Supplementary Submission No 17a

INQUIRY INTO FUNERAL INDUSTRY

Organisation:

Name: Ms Therese Mallik

Telephone:

Date Received: 31/10/2005

Theme:

Summary

The Director,
Standing Committee on Social Issues
Legislative Council
Parliament House,
Macquarie Street,
Sydney NSW 2000
Facsimile: 92302981

Therese Mallik

26/10/2005

Dear Sir/ Madam,

Re: Inquiry into the Funeral Industry

I have previously made a submission to the above inquiry supporting the need for regulation of crematoriums based on my personal experience with the St Patrick's of Nulkaba Pty Ltd cremator located at Nulkaba near Cessnock.

I referred in my submission to an impending court case in the Land and Environment court which was subsequently heard at Kurri Kurri court on the 17th, 18th and 19th of this month.

Many issues emerged during the course of this case and while the time for making submissions has passed, I hope the committee will be able to consider the matters I seek to bring to your attention now as a result of this recent hearing.

The morning of the first day of the hearing took place on site. At this site inspection, the following practises came to light.

- Unclaimed ashes are being scattered on site. Council was advised prior to development consent being granted that no disposal of any waste would occur on site. This site is the size of a residential block in the area.
- Artificial body parts (i.e hip joints etc.) and ashes are being buried in holes on site. This has been occurring since operations commenced in 2002 according to the manager. Residents gave evidence of observing these holes nearly filled with material being filled with water during a period of rain and subsequently draining to an ecologically sensitive creek.
- The operator agreed with residents when they stated that they observed ashes being scraped from the furnace in such a way that quantities of human ashes fell onto the floor. It was admitted by the operator that these ashes are hosed into the envirocycle system and the recycled water then sprayed on the grounds.
- A natural watercourse runs from this site through community land, residents properties and thence into Black Creek (a sensitive creek) when rain occurs. Any ashes deposited on this site either by scattering, as a result of cleaning, or by overflow from holes in the ground would be carried along this watercourse when periods of rain occurs.
- The operator agreed with residents when they gave evidence of observing trays of bones and ash placed in such a position that the wind blowing through the facility disturbed the ashes and concerns were raised that these ashes may become air borne.
- A sulo bin nearly filled to the top with ashes and artificial body parts was observed at the site inspection. The operator told the court that this material was to be disposed of on site.
- Evidence was given by residents of black smoke coming from the stack on 12/10/05. This was observed by one resident at 4pm and a photo was taken at this time. Three other residents (one being myself)observed this black smoke at 4.20pm. Two council officers were observed taking photos at this time. I observed the smoke for a period of 6 minutes. The manager stated that he had set the cremator on automatic 'last charge' on this day. This results in an automatic 85 minute cremation followed by automatic cool down. The facility was locked and unattended at the time black smoke was observed. The operator stated he was aware of the black smoke at 4pm when he left but was unable to take any action to stop the malfunction as the furnace was set to automatic.. Evidence was given that the smoke alarm had been switched off before 4 pm.

During the remainder of the case held in Kurri Kurri court the following matters came to light::-

- A reduction in temperature from 900 degrees to 700 degrees in the primary chamber was sought. Evidence was given by the manufacturer that this temperature should be a minimum 760 degrees. If the temperature reduction sought is granted the minimum temperature required will then be below that recommended by the manufacturer. Council officers supported this reduction despite contrary evidence by the manufacturer. This demonstrates the clear inability

of Local Councils to properly control these activities as they do not have the expertise to understand complex processes..

- Emission testing for dioxin undertaken on 26/9/2003 resulted in a 10% higher level than the maximum now permitted for heavy industries or for municipal incinerators. [Protection of the Environment(Clean Air) Regulations amended 1/9/2005]. The developer has suggested a dioxin level 10 times higher than for heavy industries such as steelworks on the basis that no regulations or limits are currently set for crematorium.
- A health risk assessment undertaken in support of the original application resulted in a 1.2 in 1 million 70 year lifetime cancer risk. We were told this result was insignificant. Residents have recently discovered that any health risk over 1 in 1 million requires an application of best practice. (air filters, scrubbers, etc)

I have spoken to the DEC(former EPA), the Health Department and Cessnock City Council following this case.
The DEC says that even though the facts raise possible pollution of waterways (Protection of the Environment Operations Act), it is a matter for council to pursue as it sees fit. They see disposal of ashes on site as a matter for council pursuant to what is or is not permitted by the development consent.

