COMPERHENSIVE INDUSTRY DOCUMENT SERIES
COINDS/26/86-87

EMISSION REGULATIONS
Part IV

Central Board for the Prevention And Control of Water Pollution New Delhi

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'Skylark' Building 60, Nehru Place, New Delhi

PREFACE

There is a need for evolving emission standards specifically for small boilers, incinerators and diesel generator sets, because these are after located near residential areas, and in industrial areas of metropolition cities. The standards proposed in the following pages meet this need. The standards are intended to be reviewed in June, 1989, based on the results obtained till then.

As prescribed in the Section 17(1)(g) of the Air (Prevention And Control Of Pollution) Act, 1981, the standards are to be laid down by the State Pollution Control Boards. The State Boards may adopt standards that are more stringent than those given herein depending upon the location of the industries, specially if it is in a protected area for instance in the Agra-Mathura trapezium. The State Boards would not, however, relax the standards.

Comments are solicited on the suggested standards.

PARITOSH C. TYAGI
Chairman

CONTENTS

BOILER EMISSIONS

1. At present the emission standards covering boilers are given under "Thermal Power" in Emission Regulations, Part-I. These are for particulate matter and are as follows:

BOILER SIZE	:	Less than 200 MW
PROTECTED AREA	:	150 mg/Nm³
OTHER AREA		
Old (Before 1979)	:	600 mg/Nm³
New (After 1979)	:	350 mg/Nm³

This means that this standard is applicable for boilers of sizes down to the package-type. It also implies that emission control is through the use of the electrostatic precipitator. Both of these need to be clarified.

1.1 The control of gaseous emissions from boilers is through the stack height given by H (Q) 0.3 where Q is the emission of sulphur dioxide in kg/hr. A requirement of 30 meters is for industries in the Schedule. This is probably too tall for the small boilers.

There appears to be a need for correcting the situation, in view of the clarifications sought from the state boards, from industry and also from boiler manufacturers.

2. THE FOLLOWING IS THEREFORE ADOPTED :

Boilers are classified according to their steam generation capacity. The relation between the boiler and the industry size is given below :

Category	Steam Generation Capacity	Size Of Industry
I	Less than 2 ton/hr	Very small manufacturers
II	2 to 15 ton/hr	Package boiler range for small scale industries.
III	More than 15 ton/hr	Site-erected boiler for medium scale industries.

2.1 It is further adopted that category I boilers should have cyclones attached to them. The cost of a 2 ton/hr boiler and accessories is about 5 lakhs while the cyclone cost would be around Rs. 50,000/-. Category II boilers should have multiclones. The 10 ton/hr boiler cost with accessories is about 50 lakhs while the multiclone cost is Rs. 1.5 lakhs. Category III boilers should have bag filters.

A 15 ton/hr boiler with accessories costs between 75 lakhs and 1.1 crore while the bag filter cost is about 12 lakhs. A boiler of 35 ton/hr with accessories costs 1.4 to 2.2 crores while the bag filter cost is about 25 lakhs. The variation in the cost of the boiler is dependent on the type of steam required. The cost of the control equipment works out to 10% or less of the cost of the boiler with accessories, in each category.

The corresponding emissions for categories I, II and III are 1600 mg/Nm^3, 1200 mg/Nm^3 and 150 mg/Nm^3 respectively.

2.2 THE PROPOSAL CAN BE SUMMARISED AS FOLLOWS :

Capacity Of Boiler	Control Device	Coal Consumption	Required Particulate Emission*
Less than 2 ton/hr	Cyclones	8.5 MT/day	1600 mg/Nm^3
2 to 15 ton/hr	Multiclones	8.5 to 64 MT/day	1200 mg/Nm^3
More than 15 ton/hr	Bag filters	More than 64 MT/day	150 mg/Nm^3

***All emissions normalized to 12 percent carbon dioxide.**

This requirement is applicable for boilers using any type of solid fuel. For liquid fuels such as furnace oil or LSHS, the control would be through the stack height covered under 4.0. Fluidized bed fired boilers would be fitted with bag filters or electrostatic precipitators. Incinerators shall be fitted with multiclones.

ASSUMPTIONS

3. The sulphur dioxide emitted from the stacks would be proportional to the coal consumption. The following assumptions have been made:

   i. 1 MW of electricity generation is equivalent to 7.0 ton/hr of steam generation.

   ii. 1 MW of electricity generation requires 30 MT of coal per day.

3.1 These figures have been obtained from Thermal Power Stations using pulverized coal as fuel Assuming that 1 ton/hr of steam generation requires 5.0 MT of coal per day, the figure taken from pulverized fuel-fired thermal power stations appears to be conservative by approximately 16% This is as expected—pulverized coal would be a more efficient source of energy than lumps.

STACK HEIGHT

4 The coal requirement for the steam generating boiler is more conservative, as indicated above, than for thermal power plant boilers. The stack heights are correspondingly lower. It is expected that the temperature of the exit gases gives an additional plume rise and, therefore, an increase in the effective stack height. These two opposing effects are likely to balance out. The stack height calculated for coal-fired boilers is given below, using the formula arrived from using the Gaussian Plume Model and published in Emission Regulation Parts I and II, namely;

$H=(14Qg);^{\infty}$ where H is the physical height of the stack and Qg is the emission of sulphur dioxide in kg/hr.

