



**A GUIDANCE NOTE ON
THE BEST PRACTICABLE MEANS
FOR
CHEMICAL INCINERATION WORKS**

BPM 20 (08)

Environmental Protection Department
Air Policy Group

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1. INTRODUCTION

- 1.1 This Note is one of a series issued by the Environmental Protection Department to provide guidance on air pollution management for processes specified under Part IV of the Air Pollution Control Ordinance (the Ordinance). It also serves as a guide for the assessment of an application for Specified Process licence under the Ordinance.
- 1.2 It should be understood that this Note sets out the basic requirements for the applicant to provide and maintain the best practicable means for the prevention of emission of air pollutants. The applicant should recognize that whether a licence is granted or refused, and on what conditions, will depend on all the circumstances of an individual application besides the requirements set out in this Note. The Authority may devise specific requirements for individual facility carrying out the specified process.
- 1.3 This Note covers the specified process and associated processes in relation to the destruction by burning of:
- (a) wastes produced from chemical manufacturing processes; or
 - (b) chemical wastes containing combined bromine, chlorine, fluorine, iodine, lead, mercury, cadmium, zinc, nitrogen, phosphorus or sulphur; or
 - (c) wastes produced in the manufacturing of plastics,
- described as “Chemical Incineration Works” in Schedule 1 to the Ordinance. Chemical Incineration Works are works in which the installed capacity exceeds 25 kilograms per hour and which are used for the destruction by burning the above types of waste, not being any works described in any other specified process.

2. EMISSION LIMITS

- 2.1 All emissions to the atmosphere, other than steam and water vapour, shall be colourless, free from persisting mist or fume, and free from droplets.
- 2.2 Smoke emission from incineration process during normal operations (including start-up and shut-down) shall not appear to be as dark as or darker than Shade 1 on the Ringelmann Chart when compared in an appropriate manner with the Ringelmann Chart or an approved device.
- 2.3 Emission from incineration process shall not exceed the concentration limits set out in Annex I. All pollutant concentration limit values are expressed at reference conditions of 0°C temperature, 101.325 kPa pressure, dry and 11% oxygen content conditions.

3. FUEL RESTRICTION

3.1 All fuels to be used shall comply with the Air Pollution Control (Fuel Restriction) Regulations in force.

4. CONTROL OF EMISSIONS

4.1 The incinerator shall be designed, equipped, built and operated in such a way that emission of air pollutants is controlled to prevent:

- (a) exceedance of emission limits set out in Section 2 of this Note;
- (b) threatening the attainment or maintenance of the relevant air quality objectives;
- (c) harm to the environment, or risks to human health, or creation of any nuisance situation;
- (d) giving rise to an objectionable odour noticeable outside the premises where the process is carried out; and
- (e) imposing undue constraint on the existing and future development or land use.

4.2 Design of Incinerator Furnace

4.2.1 The incinerator furnace shall be designed to meet the following specifications:

- (a) Destruction Efficiency
 - (i) PCBs, PCDDs, PCDFs,
Polychlorophenols and
Polychlorobenzenes Not less than 99.9999%
 - (ii) Other organic constituents Not less than 99.99%
- (b) Combustion Efficiency Not less than 99.9%
- (c) Operating Temperature
 - (i) Primary combustion chamber exit Not less than 850°C

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| (ii) | Secondary combustion chamber (for chemical waste with a content of not more than 1% halogenated organic substances (expressed as chlorine) and without PCBs, PCDDs, PCDFs, Polychlorophenols and Polychlorobenzenes) | Not less than 1,000°C |
| (iii) | Secondary combustion chamber (for chemical waste with a content of more than 1% halogenated organic substances (expressed as chlorine) or with PCBs, PCDDs, PCDFs, Polychlorophenols and Polychlorobenzenes) | Not less than 1,100°C |
| (d) | Secondary combustion residence time | Not less than two seconds |
| (e) | Oxygen content at secondary combustion chamber | Not less than 6% v/v |
- 4.2.2 The incinerator shall be designed, equipped, built and operated in such a way that the gas from the incineration process in the primary combustion chamber is raised to a temperature as set out in paragraph 4.2.1 (c) (i), after the last injection of combustion air, in a controlled and homogeneous fashion even under the most unfavourable conditions anticipated, and the gas be further treated and oxidized in a secondary combustion chamber. The temperature is to be measured near the inner wall of the combustion chamber or at another representative point of the combustion chamber acceptable to the Authority.
- 4.2.3 The secondary chamber shall be capable of burning the gas produced from the incineration process in the presence of not less than 6% v/v oxygen at a temperature according to the types of substance to be destroyed as set out in paragraphs 4.2.1 (c) (ii) and (iii) for a residence time of not less than two seconds. Also, it shall be incorporated with adequate design features to enhance the mixing and oxidation of combustion gases.
- 4.2.4 Auxiliary burner(s) shall be incorporated and automatically operated to ensure the temperature referred to in paragraphs 4.2.2 and 4.2.3 above be maintained during start-up and at the end of an incineration cycle and for as long as waste to be burnt or being burnt is in the combustion chamber.
- 4.2.5 The incinerator shall have and operate an automatic system to prevent waste feed:
- (a) at start-up, until the normal operating temperatures of the incinerator set out in paragraphs 4.2.2 and 4.2.3 have been reached;
 - (b) whenever any of the temperatures referred to in paragraph 4.2.2 or 4.2.3 is not maintained;

