भारतीय मानक मसौदा

सीमेंट संयंत्रों में वायु प्रदूषण के नियंत्रण - रीति संहिता

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Draft Indian Standard

CONTROL OF AIR POLLUTION IN CEMENT PLANTS - CODE OF PRACTICE

(*First Revision*)

ICS 13.040.99

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FOREWORD

(Formal clauses added to be later)

Protection and improvement of air quality for present and future generations should be ensured. Also for uniform application of technology and operating practices, a code of practice containing the latest available information on air pollution sources, determination of emissions, control techniques, measurement and monitoring of emissions would be useful in the design and operation of dust control equipment in cement plants.

From the point of view of pollution of the atmosphere and habitation surrounding cement plants, the large amount of dust emitted by these plants needs prime consideration. This standard has been formulated in order to help the industry to identify the sources of pollution and to take suitable action for pollution abatement.

IS 12002 was originally published in 1987. In this revision Reference clause has been updated and suitable modifications in relevant clauses have also been done based on the technological advancements over the last 30 years and emission norms in cement plants notified by Ministry of Environment Forest and Climate Change. This revision has been taken up in order to bring out the standard in the latest style and format of the Indian Standards.

1 SCOPE

1.1 This standard covers:

a) Air Pollutants from Cement Industry,

b) Sources of Air Pollutants,

c) Pollution Control Techniques,

d) Measurement of Emissions,

e) Location and Layout, and

f) Air Pollution surveys.

2 REFERENCES

2.1 The Indian Standards given below contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

IS No.	*Title*
5182 (Part 14) : 2000	Methods for measurement of air pollution: Part 14 Guidelines for planning the sampling of atmosphere (*second revision*)
11255 (Part 1) : 1985	Methods for measurement of emissions from stationary sources: Part 1 Particulate matter
11255 (Part 2) : 1985	Methods for measurement of emissions from stationary sources: Part 2 Sulphur dioxide
11255 (Part 7) : 2005	Methods for measurement of emission from stationary sources: Part 7 Oxides of Nitrogen

3 AIR POLLUTANTS FROM CEMENT INDUSTRY

3.1 The pollution of the atmosphere caused by cement industry is substantially different in nature from that caused by other industries like petro-chemicals, fertilizers, etc. The pollutants discharged into the atmosphere by a cement plant consist mostly of particulate matter and gaseous pollutants.

3.2 Particulates

The particulate matter generated from kiln operation, cooler, grinding of raw materials and finish products and transfer of material. This contains mostly limestone dust, coal dust, cement kiln dust, clinker dust, and cement dust.

3.3 Gaseous Emissions

The major gaseous emissions consist of Oxides of Sulphur, Oxides of Nitrogen and Carbon dioxide. Trace amount of Carbon monoxide, Hydrogen Fluoride, Hydrogen Chloride, Total Organic Carbon, Heavy metals and Dioxins and Furans also emitted from cement plants. These are generated due to combustion of alternative/ waste derived fuels and pyro processing of raw materials. The gaseous emission also depends upon the type of fuels and raw materials used, and their chemical composition, utilization of alternative fuels and raw materials and their characteristics.

4 SOURCES OF AIR POLLUTION

4.1 There are two types of sources that generate dust pollution in cement plant one is the point source emissions i.e., dust contained in flue gas /process air, from the manufacturing process of cement, is emitted to atmosphere via air pollution control equipment attached with various operations and the other one is fugitive dust generation from leakages, handling, transportation and storage of raw materials, clinker, coal. The sources of particulate matter emission are as given below:

a) Preparation of raw materials like crushing, stacking, reclaiming,

b) Raw material grinding

c) Coal grinding,

d) Pyro-processing of raw materials

e) Clinker grinding, and

f) Packing & dispatch of cement.

4.1.1 The sources of gaseous emissions generated due to

a) Combustion of fuels,

b) Pyro-processing of raw materials

4.1.2 Various operations used in cement plant and the technologies presently in use are as given below.

4.2 Crushers - Crushers are used in the cement industry mainly for crushing limestone and coal.

4.2.1 *Limestone Crushers*

Crusher selection depends upon the characteristics of the raw materials. In the past the trend was to use jaw crushers as primary crusher and swing hammer reversible impact crushers as secondary crushers. Present trend in the cement plants is to use a single pass high capacity swing hammer mill or impact crushers to crush the limestone to the required size.

