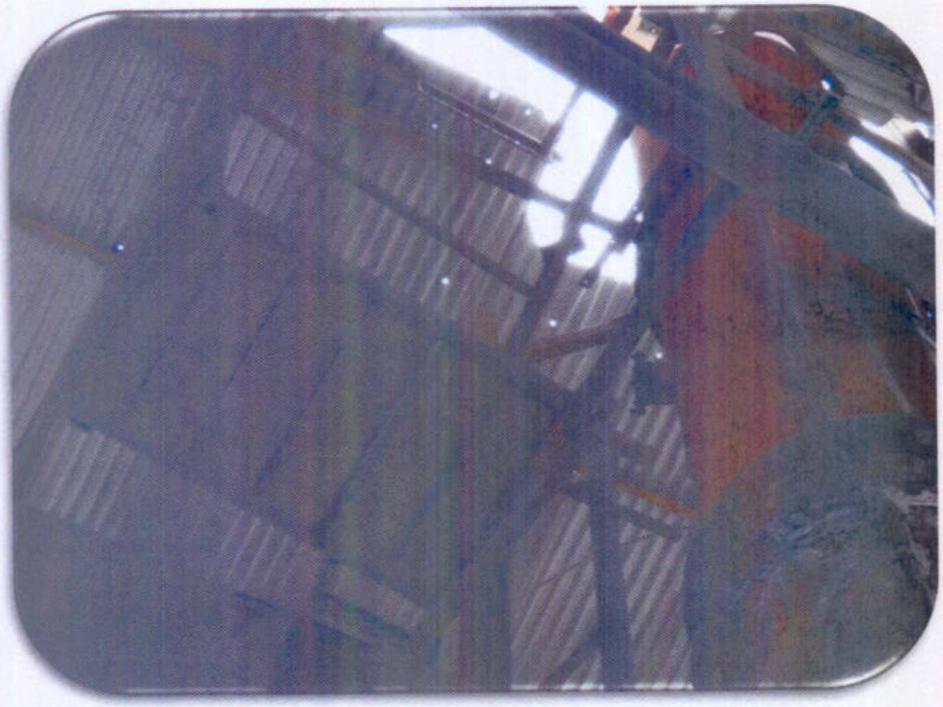
Wet Scrubber Attach With Stack

View of Wet Scrubber

View of House Keeping

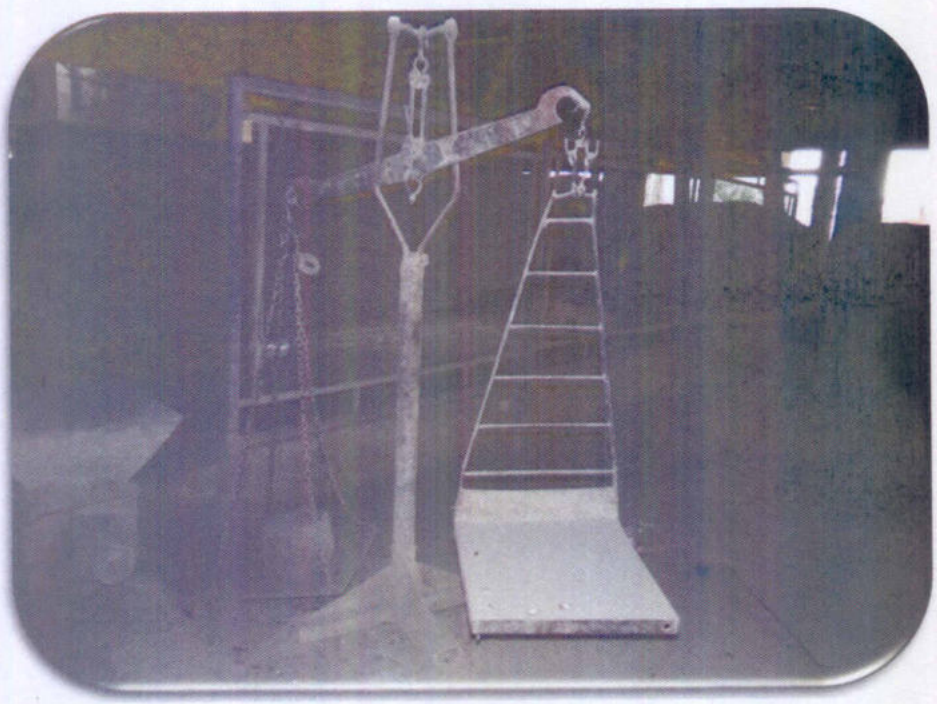
View of House Keeping

Stack Monitoring Platform



Stack Monitoring Platform

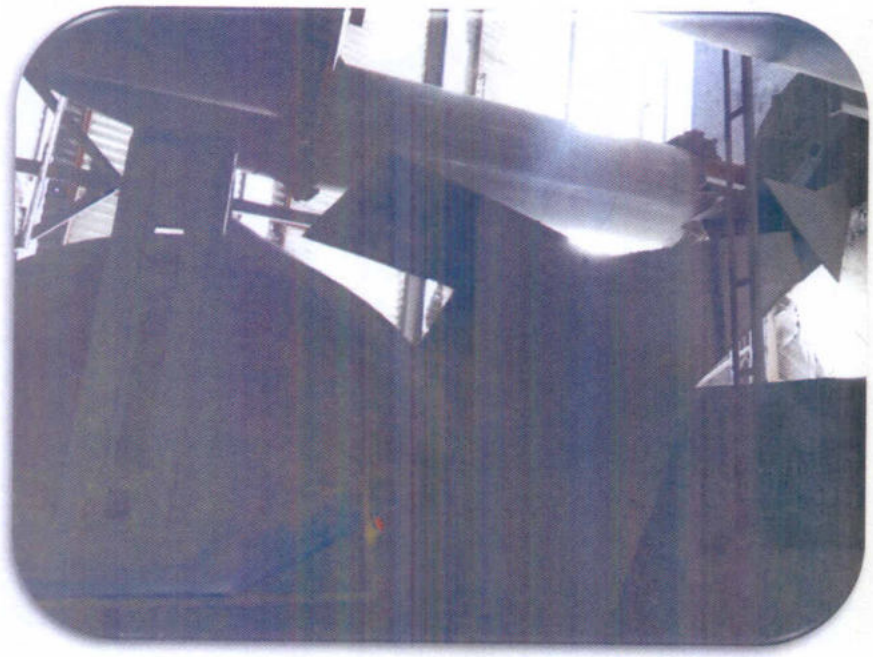
