CHAPTER IV

ENVIRONMENTAL SAFEGUARDS PROVIDED BY THE CASE UNIT

4.1 Introduction
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4.1 INTRODUCTION

In this chapter, a brief explanation of the sources of dust and air pollutant emission, noise pollution, equipments available to combat pollution, the safeguards provided by the case unit to monitor the standards fixed by the Tamil Nadu Pollution Control Board are given. This study has been made with the help of data collected from published and unpublished documents. The important sources of data are the technical books available in Madras Cements Limited and documents given by the Works Department of the factory concerned. Primary data were collected through the interview, the researcher had with the Works Manager with regard to the steps taken by the case unit to combat pollution.

4.2 THE CEMENT INDUSTRY AND ENVIRONMENT

The cement industry in India over a period of seventy years has come a long way from a very humble start to the present capacity of around 44 million tonnes and is likely to reach around 62 million tonnes by the end of the seventh plan.

In cement industry, the pollution is caused by the
dust particles discharged through the kiln stack gases which carry dust particles and throw them out into the atmosphere through chimneys. It may be mentioned that there is no emission of abnoxious gases or harmful chemical fumes as in the case of some of the chemical industries.

Cement dust causes nuisance and discomfort to those within the factory as well as to those in the neighbourhood. "Various studies have revealed that cement kiln dust is neither hazardous to crops nor harmful to human beings. Therefore, the objective of pollution control in cement industry is to ensure a cleaner and more comfortable atmosphere within the factory and outside.

The equipments used in cement manufacture contribute a small proportion towards noise pollution. It has the effect of reducing the hearing capacity of workers. So it must be given due care.

4.3 SOURCES OF DUST POLLUTION IN CEMENT INDUSTRY

4.3.1 Raw material Crushing

The limestones received from the quarry are crushed in single stage or double stage high speed impactor. The impactor produces a lot of dust due to the fan action of Rotor. The dust generated is arrested by Cyclone Separator
since the dust particles are relatively coarser in nature. Bag filters are used now-a-days to collect the dust particles.

4.3.2 Raw material Grinding

Raw material i.e. limestone is ground into powder with or without water depending upon the type of process. The problem of dust is encountered more in the case of Dry Grinding. In the case of dry grinding dust generated is arrested by the use of Bag filters and Electrostatic Precipitators (ESP).

4.3.3 Clinkerisation Process

Dust particles are carried away by the exhaust gases of the kiln during the clinkerisation process. The dust emitted from the kiln during this process is the major source of air pollution. The exhaust gases containing dust particles are vented out through the tall chimneys and they get deposited in the surrounding areas. Electrostatic Precipitators are extensively used in kiln operations to control dust emission. Bag houses or filters are installed at certain places. "The dust concentration in the raw gas is around 100-1000 gm/nm^3".
4.3.4 Coal Mills

In the coal mill, dust is generated during the pulverisation of the coal. In certain cement plants coal dust laden gases are fed back to the kiln as secondary air. In the cement plants where the above process is not possible, considerable pollution is caused by the coal dust. In such plants, some collection devices must be installed. Coal dust being explosive in nature needs special safety consideration while selecting the dust collection device. Bag filters and Electrostatic precipitators are used to dedust the coal mill vent gases. "The dust load is between 30-40 gm/m³".3

4.3.5 Clinker Cooler

There are two types of clinker coolers namely Planetary Cooler and Grate cooler. Since the Planetary cooler is at the end of the outlet of the kiln, the air blown out is utilised for secondary combustion in the kiln. Hence there is no particulate emission. But in the case of Grate cooler, only a part of the air blown out is used for combustion in the kiln and the rest is emitted which has the effect of polluting air. Multicyclones are found to be satisfactory to dedust the outgoing gases. Of late, gravel bed filters
and Electrostatic precipitators are being installed for the above purpose to reach the stipulated values of emission. "Here the dust loading is between 7-14 gm/nm³." 4

4.3.6 Cement Grinding

Considerable cement dust is generated during the grinding operation. Until very recently, almost in all cement plants, cement mills were provided with Bag type dust collectors for filtering the exhaust gas. Pulse jet type of dust collectors are used and found to be fruitful. Now-a-days Electrostatic precipitators are installed for controlling the emission. "The dust concentration in this process is 80-500 gm/nm³." 5

4.3.7 Packing House and other Miscellaneous Sources

The other sources of dust emission are packing units, crushers, silos and conveying systems. Measurement of dust nuisance can be made in the packing units only. "The measurements revealed that dust concentration from packing units is in the range of 26-45 gm/nm³." 6 At present bag filters are in use for controlling the dust emissions from packing units. Silos and crushers are replaced by fabric filters.
TABLE 4.1