4.2.2 *Coal Crushers* — Impact or hammer mill crusher or ring granulators are used for crushing of coal.

4.3 Raw Mill

4.3.1 *Grinding Mill (Cylindrical Type) for Wet Process Cement Making*

Since grinding is done in wet conditions, there is no dust pollution at wet grinding installation.

4.3.2 *Grinding Mills for Dry Process/Semi-dry Process Cement Making*

4.3.2.1 *Open circuit conventional ball mill*

These mills exist at a few of the very old cement plants of small capacity.

4.3.2.2 *Closed circuit ball mills*

Closed circuit grinding is adopted to avoid over grinding and to control the particle size distribution over an narrow range. The amount of gases to be vented through the mill system depends upon the amount of moisture to be dried.

4.3.2.3 *Vertical roller mills*

These mills are essentially of air swept type closed circuit mills having an inbuilt classifier. Entire ground product in such mills is carried away by the air/gases to the cyclone and then to the electro static precipitator/bag house or directly from the mill to an electrostatic precipitator/bag house.

4.3.2.4 *Roller Press*

Roller presses are used for grinding of raw materials in either finish mode or semi finish mode (i.e. combination of both roller press and ball) or even as a pre-grinder. In this type of grinding the feed material is subjected to a high pressure for a short time which leads to development of micro cracks in the material and subsequently leading to generation of fines.

4.3.2.5 *Horomills*

In the Horomills, a horizontal roller within a cylinder is driven. The centrifugal forces resulting from the movement of the cylinder cause a uniformly distributed layer to be carried on the inside of the cylinder. The layer passes the roller (with a pressure of 700-1000 bar). The finished product is collected in a dust filter.

NOTE - In dry process cement plants, the raw material grinding mills generally utilize the exhaust gases from the kiln so as to make use of the available heat to dry the raw materials. However, the range of dust burden remains the same as given in Table 1.

4.4 Coal Mill

4.4.1 *Coal Dryer*

Rotary dryers are generally used for drying coal in the cement industry. Volume of the exhaust gases depends on moisture content of the coal.

4.4.2 *Coal Grinding*

Pulverised coal required for calcining and clinkering of the raw materials in the kiln is ground in air swept mills. These may be either ball type air swept mills or vertical roller mills.

4.4.3 The exhaust gas volume, temperature of exhaust and dust burden are given in Table 1.

4.5 Kilns

Kiln is the area where major high temperature chemical reactions of raw material take place with combustion of coal to heat the raw material to temperatures up to 1400-1450°C to make the clinker. This generates the various pollutant gases and dust. The major portion of dust in cement plants is generated by the kiln exhaust gases. The particulate matter emitted contains mostly limestone dust & Cement Kiln Dust. The hot gases used to heat the raw material which also contributes to emission of volatiles and this varies with the type of process adopted for making clinker.

NOTE - Cement manufacture has undergone rapid technological changes. In India cement plants using various types of kilns are mentioned below. However, all the new cement plants coming up are dry process plants with preheating pre-calcination technology incorporated.

4.5.1 *Kilns Used for Production of Clinker*

The various types of kilns used for production of clinker are given below.

4.5.2 *Vertical Shaft Kiln*

This process is used only for mini cement plants having a capacity of 20 to 200 tonnes/day.

4.5.3 *Wet Process Long Kiln*

In this process, wet slurry (33-38 percent moisture) is fed to a long kiln from one end and coal firing is done at the other end. Capacity range for such plants in India is 180 to 750 tonnes/day.

4.5.4 *Wet Process Calciner Kiln*

In this process the raw meal slurry first enters the calciner for partial drying and then enters a rotary kiln. Capacity range for such plants is 500 to 1000 tonnes per day.

4.5.5 *Semi-Dry Process Kiln (Lepol Grate)*

In this process, raw meal is fed on the moving grate in the form of nodules (10 to 12 percent moisture). Flue gases from the kiln enter the grate chamber for drying and partial calcination of raw meal nodules. Capacity for such plants is about 500 tonnes per day.