Weighing Machine Use For Weight Purpose



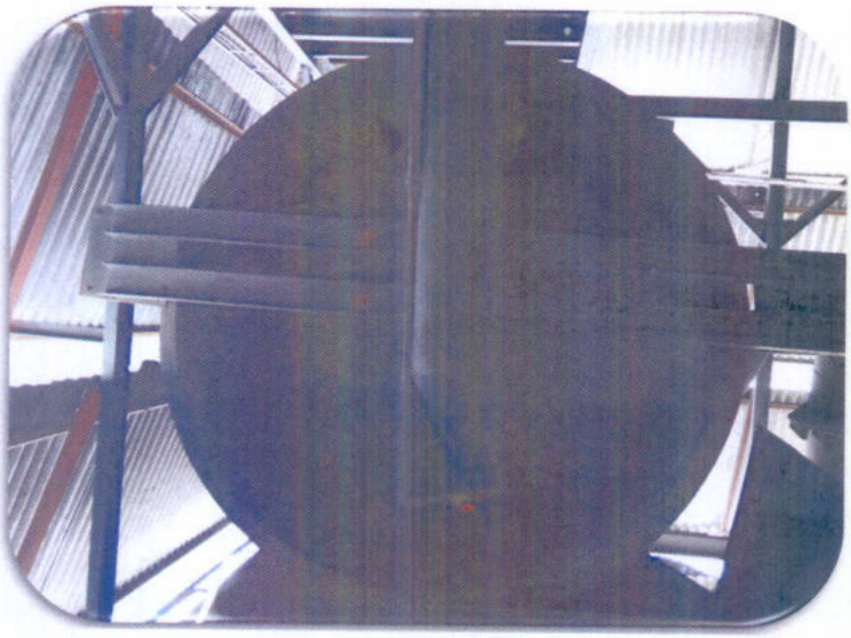
Weighing Machine Use for Weight Purpose

Stack Monitoring of Mini Cement Plant

Fugitive Emission Monitoring of Mini Cement Plant

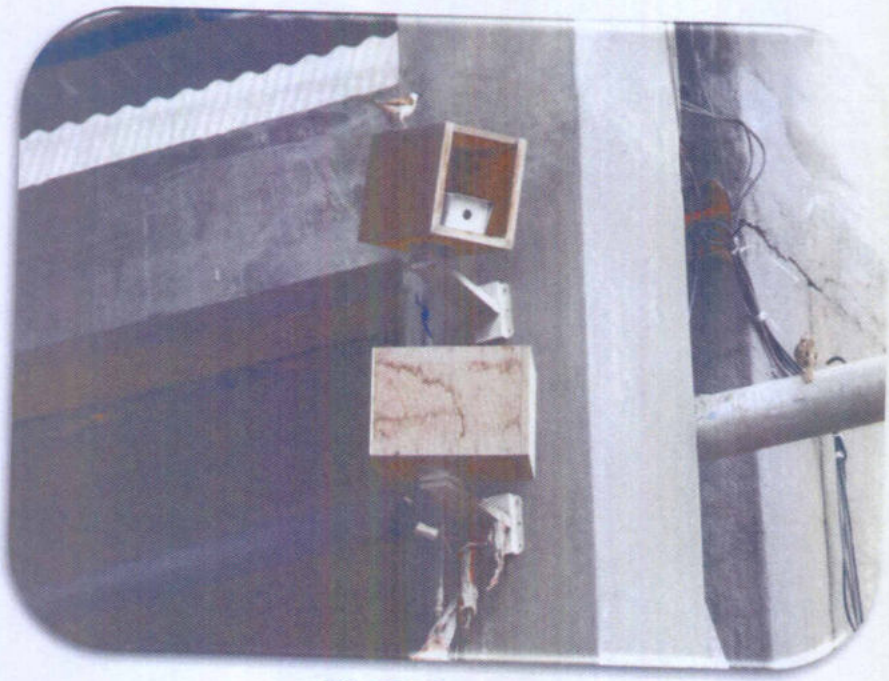