- (c) whenever the continuous measurements required by this Note show that any emission limit value been exceeded.
- 4.2.6 Combustion chambers, casings, ducts and ancillary equipment shall be made, and maintained, as gas-tight as practicable. They shall be maintained under negative pressure and designed to prevent both the release of gas and disturbance of combustion conditions during waste charging.
- 4.2.7 Any heat generated by the incineration process shall be recovered as far as practicable.
- 4.3 **Design of Chimney**
 - 4.3.1 Chimney includes vent, structure and opening of any kind from or through which air pollutants may be emitted. They shall be properly located and designed so as to satisfy the requirements set out in paragraph 4.1 above.
 - 4.3.2 For the chimney of the incineration process, the height of which shall be determined by mathematical or physical dispersion modelling techniques acceptable to the Authority. Moreover, the efflux velocity of the exhaust from the chimney shall not be less than 15 m/s at full load condition.
 - 4.3.3 The exit temperature of the exhaust gas from the chimney of the incineration process shall not be less than 80°C at full load condition.
 - 4.3.4 For hot releases, chimney flues and ductwork leading to the chimney shall be adequately insulated by materials free of asbestos to minimise the cooling of waste gas and prevent liquid condensation on internal surfaces. The design shall allow for regular internal cleaning of the chimney flues and ductwork.
- 4.4 Clean energy sources and fuels with proven benefits to air pollution reduction shall be used whenever possible in the relevant specified process and associated operations. The use of electricity or gaseous fuel for process heating or production of goods is always recommended.

5. OPERATION AND MAINTENANCE

- 5.1 Best Practicable Means requirements include 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.
- 5.2 All control and monitoring equipment shall be operational and functioning properly prior to the combustion or ignition of waste and until all the wastes are incinerated.

- 5.3 In case of 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, the incident shall be reported to the Authority without delay. Moreover, the incinerator shall be closed down as soon as practicable until normal operation can be restored.
- 5.4 The Code of Good Housekeeping (procedures for destruction of Ozone Depleting Substances (ODS)) issued under the United Nations Environment Programme on the Protection of the Ozone Layer (Annex III of UNEP document: UNEP/OzL.Pro.15/9) shall be fully followed for the destruction of ODS listed as scheduled substances under Ozone Layer Protection Ordinance to ensure that environmental releases of ODS through all media are minimized.

6. FUGITIVE EMISSION CONTROL

- 6.1 A high standard of housekeeping shall be maintained in all plant areas with suitable equipment provided and maintained to clean up spilled materials.
- 6.2 The control of fugitive emission of air pollutants shall be agreed with the Authority. As a general guideline, the loading, unloading, handling and storage of fuel, raw materials, wastes, by-products, ash and other incineration residue shall be carried out in a manner acceptable to the Authority so as to prevent the dust, organic vapours and/or odorous emissions being noticeable outside the site boundary.
- 6.3 Emissions from the wastewater treatment plant shall be minimised and properly controlled to prevent nuisance.

7. MONITORING REQUIREMENTS

- 7.1 Necessary monitoring equipment and techniques shall be provided and used to demonstrate that the process is properly operated and the emissions can be minimised to meet the air pollution control requirements. The scope, manner and frequency of the monitoring shall be sufficient for this purpose and will be determined by the Authority. Monitoring results shall be recorded in such manner specified by the Authority. The record should be retained at the premises for a minimum of two years, or other period specified by the Authority, after the date of last entry and be made available for examination as and when required by the Authority.
- 7.2 Without prejudice to the generality of paragraph 7.1 above, the following parameters of the incinerator process shall be monitored and recorded continuously or periodically.
- 7.2.1 In-stack Exhaust Gas Continuous Monitoring

(a) Emission of pollutants

Carbon monoxide, gaseous and vaporous organic substances, hydrogen chloride, hydrogen fluoride, nitrogen oxides, sulphur dioxide and particulates.

(b) Stack emission conditions

Parameters that may be used in assessing the performance of air pollution control measures include, but not limited to, pressure, water vapour content and opacity of the exhaust gas.

(Note: Continuous measurement of water vapour content shall not be required if the sampled exhaust gas is dried before analysis.)

7.2.2 Process Continuous Monitoring

(a) Temperature and oxygen content of the gas at the appropriate location(s) in the combustion chamber to demonstrate that the requirements set out in paragraphs 4.2.2 to 4.2.5 of this Note can be complied with.