4.5.6 *Dry Process Suspension Preheater Kiln*

In this process, raw material is fed in the form of dry powder from the top of suspension preheater and the hot flue gases from the kiln travel upwards. Heat transfer takes place while the particles are in suspension with the flue gases.

4.5.7 *Dry Process Suspension Preheater Kiln with Precalcination*

In-this process, fuel is fed at two locations i.e. at kiln outlet and pre-calciner. Dust burden and the quantity of gas generated is same as given in **3.7.6**. Higher kiln capacity would result in lower specific gas volume and reduced specific heat consumption.

4.5.8 The exhaust gas volume, temperature of exhaust gases and their dust burden is also given in Table 1 for different types of kilns.

4.6 Clinker Cooler

Here the atmospheric air is forced inside the cooler to cool the hot clinker. During the process air picks up the fine particulates. Dust burden varies in the range of 5-10 g/m^3 and temperature of the air is around 275°C for clinker exit temperature of around 100°C. The air volume is in the range of 0.8 to 1.2 Nm^3/kg of clinker.

4.7 Cement Mills

Open circuit ball mills, closed circuit ball mills, vertical roller mills and High pressure grinding roller mills type grinding mills are used for grinding the clinker into cement. The temperature of exit air is about 90-110°C.

4.8 Packing

The cement is packed in 50 kg bag or jumbo bags or bulk transported via truck, rail and ships. Dust generation in a packing plant takes place due to conveying equipment from the cement silo to the packing machines, packing machines where the bags are filled with cement, and various transfer points of the belt conveyors conveying the cement bags to the railway wagons or trucks.

4.9 Material Transfer Point

Dust is generated wherever there is a transfer of fine materials from one point to another especially in belt conveyor systems.

4.10 Fugitive Emissions

Fugitive emissions can occur due to improper operational practices, such as material falling from a height onto a surface, leakages in ducts, etc.

Table 1 Emissions from Mills and Kilns
(*Clause* 4.4.3 and 4.5.8)

Sl. No.	Process	Exhaust Gas Volume, Nm3/kg of Product	Temperature of Exhaust Gases, □C	Dust Burden at inlet of APCE g/Nm3	Dust emissions limit from Stack mg/Nm3
(1)	(2)	(3)	(4)	(5)	(6)
i.	Limestone crushing				
	a) Jaw crusher	-	-	20-75	<30
	b) Hammer Mill / Impact crusher	-	-	105-220	
ii.	Coal Crusher	-	-	50-165	<30
iii.	Grinding Mills (Raw mill)				
	a) Open circuit ball mills	-	75-85	25-60	<30
	b) Closed circuit ball mills	-	75-85	50-150	
	c) Vertical grinding mill	1.0 to 1.2	75-85	250-500	
iv.	Coal Dryer	-	-	45-65	<30
v.	Coal Grinding				
	a) Air swept ball mill b) Vertical grinding mill	1.2-1.5	60-70	150-350	<30
vi.	Shaft Kilns	2-3	100 to 150	0.1-0.5	<30
vii.	Wet process long kiln	3-5	150 to 200	15-45	<30
viii.	Wet process calciner kiln	3.5-5	150 to 200	70-100	<30
ix.	Semi-dry process (Lepol Grate Kiln)	2.5 to 4	90 to 130	5-15	<30
x.	Dry process suspension pre-heater kiln	1.4-1.7		50-70	<30
xi.	Dry process suspension pre-heater with pre-calciner kiln	1.4-1.6		50-70	<30

xii.	Clinker cooler	0.8-1.2	275	15-50	<30
xiii.	Cement mill				
	a) Open/Closed ball mills	0.45-0.55	90-110	20-80	<30
	b) Vertical roller mill	1.3-1.5	90-110	300-500	

5 POLLUTION CONTROL TECHNIQUES

5.1 Types of Equipment

Pollution control equipment can be divided into two categories viz., for the control of particulate matter and for the reduction of gaseous emissions (SO_2 & NOx) which are discussed below:

