A GUIDANCE NOTE ON THE

BEST PRACTICABLE MEANS

FOR

SPECIFIED PROCESS – INCINERATORS

(MUNICIPAL WASTE INCINERATION)

BPM 12/1 (2024)

Environmental Protection Department

Environmental Compliance Division /
Air Quality Management Division

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1. INTRODUCTION

1.1 This Note is one of a series issued by the Environmental Protection Department (EPD) to guide the air pollution management of specified processes (SP), to which Part IV of the Air Pollution Control Ordinance (the Ordinance) applies, and the assessment of an application for SP licence. It covers the SP and associated processes in relation to the incineration of municipal waste under the SP of "Incinerators" as described in Schedule 1 to the Ordinance –

> "Works in which the installed capacity exceeds 0.5 tonne per hour and which are used for the destruction by burning of wastes or refuse, not being any works described in any other specified process."

Best Practicable Means (BPM)

1.2 Under section 12 of the Ordinance, the owner of any premises used for the conduct of an SP shall use the BPM for preventing the emission of noxious or offensive emissions from their plants, preventing the discharge of such emissions into the atmosphere and rendering such emissions where discharged harmless and inoffensive. **This Note sets out the general requirements for the provision and maintenance of the BPM to minimize air pollutant emissions from an individual facility. However, an applicant for an SP licence should recognize that fulfilment of the requirements in this Note does not necessarily lead to the granting of a licence because the decision will also have to take into account the specific circumstances of individual application. In addition, the Director of Environmental Protection, who is the Air Pollution Control Authority under the Ordinance (or the Authority for short) may impose specific requirements in licence, if granted, in lieu of the requirements set out in this Note. The terms and conditions in the SP licence represent the statutory requirements for the environmental management of the SP.**

> (Note: The term "best practicable means", where used with respect to the emission of an air pollutant from a premises, has reference not only to the provision and efficient maintenance of appliances adequate for preventing such emission, but also to the manner in which such appliances are used, and the proper supervision by the owner of the premises of any operation that generates the air pollutant.)

1.3 For the avoidance of doubt, this Note does not affect the document "A Guidance Note on the Best Practicable Means for Incinerators (Municipal Waste Incineration) BPM 12/1 (08)" issued in September 2008, which shall remain in force and continue to apply to municipal waste incinerator (MWI) tendered for construction before 1 August 2024 in the assessment of an application for variation or renewal of SP licence. Nevertheless, upgrading of the emission control systems of these MWIs shall be made whenever technically and economically feasible with a view to meeting the emission limits and monitoring requirements as set out in Annex I and paragraph 7.2, respectively, of this Note.

2. EMISSION LIMITS

2.1 All emissions to air, other than steam and water vapour, shall be colourless, free from persisting mist or fume, and free from droplets.

2.2 Emission from non-fugitive fixed emission points in the SP and associated processes covered by this Note shall not:

(a) exceed the concentration limits set out in Annex I; and

(b) 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.

3. TYPES OF FUELS USED

3.1 All fuels to be used shall comply with the Air Pollution Control (Fuel Restriction) Regulations in force or be approved by the Authority. Clean energy sources and fuels with proven benefits to air pollution reduction (such as electricity, gaseous fuels, recovered heat, etc.) shall be adopted whenever practicable in the process.

4. CONTROL OF EMISSIONS

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

(a) causing harm to the environment, adverse effects to human health, or creation of any nuisance situation (e.g. objectionable odours noticeable outside the premises where the process is carried out);

(b) creating hindrance to the attainment or maintenance of the relevant air quality objectives; and

(c) imposing undue constraints on the existing and future development or land use.

4.2 **Incoming Waste Handling**

4.2.1 The reception hall shall be maintained under negative air pressure by withdrawing the air through the bunkers into the combustion chamber of the MWI. During a shut-down, or in any scenarios where the operating MWI cannot provide sufficient draft to maintain the negative air pressure in the waste reception hall, the air is to be extracted via a separate system to an odour and/or dust removal equipment for treatment before discharging into open atmosphere.

4.2.2 Each refuse dumping bay shall incorporate a hydraulically activated door over the chute to contain odour and dust within the refuse pit when the bay is not in use.

4.2.3 The waste feeding system shall be designed and equipped to provide a homogenized and consistent feedstock in terms of uniform size, calorific value, moisture content and throughput as appropriate.

4.3 **Design of Incinerator Furnace**

4.3.1 The furnace of MWI shall be designed to ensure effective destruction of combustible substances in the waste gas. Combustion gas temperature, residence time, air supply and gas turbulence shall be adequately and properly controlled to achieve this requirement. For effective control of dioxins, one should make reference to the latest emission management technologies for waste incinerators provided in "Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants"[1].

4.3.2 The MWI shall be designed, equipped, built and operated in such a way that the temperature of the gas from the incineration process is raised to at least 850°C, after the last injection of combustion air, in a controlled and homogeneous fashion even under the most unfavourable conditions, for at least two seconds in the presence of at least 6% v/v oxygen on dry basis. 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.

4.3.3 Auxiliary burner(s) shall be incorporated and operated to ensure the temperature specified in paragraph 4.3.2 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.

4.3.4 The MWI shall have and operate an automatic system to prevent waste feed:

(a) at start-up, until the temperature of 850°C or above referred to in paragraph 4.3.2 above has been reached;

(b) whenever the temperature of 850°C referred to in paragraph 4.3.2 above cannot be maintained; and

(c) whenever the continuous measurements required by this Note show that any of the emission limit values has been exceeded.