(b) Temperature of the gas at the appropriate location(s) in the chimney to demonstrate that the requirements set out in paragraph 4.3.3 of this Note can be complied with.

7.2.3 On-line Monitoring

The continuous monitoring data referred to in paragraphs 7.2.1 and 7.2.2 above shall be transmitted instantaneously to the Authority by a telemetry system in such manner and format agreed with the Authority.

7.2.4 Periodic Measurement

Periodic measurement of acidity, chlorine, fluorine and their compounds, dioxins, heavy metals, hydrogen bromide/bromine and total phosphorus, shall be made to confirm that these pollutants are adequately controlled. The testing frequency will be determined by the Authority. All measurement results shall be recorded, processed and presented in a summary report as agreed by the Authority. The report shall be submitted to the Authority without delay after the source sampling(s) as required is/are completed.

7.3 Evidence shall be provided that quality assurance procedures are in place to ensure all monitoring results are sufficiently accurate and reliable. Calibration of the monitoring equipment has to be done by means of parallel measurements with the reference methods as agreed by the Authority.

8. COMMISSIONING

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

ANNEX I CONCENTRATION LIMIT FOR EMISSION FROM CHEMICAL INCINERATION WORKS

I.1 Air pollutant emissions from the subject incineration process shall not exceed the concentration limits tabulated in the following tables. The air pollutant concentration is expressed at reference conditions of 0°C temperature, 101.325 kPa pressure, dry and 11% oxygen content conditions.

(a) Daily Average Value

Air Pollutant	Concentration Limit (mg/m ³)
Particulates	10
Gaseous and vaporous organic substances, expressed as total organic carbon	10
Hydrogen chloride (HCl)	10
Hydrogen fluoride (HF)	1
Sulphur dioxide (SO ₂)	50
Nitrogen oxides, expressed as nitrogen dioxide (NO ₂)	200
Carbon monoxide (CO)*	50

(b) Half-hourly Average Value

Air Pollutant	Concentration Limit (mg/m ³)
Particulates	30
Gaseous and vaporous organic substances, expressed as total organic carbon	20
Hydrogen chloride (HCl)	60
Hydrogen fluoride (HF)	4
Sulphur dioxide (SO ₂)	200
Nitrogen oxides, expressed as nitrogen dioxide (NO ₂)	400
Carbon monoxide (CO)*	100

Note * excluding the start –up and shut-down phases

- (c) Average value over the sampling period of a minimum of 30 minutes and a maximum of 8 hours

Air Pollutant	Concentration Limit (mg/m³)
Cadmium and its compounds, expressed as cadmium (Cd) Thallium and its compounds, expressed as thallium (Tl)	total 0.05
Mercury and its compounds, expressed as mercury (Hg)	0.05
Antimony and its compounds, expressed as antimony (Sb) Arsenic and its compounds, expressed as arsenic (As) Lead and its compounds, expressed as lead (Pb) Chromium and its compounds, expressed as chromium (Cr) Cobalt and its compounds, expressed as cobalt (Co) Copper and its compounds, expressed as copper (Cu) Manganese and its compounds, expressed as manganese (Mn) Nickel and its compounds, expressed as nickel (Ni) Vanadium and its compounds, expressed as vanadium (V)	total 0.5
Chlorine and its compounds (as Cl ₂)	75
Fluorine and its compounds (as HF)	18.8
Acidity (as sulphuric acid)	75
Total phosphorus (as P)	5.6
Hydrogen bromide and bromine (as HBr and Br ₂)	5

- (d) Average value over the sampling period of a minimum of 6 hours and a maximum of 8 hours

Air Pollutant	Concentration Limit
Polychlorinated dibenzodioxins and polychlorinated dibenzofurans <i>(see Annex II for the calculation of equivalent concentration)</i>	0.1 ng I-TEQ/m ³

ANNEX II CALCULATION OF EQUIVALENT CONCENTRATION FOR DIOXINS

II.1 For the determination of the total concentration of dioxins and furans, the mass concentrations of the following dibenzodioxins and dibenzofurans shall be multiplied by the following equivalence factors before summing:

		<u>Toxic Equivalence Factor</u>
2,3,7,8 -	Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8 -	Pentachlorodibenzodioxin (PeCDD)	0.5
1,2,3,4,7,8 -	Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,6,7,8 -	Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,7,8,9 -	Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8 -	Heptachlorodibenzodioxin (HpCDD)	0.01
	Octachlorodibenzodioxin (OCDD)	0.001
2,3,7,8 -	Tetrachlorodibenzofuran (TCDF)	0.1
2,3,4,7,8 -	Pentachlorodibenzofuran (PeCDF)	0.5
1,2,3,7,8 -	Pentachlorodibenzofuran (PeCDF)	0.05
1,2,3,4,7,8 -	Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8 -	Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9 -	Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8 -	Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8 -	Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9 -	Heptachlorodibenzofuran (HpCDF)	0.01
	Octachlorodibenzofuran (OCDF)	0.001