5.2 APCE for Particulate Matter

Particulate matter control includes control of material present in gas streams inside process equipment, and Control of materials arising in open or unconfined areas. Strategies for control include basic changes in procedures and materials which eliminate or reduce emissions and the use of add on auxiliary equipment to remove pollutants prior to release of the carrier gas to the atmosphere. Often, changes in hooding, material handling and good house-keeping can reduce the emission of air pollutants into the atmosphere. Equipment for the control of particulate emission includes dry inertial and centrifugal collectors, such as cyclones, low and high energy scrubbers, electrostatic precipitators and cleanable fabric filters etc. Equipment selection may be made only from among those which are capable of performing the required task with consideration given to the cost of the equipment. The selection depends on the pollutant and carrier gas characteristics, particle concentration (average and range), average particle size and size distribution, particle shape, density, resistivity, gas flow rate, temperature, moisture content, etc.

5.3 Fabric Filter / Bag Filter

This is the most widely used type of pollution control equipment in the cement industry. The efficiency of the dust collector can be over 99.99 percent. Fabric filters are conventional dust collectors used for the separation of dust in many industries. Their main advantage lies in availability of a variety of filter media to suit specific operational conditions. In cement industry it finds extensive use, especially in areas where low level dust generations are prevailing.

5.3.1 The collection of dust particles achieved in a fabric filter is based on several collecting mechanisms including inertial impaction, interception, diffusion, gravitational sedimentation and electrostatic separation or combination of these. In which one or more of these mechanisms come into play in a given filtration process is determined by the particle size of the collected dust.

5.3.2 Cleaning of bags by pulse-jet of compressed air is generally preferred. Present day bag type filters are available for all kinds of applications including fine coal dust. However, proper safety precautions are required to be taken in the case of coal grinding and drying installations. For high temperature applications Glass fibre or Poly Tetra Flouro Ethylene (PTFE) filters can be used.

To handle high gas volumes, reverse air bag houses are used particularly to treat the kiln/raw mill gases. Further, advancement in jet-pulse bag filters were also developed to handle high gas volumes.

5.4 Electrostatic Precipitator

This is the most modern piece of equipment available for controlling air pollution. Collection efficiency can be over 99.9 percent. Basically, electrostatic precipitator operation consists in the action of unidirectional electric field upon free electric charges present in the field. High voltage (30-80 KV) gives rise to emission of free electrons (carona effect). Under the influence of electrical field, the dust particles move to collecting electrodes at migration velocity. It's effective and trouble free operation demands careful selection, design, fabrication, erection and handling.

5.4.1 For the control of particulate matter emissions APCEs like Electrostatic Precipitators, Bag filters are used in the rotary kiln plants. However, in plants producing clinker using vertical shaft kilns are using Cyclones, Multicyclones, Wet Scrubbers and Settling chambers.

5.5 Cyclone

Cyclone is the simplest form of pollution control equipment for suspended matter and separates suspended particulate matter from the dust laden gases. High efficiency cyclones are generally provided in clusters. Collection efficiency ranges from 60 to 85 percent. Particles above 20-micron size can be separated. It is advisable to use cyclone as primary dust control equipment and reduce the dust load for further dust control equipment

5.6 Wet Scrubbers

5.6.1 *Venturi scrubbers*

In these scrubbers the help of a spray of water is taken to agglomerate finer dust particles. Collection efficiency ranges from 90-95 percent.

5.6.2 *Submerged type scrubbers*

In these type of scrubbers, higher efficiencies of the range of 95-97 percent can be achieved by passing the entire volume of gases through a layer of water.

5.6.3 Both the above types present a problem of separating out the fine particles of dust collected in the water and of recovering water. These can be used in the processing of limestone and coal, but not in the processing of clinker and cement.

5.7 APCE for Gaseous Emissions

The burning of kiln feed in rotary kilns generates large volumes of CO_2 due calcination of limestone in kiln feed. During the pyroprocessing of raw material, other gases are generated in addition to CO_2 are SO_2, NOx etc., among them SO_2 & NOx are significant in emissions and their control measures are given below.