The Health Department states that the disposal of ashes and artificial body parts on site is a matter for council pursuant to the conditions of the development consent.

I had previously raised with Hunter Health prior to my original submission to this inquiry, my concerns about the manner in which the Register of the crematorium was being maintained. While the Public Health(Disposal of Bodies) Regulations require the date of cremation to be included in the register (with a penalty clause attached to this requirement should non compliance occur), this has never been complied with in the register of the Nulkaba facility. I am now told by the health department that enforcement of this regulation is a matter for council as the heath department does not have the resources to enforce their own regulations. There is still non compliance occurring at Nulkaba.

I am told by Cessnock City Council that burying of body parts and ashes on site is occurring at the direction of the health department. The operator had previously told residents it was occurring because council would not allow this material to be dumped at the council waste disposal site. At the site inspection the operator stated it was occurring because that is what took place at Beresfield where he previously worked. I am told by council that it is a matter for the health department to enforce the Public Health act and not a matter for council.

As you can see, each organisation points at another for regulation of this industry. No one takes responsibility and every organisation states there are no controls for this industry.

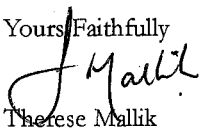
The problem caused by the lack of prescribed emission levels for cremators became apparent during last week's court case. The UK is currently phasing in new standards for cremators, recognising that mercury emissions from cremators will rise by 2/3rds in the next 15 years and that cremators will be the largest source of mercury emissions. Control equipment such as air filters and scrubbers that can remove up to 90% of emissions are being phased in currently in the UK. In NSW, there are no emission limits for crematorium and so a problem arose as to which limits should apply. It is a matter of concern that a limit for dioxin 10 times greater than the maximum permitted for heavy industries in NSW (and for cremators in the UK) was proposed and may be accepted simply because cremators are not scheduled premises and are unregulated in NSW.

This cremator has an insufficient buffer zone surrounding it. The facility was approved as a small operation for local needs. It is proposed to change it into a large facility without increasing the size of the buffer zone. This would cause an intolerable situation for the neighbours.
Following the Funeral industry enquiry in Victoria regulations were introduced for cremation facilities but as no such regulation exists in NSW the operators believe they can do what ever they please without any regard for the environment or the surrounding residents.

May overseas countries recognise the environmental harm that can arise from un controlled cremation activities even China (Hong Kong) has restrictions and controls on cremators. The UK has introduced stringent environmental and best practice policies to control emissions from cremators and I do not believe the people of NSW deserve any less.

I enclose a copy of the UK regulation (process guide 5/2 (2004)) for your information and you will note the stringent regulation for new processes and the gradual phasing out of existing processes by use of levies against non complying cremators. A similar centralised system similar including annual licensing should be introduced in NSW to ensure our cremation industry complies with World Best Practice standards. The People of NSW deserve nothing less.

Yours Faithfully



Therese Mallik

Process Guidance Note 5/2 (04)

Secretary of State's Guidance for Crematoria

defra
Department for Environment
Food and Rural Affairs

SCOTTISH EXECUTIVE

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Defra would like to acknowledge the work of the Environment Agency's Local Authority Unit in the drafting of this guidance note.

Environment Agency

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1 Introduction

1.1 This note is issued by the Secretary of State, the Welsh Assemby Government (WAG) and the Scottish Executive ("the Government") to give guidance on the conditions appropriate for the control of emissions into the air from crematoria processes/ installations[1]. It supersedes guidance PG5/2(95) issued in August 1995.