Dust generation in Cement Plants

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sources</th>
<th>Normal Dust generation Ranges in cement plants (g/Nm&lt;sup&gt;3&lt;/sup&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Crusher</td>
<td>5-15</td>
</tr>
<tr>
<td>2.</td>
<td>Raw Mill</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Gravity discharge</td>
<td>20-80</td>
</tr>
<tr>
<td>2.2</td>
<td>Air Swept (e.g. Roller Mills)</td>
<td>300-500</td>
</tr>
<tr>
<td>3.</td>
<td>Coal mill</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Gravity discharge</td>
<td>20-80</td>
</tr>
<tr>
<td>3.2</td>
<td>Drying &amp; Grinding</td>
<td>100-120</td>
</tr>
<tr>
<td>4.</td>
<td>Kiln</td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Dry</td>
<td>50-120</td>
</tr>
<tr>
<td>4.2</td>
<td>Semi-dry</td>
<td>10-20</td>
</tr>
<tr>
<td>4.3</td>
<td>Wet</td>
<td>30-50</td>
</tr>
<tr>
<td>5.</td>
<td>Clinker Cooler</td>
<td>10-15</td>
</tr>
<tr>
<td>6.</td>
<td>Cement mill</td>
<td>150-250</td>
</tr>
<tr>
<td>7.</td>
<td>Packing plant</td>
<td>20-40</td>
</tr>
<tr>
<td>8.</td>
<td>Material Handling Operations</td>
<td>10-30</td>
</tr>
</tbody>
</table>

Source: Cement Data Book.
Table 4.1 shows clearly the sources of dust generation in a cement plant. It also depicts the dust generation ranges in the cement plant at various sources.

In the case of cement plants, pollution is predominantly caused by the particulates which go along with the gases from kiln stacks. Fortunately these gases do not contain any toxic chemicals.

The flue gases from the cement kiln consist substantially of Nitrogen($N_2$) Oxygen($O_2$) Carbon-di-oxide($CO_2$) and water vapour. In addition, small amounts of sulphur compounds and Nitrogen oxide as well as Carbonmonoxide and Hydrogen Sulphide may be present.

4.4 SOURCES OF NOISE POLLUTION

The environmental nuisance caused by the noise has increased constantly in recent years. Noise is a growing cause of complaint particularly in urban and industrial areas. Many people are annoyed by excessive noise to which they are exposed against their will. Traffic noise annoy the people much. Industrial plants and all types of noise producing equipment present a nuisance to the workers of the plant.

In cement industry the source of noise is from the
heavy plants and equipments installed and also in the process of cement manufacture like removing rocks from the ground, reducing the rocks and mixing it with clay.

4.5 PURPOSE OF DUST CONTROL IN CEMENT PLANT

i) To improve conditions of industrial hygiene for greater worker comfort and efficiency.

ii) To eliminate or substantially minimise air pollution by preventing the travel of dust to surrounding areas.

iii) To reduce equipment maintenance and wear by preventing the dust from re-entering the working atmosphere of a machine or process.

iv) To recover valuable products which otherwise might escape into the atmosphere.

v) To achieve better house-keeping in the plant.

4.6 MEANS TO CONTROL AIR POLLUTION IN CEMENT INDUSTRY

There are several varieties of dust collection equipments depending upon the principles of operation. They are Cyclones and Multicylone Dust collectors, Scrubbers, Bag type dust collectors and Electrostatic Precipitators. The selection of equipment depends upon the volume of dust emitted and the necessity of arresting the dust emitted.
4.6.1 Electrostatic Precipitators (ESPs)

Electrostatic Precipitators have been found very successful in cement plants. Major pollution from a cement plant is generated from its kilns and Electrostatic Precipitators are found to be the most suitable equipment for dedusting the kiln exhaust gases. ESPs are also used for dedusting application like

i) Cement mill vent air
ii) Raw mill vent air
iii) Combined gases from kiln and raw mill
iv) Clinker cooler vent air
v) Coal mill vent gases.

ESPs are preferred to other dust handling devices due to the following reasons.

i) A well-designed, well-constructed ESP has minimum maintenance downtime.

ii) ESP is the only particulate collecting device that directly works on particles in the exit gases, electrically charging them and does not waste energy on gas stream.

iii) Minimum power consumption

iv) Higher collection efficiency can be achieved.

For handling ESP efficiently, precautions against fire
or explosion hazards must be taken. Systems like monitoring of gas parameters, triggering of fire extinguishers, installation of precision explosion discs etc., must form a part of the safety package. If these measures are not taken, the operation of ESP may be interrupted.

4.6.2 Bag Type Dust Collectors

Fabric filters used in Cement Industry are generally Bag type dust collectors. In the collector bags with maximum of 300mm diameter and upto 10 metres height are placed. The bags are made up of synthetic fibre or polyester or cloth. The dust laden gas flows through the porous medium in the bags and the particles are deposited in the voids. The particles deposited are removed either by blowing low pressure air in a reverse direction through the bags or by using short duration high pressure reverse air jets.