5.8 Oxides of Sulphur (SO_2)

SO_2 emissions from cement plants are primarily determined by the content of the volatile sulphur in the raw materials. The emission concentration in the flue gas are below 100 mgSO_2/Nm^3 without abatement at some kilns, the SO_2 emission concentration increase with increased levels of volatile sulphur in the raw material used. The raw materials containing organic sulphur or pyrite (FeS_2) are used in cement rotary kiln the emissions of SO_2 can be high. SO_2 is the main (99 percent) sulphur compound to be released, although some SO3 is produced and, under reducing conditions, H_2S could be evolved. Sulphur in the raw material occurring as sulphides and organically combined sulphur will evaporate, and 30 percent or more may be emitted from the first stage of a preheater. The gases from this unit will either be emitted directly to the atmosphere, or fed to the raw mill if it is in operation. In the raw mill, 20-70 percent of the SO_2 will be captured by the finely ground raw materials. Thus, it is important that raw milling is optimised so that the raw mill can be operated to act as SO_2 abatement for the kiln. Sulphur in the fuels fed to preheater kilns will not lead to significant SO_2 emissions, due to the strong alkaline nature in the sintering zone, the calcination zone and in the lower stage of the preheater. This sulphur will be captured in the clinker. The excess oxygen (1 to 3 percent O_2 maintained in the kiln for satisfactory cement product quality) presence in the kiln flue gases will oxidise sulphide compounds to SO_2. In long kilns the contact between SO_2 and alkaline material is not so good, and sulphur in the fuels can lead to significant SO_2 emissions. Despite the fact that most sulphur remains in the clinker as sulphate, SO_2 emissions can be significant from raw materials with a high volatile sulphur content and can be regarded as a major pollutant.

5.8.1 SO_2 reduction techniques applied in the cement industries

5.9 Absorbent addition

One of the Secondary emissions control techniques employed in the cement industry is addition of absorbent like Hydrated Lime by which up to 60 percent SO_2 reduction can be achieved. Hydrate-of-lime addition is done by using the so-called 'dry additive process' (sorbent addition to raw material) or the 'dry sorption process' (sorbent injection into the gas stream). Hydrate-of-lime addition offers the additional advantage that the calcium-bearing additive forms reaction products that can be directly incorporated into the clinker burning process. The optimum temperature ranges for hydrate-of-lime addition are 350 to 400°C and below 150°C if the gas is enriched with water. Suitable locations for hydrate-of-lime addition in cement rotary kiln systems are the upper cyclone stages or the raw gas duct.

5.10 Wet scrubber

The wet scrubber is the most commonly used technique for flue-gas de-sulphurisation in coal fired power plants. For cement manufacturing processes, the wet process for reducing SO_2 emissions is an established technique. Wet scrubbing is based on the following chemical reaction:

$$SO_2 + \frac{1}{2} O_2 + 2\ H_2O + CaCO_3 = CaSO_4 \bullet 2\ H_2O + CO_2$$

The SO_2 is absorbed by a liquid/slurry which is sprayed in a spray tower. The absorbent is calcium carbonate. Wet scrubbing systems provide the highest removal efficiencies for soluble acid gases of all flue-gas desulphurisation (FGD) methods with the lowest excess stoichiometric factors and the lowest solid waste production rate. However, wet scrubbers also significantly reduce the HCl, residual dust and, to a lesser extent, metal and NH_3 emissions.

5.11 Activated carbon

Pollutants such as SO_2, organic compounds, metals, NH_3, NH_4 compounds, HCl, HF and residual dust (after an ESP or fabric filter) may be removed from the exhaust gases by adsorption on activated carbon. The activated carbon filter is used for the injection technique or is constructed as a packed-bed with modular partition walls. The modular design allows the filter sizes to be adapted for different gas throughputs and kiln capacity. The used activated coke is periodically extracted to a separate silo and replaced with fresh adsorbent. By using the saturated coke as fuel in the kiln, the trapped substances are returned to the system and to a large extent become fixed in the cement clinker.

5.12 Oxides of Nitrogen

The clinker manufacturing process is a high temperature process resulting in the formation of nitrogen oxides (NOx). These oxides are of major significance with respect to air pollution from cement manufacturing plants. They are formed during the combustion process either by a combination of fuel nitrogen with oxygen within the flame or by a combination of atmospheric nitrogen and oxygen in the combustion air.

