



**A GUIDANCE NOTE ON THE
BEST PRACTICABLE MEANS**

FOR

ELECTRICITY WORKS

**(COAL-FIRED PLANT, GAS-FIRED GAS TURBINE, AND
OIL-FIRED GAS TURBINE (PEAK LOPPING PLANT))**

BPM 7/1

Environmental Protection Department
Air Management Group

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1. Introduction

This note lists the minimum requirements for meeting the best practicable means for Electricity Works (coal-fired plant, gas-fired gas turbine and oil-fired gas turbine (peak lopping plant)). It should be noted that in granting a licence under the Ordinance, the Authority, i.e., the Director of Environmental Protection, will also consider all other relevant aspects and may impose more stringent and/or additional control requirements.

The requirements in this note are applicable to all units constructed after 1 January 1991 with ratings equal to or greater than the following: (Note 3)

- (a) Coal-fired Power Stations : 200 MW (electrical output; aggregate generating capacity)
- (b) Gas-fired Gas Turbines : 15 MW (electrical output)
- (c) Oil-fired Gas Turbines : 15 MW (electrical output)
(Peak Lopping Plant)

Upgrading of control on the older units to meet the requirements should, however, be made whenever they can be achieved technically and economically. Discussion would be arranged by the Authority to agree on the details and time schedule of implementation when the need arises. (Note 1)

2. Design of Chimney

(a) Chimney height

To be determined by mathematical or physical dispersion modelling techniques acceptable to the Authority. The aims are to ensure:-

- (i) the relevant Air Quality Objectives (AQO) will not be threatened;
- (ii) the emission of non-AQO pollutants, in particular, heavy metals and carcinogenic organic compounds, will not cause any adverse effect to human health or environment;
- (iii) no undue constraint will be incurred to existing and future development or land use.

The final chimney height should be agreed with the Authority but as a general guideline, the chimney height in a flat terrain situation, should be Building Height + 1.5 x Building Width or Building Height, whichever is the lesser (Note 2). Suitable adjustment should be made to take into account local meteorological data, local topography and background air pollutant concentrations.

For non-combustion processes, the same guideline should be observed as far as practicable and in any case, the chimney height should not be less than 3 metres plus the building height.

(b) Efflux velocity

Not less than 15 m/s (at full load condition).

(c) Exit temperature

Not less than 80°C (at full load condition).

(d) Mode of discharge

Releases to air from chimneys should be directed vertically upwards and not restricted or deflected by the use of, for example, plates, caps or cowls. The weather protection device of a chimney, if used, should be properly designed so as not to restrict the upward movement of the gas flow.

In order to obtain maximum advantage from thermal buoyancy, hot emissions should take place from the minimum practicable number of chimneys, i.e., a multi-flue chimney design should be used as far as practicable.

Chimneys for release of hot emissions should, wherever necessary, be insulated with materials which should be free of asbestos.

3. Emission Limits

The emission limits stipulated below shall be applicable to all emissions during normal operations including soot blowing and load change. For smoke emission, the emission limits shall also be applicable to the start-up and shut-down periods.

(a) Coal-fired Power Stations

(All figures, other than smoke emission or those specified below, are based on an hourly averaging period and expressed as at 6% O₂, 0°C, 101.325 kilopascals and dry conditions)

Combustion process :

Particulates : 50 mg/m³ (2-hourly average)

Sulphur dioxide : 90% removal of the potential emission from burning of coal with a maximum allowable sulphur content of 1% by weight (air dry basis)
(Approximate equivalent concentration: 200 mg/m³)

Nitrogen oxides : 670 mg/m³
(as NO₂)

Smoke :

Start-up from cold : Less than Ringelmann Shade 2

Other periods : Less than Ringelmann Shade 1

Non-combustion process :

(The following figure is expressed as at 0°C, 101.325 kilopascals and undiluted conditions)

Particulates : 50 mg/m³

(b) Gas-fired Gas Turbines

(All figures, other than smoke emission or those specified below, are based on an hourly averaging period and expressed as at 15% O₂, 0°C, 101.325 kilopascals and dry conditions)

Combustion process :

Particulates : 5 mg/m³ (2-hourly average)

Sulphur dioxide : 10 mg/m³

Nitrogen oxides : 90 mg/m³
(as NO₂)

Smoke

Start-up from cold : Less than Ringelmann Shade 2

Other periods : Less than Ringelmann Shade 1

(c) Oil-fired Gas Turbines (Peak Lopping Plant)

(All figures, other than smoke emission or those specified below, are based on an hourly averaging period and expressed as at 15% O₂, 0°C, 101.325 kilopascals and dry conditions)

Combustion process :

Particulates : 10 mg/m³ (2-hourly average)

Sulphur dioxide : 290 mg/m³ or Potential emission from burning of fuel oil with sulphur content and viscosity of not greater than 0.5% (by weight) and 6 centistokes (at 40°C), respectively.