Bag filters can handle small particles in the submicron range at high efficiency of 99%.

In a cement plant, bag filters are used in the following areas:

i) Raw mill vent gases
ii) Cement mill vent gases
iii) Belt conveyors transfer points
iv) Coal mill vent gases
v) Dedusting of auxillaries
vi) Kiln exhaust gases.

For small gas volumes ESPs are uneconomical and hence bag filters are the best choice.

4.6.3 Cyclone Dust Collectors

Cyclone dust collectors are cheaper and easiest to maintain. These type of dust collectors are useful for coarser particles. In the case of very fine dust particles, the collection efficiency drops and they are not recommended for use with kiln exhaust gases.

4.6.4 Better House-Keeping

Better house-keeping contributes to a greater extent in controlling the fugitive dust. For example, covered storage for raw materials, coal, gypsum and clinker could reduce the general level of dust due to wind blowing in the Indian climatic conditions. Similarly, timely maintenance and upkeep of the plant and machinery helps in curtailing dust nuisance inside the plant. Development of green trees in and around the cement plant helps in reducing the dust nuisance to some extent.
TABLE 4.2

Suggested Controls for Dust Emission Sources

<table>
<thead>
<tr>
<th>Sources of Potential emission</th>
<th>Type of dust, collectors which may be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone crushing</td>
<td>Limestone</td>
</tr>
<tr>
<td>Raw material Milling &amp; Drying</td>
<td>Limestone</td>
</tr>
<tr>
<td>Coal handling and crushing</td>
<td>Coal</td>
</tr>
<tr>
<td>Coal milling</td>
<td>Coal</td>
</tr>
<tr>
<td>Kiln exhaust</td>
<td>Partially calcined</td>
</tr>
<tr>
<td>Clinker cooler exhaust</td>
<td>Cement clinker</td>
</tr>
<tr>
<td>Cement mill ventilation</td>
<td>Cement</td>
</tr>
<tr>
<td>Cement conveying and storage</td>
<td>Cement</td>
</tr>
<tr>
<td>Clinker conveying and storage</td>
<td>Cement clinker</td>
</tr>
<tr>
<td>Cement packing &amp; loading</td>
<td>Cement</td>
</tr>
</tbody>
</table>

Key to types of dust collector
A - Electrostatic Precipitator  B - Cyclone  C - Fabric filter
D - Dust suppression sprayers  E - Gravel bed filter

Source: T.M. Aggrawal and C.S. Sharma, Dust emission and control in cement plant, paper presented at National Symposium on Environmental Aspects in cement industry, organised by CMA.
Table 4.2 displays the type of dust generated from different sources of emission points and also the equipments which can be used to control the dust emission.

4.7 ACHIEVEMENT OF MADRAS CEMENTS LIMITED IN POLLUTION CONTROL

The major emission from cement plants is in the form of dust associated with kiln exhaust gases. The dust emitted from cement plants, however, have a considerable nuisance value, and is a source of nuisance to the employees of the factory and to those living in the neighbourhood. Accordingly the industry has taken appropriate measures to reduce dust emission. Madras Cements Limited situated in Ramasami Raja Nagar has taken all the required steps in keeping the environment clean. The cement plant has initiated all the programmes necessary for pollution control before the Pollution Standards come into existence. It has a strong commitment towards the pollution-free environment which is clear from the installations made in the plant.

The widely-accepted and practically used equipment is Electrostatic Precipitators briefly called as ESPs. In Madras Cements Limited, four Electrostatic Precipitators are in operation. They are installed as indicated below.
i Kiln : ESP with gas conditioning tower worth Rs. 85,00,000.

ii Cement Mill : ESP worth Rs. 55,00,000

iii Coal Mill : ESP worth Rs. 2,00,000

iv Cement Mill : ESP worth Rs. 28,00,000

The total investment on the Electrostatic Precipitators is Rs. 1,70,00,000. On seeing the amount of investment, we can understand clearly the importance given by the case unit to combat Air pollution. The supplier of ESP is S.F. Inia limited, Calcutta. The collection efficiency of ESP is 99.75% in Madras Cements Limited as against the standard 99.99% fixed by the suppliers.

The Madras Cements Limited has the practice of including the value of ESP under the head Plant & Machinery. For the purpose of knowing the interest shown by the case unit in the installation of pollution abatement equipments, an attempt has been made to find out the percentage of ESP value in the total value of Plant & Machinery.

For instance, the value of ESP installed in Cement Mill purchased during 1982 is Rs. 55,00,000. The value of Plant & Machinery during 1982 is Rs. 7,19,14,561.