1.2 This is one of a series of notes giving guidance on Best Available Techniques (BAT) and Best Available Techniques Not Entailing Excessive Cost (BATNEEC)[2]. The notes are all aimed at providing a strong framework for consistent and transparent regulation of installations.

1.3 This note is for use under both Local Air Pollution Control (LAPC) established by Part I of the Environmental Protection Act 1990, and Local Air Pollution Prevention and Control (LAPPC) established by the Pollution Prevention and Control Act 1999[3]. It constitutes statutory guidance to regulators under regulation 37 of The Pollution Prevention and Control (England and Wales) Regulations 2000, SI 1973[4]. To the extent it provides guidance on techniques, it also constitutes statutory guidance to regulators under section 7(11) of the 1990 Act, and in any event regulators are expected to have regard to it. The note will be treated as one of the material considerations when determining any appeals made against a decision under either the 1990 or 1999 Acts

1.4 The note also (where appropriate) gives details of any mandatory requirements affecting air emissions which are in force at the time of publication, such as those contained in Directions from the Government.

Site specific BAT/ BATNEEC

1.5 All processes are subject to BAT/ BATNEEC. In general terms, what is BAT/ BATNEEC for one process in a sector is likely to be BAT/ BATNEEC for a comparable process; but in each case it is, in practice, for regulators (subject to appeal) to decide what is BAT/ BATNEEC for the individual process and the regulator should take into account variable factors (such as configuration, size and other individual characteristics of the process) and the locality (such as proximity of particularly sensitive receptors[5]). Ultimately, therefore, what constitutes BAT/ BATNEEC is site specific but this guidance note comprises guidance for the generality of processes in the sector and careful regard should be had to it, in order to maximise consistency of permits as appropriate.

Who is affected

1.6 This guidance is for:

- regulators: who must have regard to the guidance when determining applications and reviewing extant authorisations and permits
- operators: who are best advised also to have regard to it when making applications, and in the subsequent operation of their process
- members of the public: who may be interested to know what the Government considers (in accordance with the legislation) amounts to appropriate conditions for controlling air emissions for the generality of processes in this particular industry sector

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1. The term "process(es)" is used in the remainder of the note to mean both "processes" under the Environmental Protection Act 1990 and "installations" under the Pollution Prevention and Control Act 1999.
2. BATNEEC is the formulation used in the Environmental Protection Act 1990 and BAT is used in the Pollution Prevention and Control Act 1999. For the purpose of this guidance note, the two concepts are regarded as having essentially the same effect.
3. In accordance with the Pollution Prevention & Control (England and Wales) (Amendment) Regulations 2002, SI 2002/275, crematoria processes transfer from regulation under the 1990 Act to the 1999 Act from 1 April 2003. The relevant date in Scotland under Part 2 of schedule 3 to SSI 2000/323 is 31 December 2002.
4. In Scotland, section 24 of the Pollution Prevention and Control (Scotland) Regulations 2000.
5. Guidance on the relationship between BAT/BATNEEC and air quality objectives is contained in the General Guidance Manual on policy and procedures for A2 and B installations.

1.7 The guidance is based on the state of knowledge and understanding at the time of writing of:

- crematoria

1.8 The note may be amended from time to time in order to keep abreast with developments in BAT/BATNEEC including improvements in techniques and new understanding of environmental impacts and risks. Such changes may be issued in a complete revision of this document, or in separate additional guidance notes which address specific issues. (It may not always be possible to issue amending guidance quickly enough to keep in absolute step with rapid changes, which is another circumstance where paragraph **1.5** above might apply.)

- their potential impact on the environment ; and
- what constitutes BAT/ BATNEEC for preventing and reducing air emissions

1.9 Steps will be taken to ensure that those who need to know about changes are informed. Operators (and their advisers) are, however, strongly advised to check with the regulator whether there have been any changes before relying on this note for the purposes of making an application under the 1990 or 1999 Acts or making any other decisions where BAT/ BATNEEC may be a consideration.

Consultation

1.10 This note has been produced in consultation with relevant trade bodies, representatives of regulators including members of the Industrial Pollution Liaison Committee, and other interested organisations.

