



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

**FOR**

**INCINERATORS**

**(CREMATORIA)**

**BPM 12/2 (06)**

Environmental Protection Department  
Air Policy Group

September 2008

## **1. INTRODUCTION**

- 1.1 This Note is issued by the Environmental Protection Department as one of the series to provide guidance for the control of specified processes under Part IV of the Air Pollution Control Ordinance (*the Ordinance*). It is a guide in the assessment of an application for a Specified Process licence issued under this 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 the emission of air pollutants. The applicant should note that whether a licence is granted or refused, and the conditions imposed, will depend on all the particular circumstances of an individual application in addition to the requirements in this Note.
- 1.3 This Note covers specified process and associated processes in relation to the cremation of human remains, described as “Incinerators” in Schedule 1 of the Ordinance. Incinerators are 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.
- 1.4 This Note supersedes the previous document “A Guidance Note on the Best Practicable Means for Incinerators (Crematoria) BPM 12/2” issued in August 1998.
- 1.5 The requirements in this Note are applicable to cremators commissioned from 2003 onwards. Upgrading of controls on the older cremators to meet these requirements should be made whenever technically and economically feasible.

## **2. EMISSION LIMITS**

- 2.1 All emissions to 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 cremator 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 the appropriate manner with the Ringelmann Chart or an approved device.
- 2.3 Emission from cremator shall not exceed the concentration limits set out in Annex I.

## **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 crematorium 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; and
- (d) giving rise to an objectionable odour noticeable outside the premises where the process is carried out.

### **4.2 Design of Cremators**

4.2.1 Cremators 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.

4.2.2 The temperature of the combustion gas from the primary combustion zone shall be raised to 850°C, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, for at least two seconds in the secondary combustion zone in the presence of at least 6% v/v oxygen.

4.2.3 Coffin shall not be introduced to the cremator unless the temperature of 850°C referred to in paragraph 4.2.2 above has been reached. The temperature of 850°C shall be maintained until the cremation is completed.

### **4.3 Design of Chimney**

4.3.1 Chimney includes vents, structures and openings of any kind from or through which air pollutants may be emitted. It shall be properly located and designed so as to satisfy the requirements set out in the paragraph 4.1 above.

4.3.2 For the chimney of the cremation 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 10 m/s at full load condition.

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 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 when the cremator is in operation.
- 5.3 The 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 abnormal conditions.
- 5.4 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 immediately without delay. Moreover, all practicable means (including refraining from using the defective cremator) shall be taken to minimize the abnormal emission.

## **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 the fugitive emissions of air pollutants shall be agreed with the Authority so as to prevent the dust, organic vapours and/or odorous emissions being noticeable outside the site boundary. As a general guideline, the removal of ash and other residue shall be done carefully to prevent dust emissions. Cremated remains shall be removed and stored in a covered container.

## **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 cremation shall be monitored and recorded continuously or periodically:

(a) Process and Waste Gas Continuous Monitoring

- (i) Temperature inside the primary combustion zone.
- (ii) Temperature and oxygen content of the gas at the appropriate location(s) to demonstrate that the requirements set out in the paragraphs 4.2.2 to 4.2.3 of this Note can be complied with.
- (iii) Carbon monoxide concentration at the outlet from the secondary combustion zone.
- (iv) Gas opacity at the chimney of the cremator.
- (v) Other essential operating parameter(s) which may affect the performance of air pollution control measures.

(b) On-line Monitoring

The continuous monitoring data referred to in (a) above shall be transmitted instantaneously to the Authority by telemetry system or the real time and logged monitoring data shall be accessible by the Authority in such manner and format agreed with the Authority.

(c) Periodic Measurement

Periodic measurements of particulates, hydrogen chloride, carbon monoxide, gaseous and vaporous organic substances, mercury and dioxins shall be made to confirm the compliance with the emission limits set out in Annex I. The sampling 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 within reasonable time(s) to be agreed with the Authority after the source sampling(s) as required is/are completed.

7.3 The monitoring equipment to be used shall meet the specifications specified by the Authority. They shall be maintained and calibrated according to the manufacturer's recommendations. Unless otherwise agreed by the Authority, zero and span checks shall be carried out every 24 hours and recorded.

7.4 The instruments for gas opacity monitoring shall be fitted with audible and visual alarms which shall activate at a trigger level agreed with the Authority. Emission events which lead to the alarms being activated shall be properly recorded in such manner and format agreed with the Authority. These instruments shall be checked regularly to ensure that they are functioning correctly in accordance with the manufacturer's instructions.

## **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. Unless otherwise agreed by the Authority, 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  
INCINERATORS - CREMATORS**

I.1 Air pollutant emissions from a cremator shall not exceed the concentration limits tabulated in the table below. The air pollutant concentration is expressed at reference conditions of 0°C temperature, 101.325 kPa pressure, 11% oxygen and dry gas.

<b>Air Pollutants</b> <i>(one-hourly average value except for mercury and dioxins)</i>	<b>Concentration Limit</b>
Particulates	40 mg/m <sup>3</sup>
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m <sup>3</sup>
Hydrogen chloride (HCl)	30 mg/m <sup>3</sup>
Carbon monoxide (CO)	100 mg/m <sup>3</sup>
Mercury and its compounds, expressed as mercury (Hg)	0.05 mg/m <sup>3</sup>
Polychlorinated dibenzodioxins and polychlorinated dibenzofurans <i>(see Annex II for the calculation of equivalent concentration)</i>	0.1 ng I-TEQ/m <sup>3</sup>

I.2 For demonstration of compliance with the limits, the gas sample shall not be taken before the coffin is charged into the combustion chamber. The sampling shall commence as soon as stable conditions are achieved inside the cremator after the coffin is charged into the combustion chamber, and complete or interrupt before the process of removing the ash from the combustion chamber commences.

I.3 Other than continuous emission monitoring, the sampling for hourly average emission value shall be completed within one cremation cycle.

I.4 For the measurement of mercury and dioxins, the sampling shall last for a minimum of three complete cremation cycles or the requisite number of complete cremation cycles to cover a minimum period of six hours, whichever is the longer duration. Sampling shall be interrupted during the idle period between two cremations.

## 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:

		<b><u>Toxic Equivalence Factor</u></b>
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