View of Nodulizer



View of Nodulizer

CCTV Monitor

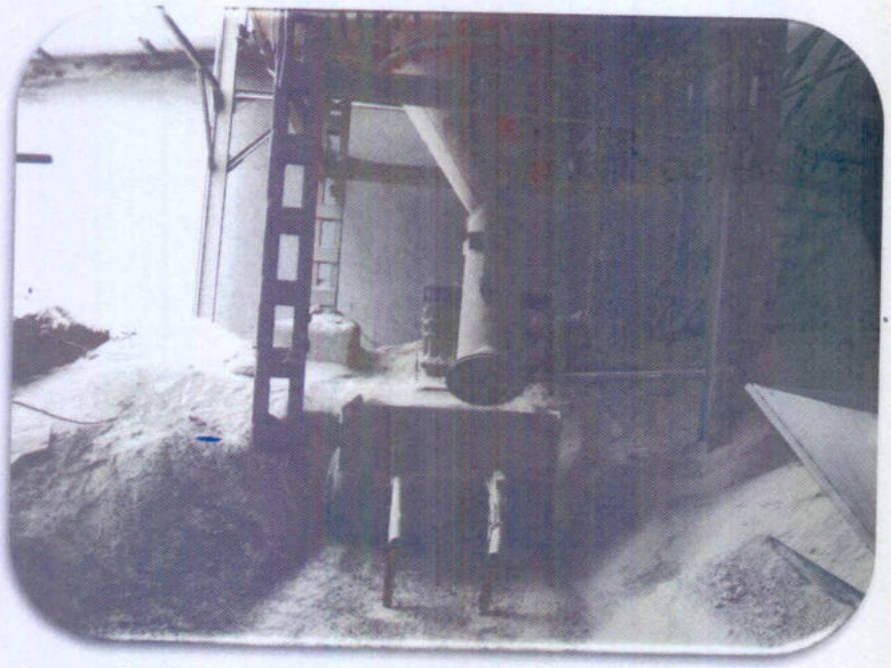


CC TV Camera

Dust Settling Chamber Attach With VSK

Dust Settling Chamber Attach With VSK

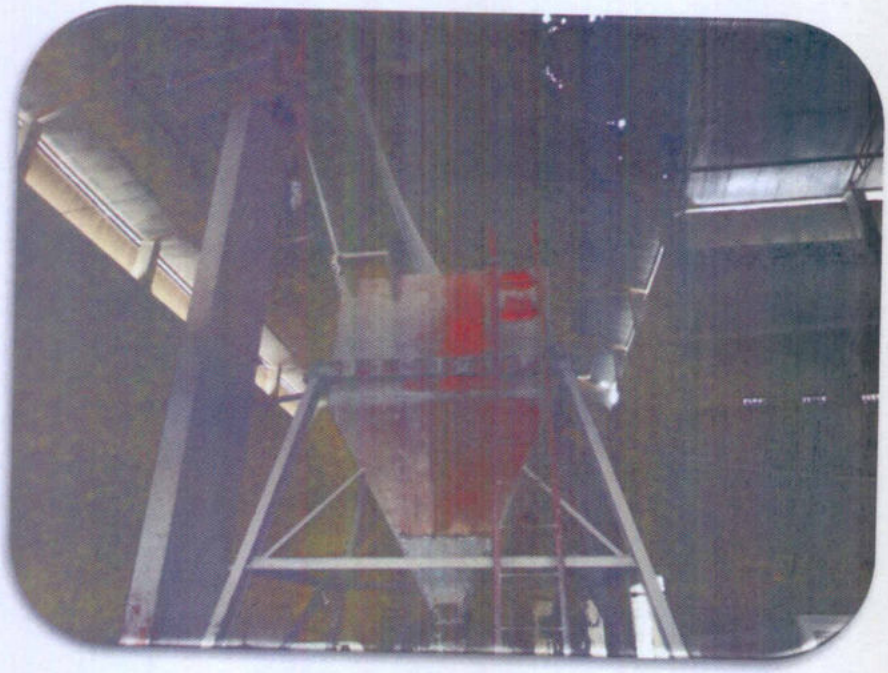
Dust Collection System At Transfer Point