Publication

1.11 This and the other published guidance in this series is available, free of charge, via Defra at **www.defra.gov.uk**. There are links to this site from the following web sites:

- Scottish Executive at **www.scotland.gov.uk**
- Environment Agency at **www.environment-agency.gov.uk**
- Scottish Environment Protection Agency at **www.sepa.org.uk**

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1.12 General guidance explaining LAPPC and setting out the policy and procedures, is contained in the "General Guidance Manual on Policy and Procedures for A2 and B Installations" (Ref. **(a)**) available from **www.defra.gov.uk/environment/ppc/index.htm**, referred to in this document as the "General Guidance Manual." This is designed for operators and members of the public, as well as for local authority regulators. In Scotland there is the SEPA Practical Guide for Part B activities (Ref. **(b)**) available from **www.sepa.org.uk/ppc/guidance/practicalguidepartbactivities.pdf**

1.13 In addition to the General Guidance Manual referred to above, explanation or clarification of certain terms used in this guidance note may be found in a general guidance note issued under Part I of the Environmental Protection Act 1991: 'Interpretation of terms used in process guidance notes', known as General Guidance Note 4 - GG4 - published by HMSO in 1991. Where there is any conflict between GG4 and the guidance issued in this note or in the General Guidance Manual, the latter two documents should prevail, as should any subsequent guidance issued in relation to LAPPC.

2 Timetable for compliance and reviews

Existing processes or activities

2.1 The previous guidance advised that upgrading to that standard should usually have been completed by 1 April 1996. Requirements still outstanding from any existing upgrading programme should be completed.

Upgrading for this note

2.2 The new provisions of this note and the dates by which compliance with these provisions is expected are listed in the table below, together with the paragraph number where the provision is to be found. Compliance with the new provisions should normally be achieved by the dates shown. Authorisations/permits should be varied as necessary, having regard to the changes and the timetable.

Table 1: Compliance timetable

Relevant paragraph/row in this note	Provision	Compliance date
Table 3	Mercury and PCDD/F limits and arrestment plant at new processes	From the 1st October 2006
Paragraph **5.7** 5th bullet	Instrument reliability guideline	12 months from publication
All other provisions	-	To be complied with as soon as practicable, which in most cases should be within 12 months of the publication of this note
1. For the change to 2 seconds uncorrected residence time, where this can be achieved without structural change, up to 12 month sis appropriate. Where structural work is required, it should be at the earliest opportunity which should normally be when the cremator is next replaced.		

2.3 Replacement plant should normally be designed to meet the appropriate standards specified for new installations or activities.
This does not apply to the provision of gas cleaning, which should not be required at crematoria which were existing processes on the first day of the month following publication of this guidance note.

Relaxation of conditions

2.4 Where provisions in the preceding guidance note have been deleted or relaxed, authorisations should be varied as necessary as soon as reasonably practicable. **Section 7** provides a summary of all changes.

New processes or activities

2.5 For new processes or activities, the authorisation/permit should have regard to the full standards of this guidance from the first day of operation.

Substantially changed processes or activities

2.6 For substantially changed processes or activities, the authorisation/permit should normally have regard to the full standards of this guidance with respect to the parts of the process that have been substantially changed and any part of the process affected by the change, from the first day of operation.

This does not apply to the provision of gas cleaning, which should not be required at crematoria which were existing processes on the first day of the month following publication of this guidance note.

Permit reviews

Reviewing permits

2.7 Under LAPC the requirement is to review conditions in authorisations at least every four years. (Section 6(6) Environmental Protection Act 1990).

2.8 Under LAPPC the legislation requires permits to be reviewed periodically but does not specify a frequency. It is considered for this sector that a frequency of once every six years ought normally to be sufficient for the purposes of Regulation 15(1) Pollution Prevention and Control Regulations 2000 [6].

More frequent review may be necessary in individual cases for the reasons given in Regulation 15(2). Further guidance on permit reviews is contained in chapter 26 of the General Guidance Manual. Regulators should use any opportunities to determine the variations to authorisations/permits necessitated by paragraph **2.2** above in conjunction with these reviews.