There are two main sources for the production of NOx:

Thermal NOx: Part of the nitrogen in the combustion air reacts with oxygen to form various oxides of nitrogen is the major mechanism of nitrogen oxide formation in the kiln flame

Fuel NOx: Compounds containing nitrogen, chemically bound in the fuel, react with oxygen in the air to form various oxides of nitrogen.

5.12.1 Control techniques to reduce NOx emissions were considered in the following categories: primary control measures/technologies like process modifications, combustion modifications, and Secondary control technologies including Selective Non-Catalytic Reduction (SNCR) and Selective Catalytic Reduction (SCR).

5.13 Primary Control Techniques

a) Process Optimization

b) Maintain optimum excess air

c) Reduce Primary air – lower limit depends upon fuel burned & type of burner used

d) Optimize burner settings

e) Finer grinding of pet coke up to 1 percent residue on 90 µ sieve.

5.14 Combustion Modification

a) Lower Nitrogen Fuel

b) Higher Volatile content in fuels

c) Installation of Low-NOx burner in kiln – high tip velocity with low primary air

d) Installation of low NOx Calciner to create a long enough reducing atmosphere zone in the pre-calciner by creation of reducing atmosphere in calciner by meal, fuel splitting and readjustment of hot air entry from tertiary air duct so that reverse reaction takes place NOx -> N_2

e) Reburning of thermal NOx generated from kiln with riser firing

f) Use of AFR which creates reducing atmospheres

g) Use of liquid waste with small percentage of moisture

6 SECONDARY CONTROL TECHNIQUES

6.1 Selective Non-Catalytic Reduction (SNCR)

SNCR is a post-combustion technology that uses a reagent (aqueous ammonia or urea) without a catalyst to reduce NO to nitrogen gas. This technology for NOx control is used in cement plants world wide. To provide effective removal, the reagent and NOx must be well-mixed, and within the optimal temperature window (900-950°C) for the required residence time. Preheater and precalciner kilns provide accessible regions between the kiln inlet and bottom cyclone where the gas temperatures are within the SNCR window. The majority of the cost of an SNCR system is the recurring cost of the reagent.

6.2 Selective Catalytic Reduction (SCR)

SCR is a post-combustion control technique that uses a reagent in the presence of a catalyst to reduce NO to nitrogen gas. Although it is an effective NOx control technique for a number of different types of combustion units, including coal-fired boilers, there are significant technical, design and operational issues associated with installing a high dust SCR system on a cement kiln. The most critical issues are related to catalyst formulation and catalyst cleaning.

6.3 Selection of Air Pollution Control Equipment to meet the emission limits

6.3.1 *Crusher Installations*

A bag type dust collector is necessary for crushers of capacity 150 tonnes per hour and above.

6.3.2 *Dry Raw Grinding Mills*

In case hot gas is drawn from the dry process kiln, it is better to vent the raw mill vent gases directly into the kiln exhaust gas dust control equipment. Otherwise, a pulse-jet type of bag dust collector may be used. However, in case moisture content of the raw material is high an electrostatic precipitator may also be considered.

6.3.3 *Coal Dryers*

6.3.3.1 *Coal dryer exhaust gases*

An electrostatic precipitator or special material bag type dust collector can be considered for cleaning coal dryer exhaust gases. Air pollution control installations should comply with all safety regulations.

6.3.3.2 *Coal dryers*

For bigger installations, electrostatic precipitators may be considered. In such cases proper safety regulation should be applied. For smaller installations special material bag type dust collectors are also suitable. In case water is available in adequate quantity, wet scrubbers can also be considered but they pose a problem in the disposal of coal sludge formed in these scrubbers.

6.3.4 *Kiln*

To meet the pollution control requirements, use of high efficiency reverse air bag house with glass membrane bags or PTFE bags is preferred. Electrostatic precipitators can also be used with sufficient no of fields maintained to meet the emission limits.