Nitrogen oxides : 150 mg/m³
(as NO₂)

Smoke

Start-up from cold : Less than Ringelmann Shade 2

Other periods : Less than Ringelmann Shade 1

4. Fugitive Emission Control

(a) Boundary Ambient Standards

Total suspended particulates : 260 $\mu\text{g}/\text{m}^3$ (24-hour average)

Odour : 2 odour units¹

(b) Engineering Design/Technical Requirements

To be agreed with the Authority. As a general guideline, the loading, unloading, handling and storage of fuel, raw materials, wastes or by-products should be carried out so as to prevent the release of:-

- (i) visible dust emissions; and/or
- (ii) emissions of organic vapours; and/or
- (iii) other noxious or offensive emissions

and to render these emissions harmless and inoffensive where released.

5. Material / Fuel Restriction

(a) Solid Fuel

Sulphur content : Not greater than 1% (by weight)

(b) Liquid Fuel

Sulphur content : Not greater than 0.5% (by weight)

Viscosity : 6 centistokes (at 40°C)

6. Monitoring Requirements

¹ An odour unit is the measuring unit of odour level and is analogous to pollution concentration. In this context, the odour level is defined as the ratio of the volume which the sample would occupy when diluted with air to the odour threshold, to the volume of the sample. In other words, one odour unit is the concentration of odorant which just induces an odour sensation.

Parameters and sampling frequency will be determined by the Authority. However, the following parameters should be monitored continuously. The in-stack monitoring data should also be transmitted to the Authority instantaneously by telemetry.

(a) Coal-fired Power Plant

In-stack monitoring

Oxygen, carbon monoxide, particulates (opacity), sulphur dioxide, nitrogen oxides, stack temperature.

Process monitoring

Generation output, essential operating parameter(s) which may significantly affect the emission of air pollutants of air pollution control equipment.

Ambient monitoring

At site boundary : Total suspended particulates (at least one 24-hour sample per 6 calendar days)

At location(s) acceptable to the Authority : Sulphur dioxide, nitrogen dioxide

(b) Gas-fired Gas Turbines

In-stack monitoring

Nitrogen oxides, oxygen, carbon monoxide, stack temperature.

Process monitoring

Generation output, water-to-fuel injection ratio, and/or essential operating parameter(s) which may significantly affect the emission of air pollutants of air pollution control equipment.

Ambient monitoring

At location(s) acceptable to the Authority : Nitrogen dioxide

(c) Oil-fired Gas Turbines (Peak Lopping Plant)

Process monitoring

Generation output, water-to-fuel injection ratio, and/or essential operating parameter(s) which may significantly affect the emission of air pollutants of air pollution control equipment.

7. Commissioning

Commissioning trials (to be witnessed by the Authority whenever appropriate) should be conducted to demonstrate performance capability of the air pollution control measures and a report of commissioning trial should be submitted to the Authority within 1 month after completion of the trial.

8. Operation and Maintenance

Requirements include not only the provision of the appliances, but the proper operation and maintenance of equipment, its supervision when in use and the training and supervision of properly qualified staff. Specific operation and maintenance requirements may be specified for individual equipment.

Malfunctioning and breakdown of the process or air pollution control equipment which would cause exceedance of the emission limits or breaches of other air pollution control requirements should be reported to the Authority within 3 working days.

Note 1 : Since 1997, the Authority will, under normal circumstances, not approve installation of any new coal-fired power generation unit. (added in December 2001))

Note 2 : The equation “1.5 X Building Height + Building Width or Building Height” in section 2(a) was amended as “Building Height + 1.5 x Building Width or Building Height”. (amended in December 2001)

Note 3 : “equal to or greater than” was added to make it clear the scope of generation units covered by this Note. (amended in December 2009)