2.9 Under both LAPC and LAPPC, conditions should be reviewed where complaint is attributable to the operation of the process and is, in the opinion of the regulator, justified.

6. In Scotland, Regulation 11(1) of the Pollution Prevention and Control (Scotland) Regulations 2000 (SSI 2000/323). More frequent reviews may be necessary for the reasons given in Regulation 11(2).

3 Process description

3.1 Crematoria are prescribed for:

- **LAPC**, under section 5.1 of Schedule 1 to the Environmental Protection (Prescribed Processes and Substances) Regulations 1991, SI 472 (as amended)
- **LAPPC**, under section 5.1 Part B of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973 as amended, in particular by SI 2002/2980[7].

3.2 This Note refers to the cremation of human remains in

- gas fired and electric fired cremators that are existing processes and substantially changed processes
- gas and electric cremators that are new processes
- standby cremators
- small-scale cremators

3.3 In the context of this Note, "process" or activity comprises the whole process from receipt to dispatch of materials, and including the treating, handling and storage of all materials relating to the process.

3.4 There were 240 crematoria operating in the UK at the end of 1999 which carried out 444,169 cremations, about 70.4% of the total number of deaths. In 1999, 37 crematoria carried out less than 1000 cremations, three-quarters of crematoria carried out between 1000 and 3000 cremations, and there were 4516 cremations at the busiest crematoria. In 2000, 51 were privately owned crematoria including 13 new sites since 1995. 1 new municipal crematoria opened in 2000.

7. In Scotland, under section 5.1 Part B of Schedule 1 of the Pollution Prevention and Control (Scotland) Regulations 2000 (SSI 2000/323) as amended, in particular by SI 2003/170.

4 Potential releases

4.1 The key emissions from these processes that constitute pollution for the purposes of Part I of the Environmental Protection Act 1990 or the Pollution Prevention and Control Regulations 2000 and therefore warrant control are those consisting of odour, particulate matter, hydrogen chloride, nitrogen oxides, carbon monoxide, volatile organic compounds (from methane to polyaromatic hydrocarbons ie PAH), mercury compounds and PCDD/F. (PCDD/F are polychlorinated dibenzo-p-dioxins and furans - often referred to simply as dioxins.)

4.2 The flue gases are the main source of these releases and potential releases from crematoria.

4.3 The cremated remains size reduction machine may emit particulate matter.

4.4 At processes with gas cleaning, gas cleaning residues may emit particulate matter

5 Emission limits, monitoring and other provisions

5.1 The emission limit values and provisions described in this section are achievable using the best available techniques described in **Section 6**. Monitoring of emissions should be carried out according to the method specified in this section or by an equivalent method agreed by the regulator. (See Ref. **(f)** (M1) and Ref. **(g)** (M2))

New and Existing processes: **Table 2** and paragraphs **5.1 - 5.16, 6.1 - 6.15** and **6.19 - 6.33** apply.

New processes (excluding substantial changes): **Table 3** and paragraphs **5.17 - 5.19, 6.16 - 6.18** apply additionally, and parts of **Table 2** are superseded.

- The reference conditions for limits in **Table 2** and **Table 3** are:
  - 273K, 101.3kPa,11% oxygen v/v, dry gas unless otherwise stated

Table 2: Emission limits, monitoring and other provisions

Row	Substance	Mass limits per cremator	Concentration limits	Type of monitoring	Monitoring frequency (subject to paragraph 5.14, 5.15 and 5.19)
1	Hydrogen chloride (excluding particulate matter)	300g an hour	200mg/m^3 averaged over an hour.	Extractive test See **Section 9**	Annual
2	Total particulate matter from cremator	120g an hour for 95% of cremations and 240 g an hour for all cremations	80 mg/m^3 averaged over an hour for 95% of cremations and 160 mg/m^3 averaged over an hour for all cremations.	Provide visual alarms and record levels and alarms Manual extractive test See **Section 9** (capable of collecting 75% of particulate matter with a diameter of 0.1micron or less)	Continuous indicative Annual
3	Carbon monoxide	150g in the first hour of cremation for 95% of cremations and 300g in the first hour of cremation for all cremations	100mg/m^3 averaged over the first hour for 95% of cremations and 200mg/m^3 averaged over the first hour for all cremations.	Record data at less than 10 second intervals, No more than 3 cremators per analyser, Provide visual alarms and record alarm events See **Section 9**	Continuous indicative Annual test
4	Organic compounds (excl particulate matter) expressed as carbon	30g an hour.	20mg/m^3 averaged over an hour of cremation.	See **Section 9**	Annual test