6.3.4.1 In the case of dry process plants, exhaust gases are required to be conditioned in a conditioning tower before entering the electrostatic precipitator. Spraying of water inside the conditioning tower lowers down the temperature of gases to 150°C, and increases the dew point temperature to about 55°C, thus providing the best conditions for precipitation in an electrostatic precipitator. However, in the plants where availability of water is a problem, it is recommended to use fibre glass bag dust collectors with latest pulse jet type of arrangement.

6.3.4.2 Selection of dust control equipment for semi-dry process cement kilns with grate type preheaters needs careful consideration with respect to acid dew point temperature and analysis should be done with care for the same before installing electrostatic precipitators or bag type dust collectors.

6.3.4.3 In case of wet process kilns electrostatic precipitators are ideally suited. On the relatively old wet process kilns of small capacities, wet scrubbers may also be used.

6.3.5 *Clinker Coolers*

There is no generation of dust in the operation of planetary coolers. In the case of grate type clinker coolers, dust generation is not appreciable when operating under stable condition and a multi cone dust collector is adequate for the control of dust pollution. Other options available for this are electrostatic precipitators and gravel bed filters.

6.3.6 *Cement Mills*

Electrostatic precipitators and pulse-jet type bag dust collectors are good for venting the exit gases from cement mills.

6.3.7 *Material Handling Operations*

In material handling operations, especially the transfer of material from one conveyor to other, hoods are to be provided from which the air can be drawn by means of suction and de-dusted in a fabric filter. Several conveyor transfer points can thus be ventilated through a dust collector.

6.3.8 *Fugitive Emission Sources*

Fugitive emissions can be prevented by better operational practices. CBCB has also formulated guidelines for prevention of fugitive dust from cement plants.

7 SAMPLING AND MEASUREMENT

7.1 Regular measurement of emissions from the various vent stacks in a cement plant is necessary. This, however, requires specialized equipment and considerable skill. It is, therefore, necessary that adequate training is given to the concerned personnel. Alternatively, such measurements may be carried out with the aid of specialized agencies that are equipped for this work.

7.2 Sampling and measurement of particulate emission from stacks should be carried out in accordance with the method prescribed in IS 11255 (Part 1).

7.3 Sampling and Analysis of Sulphur Dioxide and Oxides of Nitrogen from stacks should be carried out in accordance with the method prescribed in IS 11255 (Part 2) and IS 11255 (Part 7) respectively.

7.4 Emission regulation guidelines issued by CPCB may also be followed for sampling location for various parameters.

8 LOCATION AND LAYOUT

8.1 While deciding location of a new cement plant, the micrometeorological factor prevailing in the area and the topography of the area should be considered (*see* IS 8829). Areas with frequent record of inversion occurrence and valleys should not be considered as prospective location from air pollution episode view point. The location of residential areas should be such that they are located towards the cleaner side of the plant. There should be a green belt of adequate width around the plant boundary to absorb noise and arrest dust.

8.2 The layout of the plant should be such that a predominant wind direction is from cleaner side of plant to pollution emitting side of plant. The layout of highly polluting sections should be preferably perpendicular to the predominant wind direction.

9 AIR POLLUTION SURVEY

9.1 An air-pollution survey of, the localities around the proposed plant or proposed expansion should be conducted to determine the background pollution level already existing, due to natural and other sources. If the background level is found to be excessive, measures should be taken to reduce it by modifying pollution control systems of the existing sources. The new pollution control units of the plant should then be designed to contribute only the difference between acceptable value of ground level concentration and the background level already existing.

9.2 In each cement plant, independent pollution monitoring facilities should be provided. A systematic record of emission inventories and ground level concentrations in residential location at predetermined grid points [*see* IS 5182 (Part 14)] should be maintained by the pollution monitoring group. It is preferable to have a sampling and analysis laboratory and trained personnel for pollution monitoring in the plant itself.

10 EMISSION LIMITS

All the cement plants (without co-processing) shall comply with the emission norms notified by Ministry of Environment, Forests and Climate Change (MOEF&CC) vide notification no. G.S.R.612 (E) dated 25th August 2014 and thereafter some amendments were made and published vide notification no. G.S.R. 496 (E) dated 9th May 2016. Whereas cement plants (with co-processing) shall comply with the emission norms notified by MOEF&CC vide notification no G.S.R. 497 (E) dated 10th May 2016.