Percentage of ESP value in P & M value = \( \frac{\text{Rs.} 55,00,000}{\text{Rs.} 7,19,14,561} \times 100 \)

= 7.5%
The prominent percentage level indicates that the company is showing keen interest in dust control. A limitation in this process is that the value of P&M is not the actual value but a depreciated one. At the same time the value of ESP installed very recently shows a high value, since the depreciation has not been provided.

Other than the ESPs, the plant is provided with bag type dust filters. Studies carried out by and outside agency have confirmed that bag-type dust filters are capable of collecting dust with very high efficiency. Hence efforts must be taken to improve the maintenance and operation of these bag filters, to keep emission within the stipulated limit. Madras Cements Limited is provided with five Bag filters. Their installation points are as follows:

1. Raw mill
2. Kiln feed
3. Blending Sylo-Top
4. &V Packing House

Thus packing house, where the dust emission is greater, is provided with two bag filters. The total investment of the case unit on Bag type filters is Rs. 60,00,000. The efficiency achieved ranges between 70-80%.
Cyclone dust collectors are also installed in this plant. Cyclone Separator worth Rs. 5,000 is installed in the coal mill.

4.7.1.1 Sincere Follower of Legislation

In Madras Cements Limited the authorities send the following monthly reports to the Tamil Nadu Pollution Control Board, Madras in compliance with Air (Prevention & Control of Pollution) Act 1981.

i Progress on the procurement and installation of equipments for monitoring ambient air quality in the chimney.

ii Meteorological data

iii Daily discharge of emissions through each chimney/Stack

iv Report of analysis of stack monitored and Ambient Air Quality monitored.

Development of green foliage in and around the plant is also one of the means to reduce air pollution. Tree plantation is done in a big way at Madras Cements Limited for checking air pollution and maintaining the ecological balance. The investment of the case unit for Vegetation purposes is worth Rs. 2,00,000. Coniferous trees at short intervals are planted. The trees planted act as a filter media.

Moreover Belt-cover is used in the conveyors used for the transport of raw-materials from one place to another. These belt-covers prevent the spreading of materials to the surrounding areas.
Limestone stock pile known as LSSP are also used to prevent the spreading of limestone particles to a larger area when dropped from a higher attitude. Telescopic Chute is helpful in avoiding dust pollution.

The emission standards fixed for the equipments installed at various points and the actual emission are given in the Table 4.3

<table>
<thead>
<tr>
<th>Nature of equipment</th>
<th>Installation Point</th>
<th>Standard Mgs/Nm$^3$</th>
<th>Actual Mgs/Nm$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESP</td>
<td>Kiln</td>
<td>250</td>
<td>200</td>
</tr>
<tr>
<td>ESP</td>
<td>Cement Mill</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>ESP</td>
<td>Coal Mill</td>
<td>250</td>
<td>55</td>
</tr>
<tr>
<td>Bag filters</td>
<td>Cement Mill</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>Bag filters</td>
<td>Packing House</td>
<td>250</td>
<td>55</td>
</tr>
</tbody>
</table>

Source: Report given by the Pollution Control Board

Mgs/Nm$^3$ - Milligrams/Notical metric cube.

Due to proper application of appropriate dust collection equipments, Madras Cements Limited has succeeded in monitoring the limit specified by the Tamil Nadu Pollution Control Regulation. On seeing the magnitude of investment made by the
case unit on pollution control equipments one can know its commitment to the society in giving pollution-free environment.

4.7.2 Noise Pollution Monitoring

As mentioned earlier, the main source of noise is from the operation of the plant and machinery used in the plant. To protect the employees from the evil-effects of noise, ear-plugs and ear moughs are given by Madras Cements Limited. The cost of twelve ear plugs is only about two rupees. Mostly all operations are done mechanically. So no human being is exposed to noise often and continuously. The operators are provided with Air-conditioned rooms where there is no scope for noise nuisance. In certain places, the working place is provided with two or three glass doors which has the effect of reducing noise to a considerable extent.

The company is doing the following to reduce the effect of dust on the workers. At the end of each shift the workers are given jaggery and coconut oil. The jaggery has the effect of removing the cement dust taken in by the workers. The coconut oil when put on the exposed parts of the body, has the effect of removing the cement dust found inside the holes on the skin. Moreover cada clothes and face masks are given to prevent the taking up of dust particles by the workers.
4.8 SUMMARY

This chapter gives an idea about the nature of pollution caused by cement industry, the use of equipments at various points to monitor the standard, and the efforts put forth by the case unit in maintaining acceptable air quality in surrounding areas. From the above discussions, it is easy to infer that Madras Cements Limited is reaching the point of perfection with regard to pollution control and in taking the necessary precautions required to keep its environment free from any form of pollution.

REFERENCES


3. Ibid., p. 62

4. Ibid., p. 63

5. Ibid., p. 64

6. Ibid., p. 65