Clinker Collection Throws Hand Trolley

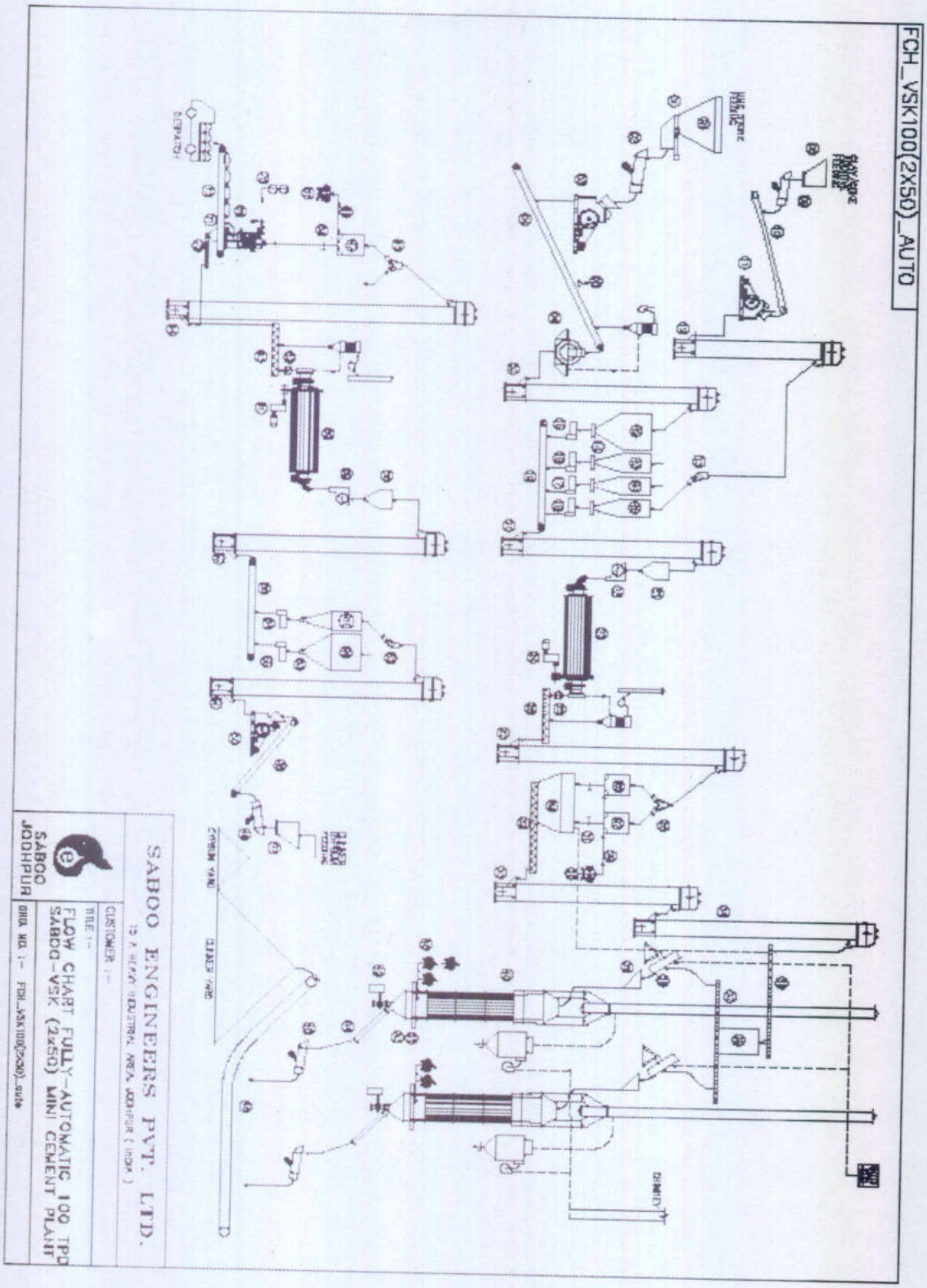
Exhaust Fan

Bag Filter Attach With Cement Mill



Bag Filter Attach With Hopper

Bag Filter Attached With Hammer Mill


FCH_VSK100(2X50)_AUTO
SABOO ENGINEERS PVT. LTD.
SABOO
JODHPUR
FLOW CHART FULLY-AUTOMATIC 100 TPD
SABOO-VSK (2x50) MINI CEMENT PLANT