4.3.5 Combustion chambers, casings, ducts and ancillary equipment shall be made, and maintained, as gas-tight as practicable. They shall be maintained under slightly reduced pressure and designed to prevent both the release of gas and disturbance of combustion conditions during waste charging.

4.3.6 Any heat generated by the incineration process shall be recovered for beneficial use as far as practicable.

[1] https://nips.pops.int/Guidance_docs/Document_2_4_1.pdf

4.4 **Design of Chimney**

4.4.1 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.

4.4.2 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.

4.4.3 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.

4.4.4 For hot releases, chimney flues and ductwork leading to the chimney shall be adequately insulated by materials free of asbestos to minimize 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.

5. OPERATION AND MAINTENANCE

5.1 BPM requirements include the proper operation and maintenance of equipment, its supervision when in use and the training and supervision of qualified staff. Specific operation and maintenance requirements may be specified by the Authority in SP licence 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 Operating staff shall be properly trained in their duties relating to control of the process and emissions to air. Particular emphasis shall be given to training for start-up, shut-down and handling abnormal conditions.

5.4 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, shall be reported to the Authority without delay. Moreover, all practicable means (including refraining from using the defective equipment) shall be taken to minimize the abnormal emission.

6. FUGITIVE EMISSION CONTROL

6.1 The Authority will prescribe the requirements in consideration of the specific circumstances of individual SP plant. As a general guidance, the loading, unloading, handling and storage of fuels, 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 release of:

(a) visible dust emissions; and

(b) other noxious or offensive emissions.

6.2 The integrity of all plant buildings, except those without waste handling areas and with no risk of malodourous emissions, shall be maintained to prevent any uncontrolled escape of malodourous emissions from the buildings. Doors should have seals and be kept closed at all times, except when necessary for the movement of plant, personnel and materials. Self-closing or motorized doors should be provided and fitted with alarms which operate if the doors fail to close within a reasonable period of time.

6.3 A high standard of housekeeping shall be maintained in all plant areas. Adequate provisions shall be made for the containment of liquid and solid spillages from the waste incineration operations and associated processes. All spillages shall be cleared as soon as possible and discarded in closed containers for proper disposal.

6.4 Emissions from the wastewater treatment plant shall be minimized 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 minimized 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 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 incineration 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, ammonia 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, oxygen content and volumetric flow rate 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 4.3.1 to 4.3.4 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 4.4.3 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 telemetry system in such manner and format agreed with the Authority.

7.2.4 Periodic Measurement

Periodic measurement of dioxins, furans, metalloids and heavy metals shall be made to confirm that these pollutants continue to be adequately controlled. The testing frequency shall 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 The system of continuous emission monitoring including instrument specifications, quality control, operation and maintenance to be implemented by the licence holder shall meet the protocols set out in the guideline "General Requirements of Continuous Emission Monitoring (CEM) System" issued by the Authority.

7.4 The licence holder shall publicize emission data, in an agreed format by the Authority, at regular intervals as required by the Authority.

8. COMMISSIONING

8.1 Commissioning trial of the plant, to be witnessed by the Authority whenever appropriate, shall be conducted in such manner and format agreed with the Authority to demonstrate the effectiveness of the air pollution control measures and the compliance with emission limits. A report shall be submitted to the Authority within 1 month after the completion of the commissioning trial.

ANNEX 1 CONCENTRATION LIMITS FOR EMISSIONS FROM MUNICIPAL WASTE INCINERATORS

I.1 Air pollutant emissions from the incineration of municipal waste shall not exceed the concentration limits tabulated in the following tables. All air pollutant concentrations are expressed at reference conditions of 0°C temperature, 101.325 kilopascals pressure, dry and 11% oxygen content conditions.

(a) Hourly Average and Daily Average

Air Pollutant	**Concentration Limit (mg/m^3)**	
	Hourly Average	**Daily Average**
Particulates	10	5
Gaseous and vaporous organic substances, expressed as total organic carbon	10	10
Hydrogen chloride (HCl)	8	6
Hydrogen fluoride (HF)	2	1
Sulphur dioxide (SO_2)	30	30
Nitrogen oxides (NO_x), expressed as nitrogen dioxide (NO_2)	80	80
Carbon monoxide (CO) (1)	50	30
Ammonia (NH_3) (2)	---	10

Note:

(1) The concentration limits of CO do not apply to the start-up and shut-down phases.

(2) Higher value of concentration limit of NH_3 may be accepted if it can be demonstrated to the satisfaction of the Authority that the licence holder has exhausted all options to reduce the ammonia slip but is still unable to attain this concentration limit due to technical constraints.

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

Air Pollutant	**Concentration Limit (mg/m^3)**
Cadmium and its compounds, expressed as cadmium (Cd) Thallium and its compounds, expressed as thallium (Tl)	total 0.02
Mercury and its compounds, expressed as mercury (Hg)	0.02
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 0.3

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

Air Pollutant	**Concentration Limit ($ng\ I\text{-}TEQ/m^3$)**
Polychlorinated dibenzodioxins and polychlorinated dibenzofurans *(see Annex II for the calculation of equivalent concentration)*	0.04

ANNEX II CALCULATION OF EQUIVALENT CONCENTRATION FOR DIOXINS AND FURANS

II.1 For the determination of 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:

		Toxic Equivalence Factor
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