4.1

Steam Generation Capacity	Coal Consumed	Stack Height
Less than 2 ton/hr	8.5 MT/day	2 & 1/2 times the neighbouring building height or 9 meters (which ever is more)
More than 2 ton/hr to 5 ton/hr	8.5 MT/day to21 MT/day	12 m
More than 5 ton/hr to 10 ton/hr	21 MT/day to 42 MT/day	15 m
More than 10 ton/hr	42 MT/day to 64 MT/day	18 m
More than 15 ton/hr to 20 ton/hr	64 MT/day to 104 MT/day	21 m
More than 20 ton/hr to 25 ton/hr	104 MT/day to 105 MT/day	24 m
More than 25 ton/hr to 30 ton/hr	105 MT/day to 126 MT/day	27 m
More than 30 ton/hr	More than 126 MT/day	30 m (whichever is more) or usingformula $H=14(Q)^{0.3}$

4.2 For industrial furnace and kiln applications, that is for devices other than boilers for steam and power generation, the criteria for selection of equipment would be based on coal usage.

This would be as given in 2.2 above. The stack height shall follow the norms given in 4.1.

4.3 These specifications apply to existing as well as new industries. Existing industries will have to carry out necessary modifications to their plants to accommodate new chimneys and control equipment.

4.4 The industries which install facilities for removal of particulates or gaseous emissions to adhere to the limits prescribed, then the stack height H, can be relaxed to $H=(Q)g;^{0.3}$ where Qg=amount of gaseous emissions (para 4.0) in kg/hr. In case of particulates, when controlled to the limits specified in 2.2, then stack height can be relaxed to $H=74(Q)p^{0.27}$, where Qp is the particulate emission in tonnes/hr.

4.5 Minimum height of stack in all cases shall be 9.0 M.(30 ft) or as calculated by the relevant formula, whichever is more.

DIESEL GENERATOR SETS

5. The minimum height of stack to be provided with each generator set can be worked out by using the following formula :—
H=h+0.2 KVA
H=Total height of stack in meter
h=height of the building in meters where the generator set is installed.
KVA=Total generator capacity of the set in KVA
Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorised as follows :

5.1 **For Generator Sets**	**Total Height Of Stack In Meter**
50 KVA	Ht. of the building + 1.5 meter
50-100	Ht. of the building + 2.0 meter
100-150 KVA	Ht. of the building + 2.5 meter
150-200 KVA	Ht. of the building + 3.0 meter
200-250 KVA	Ht. of the building + 3.5 meter
250-300 KVA	Ht. of the building + 3.5 meter

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

5.2 The stack height for generators was originally evolved for those to be used in the metropolitan area of Delhi. The objective was to avoid the problem of road side discharge from stacks and build-up of pollutants in the ambient air. However, due to shortage of power, factories have installed diesel-based power generating (DG) sets. Many of the factories are away from metropolitan or urban areas where standards covered in 5.1 would appear stringent. It is also expected that a DG set is a stand-by used only during power breakdowns. For both these reasons, the relaxation in the height of the stack from ground level is made to two and a half times the building height. This building may be either the one in which the DG set is housed or a building, with people working, within the premises of the factory. This is also applicable for oil-fired furnace, engines and equivalent.
The State Pollution Control Board would decide if the plant is sufficiently removed from urban, residential or commerecial areas so that this relaxation from 5.1 is applicable.

5.3 It is evident that the stack requirement foir coal-fired boilers is more than that required for DG sets. This is necessary because ambient values for sulphur dioxide and nitrogen oxides indicate stricter for sulphur dioxide.

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MONITORING REQUIREMENTS FOR LARGE INDUSTRIES

Several large industries are being cleared by the Environmental Appraisal Committee of the different states. These industries include Petrochemicals, Steel plants, Cement plants, etc. The Emissions Regulations Part III published by the Central Board deals with the monitoring requirements for these industries. However, one item which has been over-looked in the past, in the regulations, is the requirement for continuous monitoring of pollutants emitted from the stacks of these large industrial units. There is a greater requirement for the larger industries to control the emissions because of the larger emissions rate. Industries beyond a certain capacity, shall install continuous monitoring equipment with plotter/integrator for the pollutants given below. The location and type of equipment is given along with the plant capacity under the various industrial heads.

		Plant Capacity	**Location**	**Type of Monitor**
1.	Cement	More than 300,000 TPA	Kiln Stack	Opacity Monitor with recorder
2.	Thermal Power	More than 200 MW	Boiler Stack	—do—
3.	Nitric Acid	More than 150 TPD	Spent gas stack	NOx Monitor
4.	Sulphuric Acid	More than 100 TPD	Converter stack	SO_2 Monitor
5.	Primary Aluminium	All	Pot Gas stack	Fluorides
6.	Oil Refinery	3000 TPD Crude	Distillation Stack, Catalytic Cracker and Sulphur Recovery	Sulphur Dioxide

These regulations would be applicable for industries which have applied for industrial licence and also in those cases where state board thinks appropriate.

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CENTRAL BOARD FOR THE PREVENTION AND CONTROL OF WATER POLLUTION

5TH & 6th Floors, Skylark Building
60, Nehru Place, New Delhi-110 019

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