Table 2: Emission limits, monitoring and other provisions

Row	Substance	Mass limits per cremator	Concentration limits	Type of monitoring	Monitoring frequency (subject to paragraph 5.14, 5.15 and 5.19)
5	Particulate matter from cremated remains reduction plant that vents externally		50mg/m^3 with no correction for oxygen concentration or water vapour	See **Section 9** and paragraph **6.16**	On commissioning

Row	Parameter		Combustion provision	Type of monitoring	Monitoring frequency
6	Temperature		Minimum of 1123K (850°C) in the secondary combustion chamber	• Measure at the entrance and after the exit from the secondary combustion zone • Automatically record temperatures • Visual alarm when temperature falls below 1123k • Interlock to prevent cremator loading	• Continuous • Continuous • Record alarm activations • To operate when temperature and combustion provisions in rows 6, 7and 8 are not met
7	Residence time		2 seconds residence time in the secondary combustion chamber without correction for temperature, oxygen or water vapour	Measurement and calculation of the volume rate of the flue gases throughout the cremation cycle at the cremator exit.	On commissioning
8	Oxygen		At the end of the secondary combustion chamber, measured wet or dry, minimum average 6% and minimum 3%	Monitor and record of concentration at outlet of secondary combustion zone Visual alarm and record alarm activations During discontinuous tests, continuous reference oxygen measurements should be at the same sampling location as the parameters tested	Continuous Activate alarm when oxygen falls below provision
If the combustion provisions are not met, then the dioxin emission limit and monitoring provision in Row 8 should be applied					

9	PCDD/F On existing processes [1] for cremators that don't meet the combustion provisions above	4.5 micrograms as ITEQ per 3 cremations	1ng/m^3 as ITEQ	Extractive see **Section 9** Temperature, oxygen and any flow parameters that apply during the dioxin tests, should be required by the authorisation / permit Interlock to prevent cremator loading unless those parameters are met	On commissioning Continuous

For cremators, the operator chooses whether the mass or the concentration limits apply and the regulator should then specify those limits in the permit or authorisation.

When calculating mass emissions, the cremator should multiply the flow rate at that moment by the concentration at that moment.

Carbon monoxide continuous monitors may be replaced by direct continuous monitors for total gaseous combustibles. They should be calibrated by, and read as, carbon monoxide.

At commissioning and substantial changes, shielded thermocouples should be calibrated in the cremator by suction pyrometer or calibrated thermocouple measurements alongside each thermocouple.

Monitoring, investigations and recording

5.2 The need for and scope of testing, and the frequency and time of sampling depend on local circumstances, operational practice and the scale of operation. As part of proper supervision the operator will monitor emissions, make tests and inspections of the process and keep records, in particular:

- The operator should keep records of inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. The records should be:
  - kept on site
  - kept by the operator for at least two years; and
  - made available for the regulator to examine

Information required by the regulator

5.3 The regulator needs to be informed of monitoring to be carried out and the results; the results should include process conditions at the time of monitoring.

- The operator should provide a list of key arrestment plant and should have a written procedure for dealing with its failure, in order to minimise any adverse effects.
- The operator should notify the regulator at least 7 days before any periodic monitoring exercise to determine compliance with emission limit values. The operator should state the provisional time and date of monitoring, pollutants to be tested and the methods to be used.
- The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of the completion of the sampling.

- Adverse results from **any** monitoring activity (both continuous and non-continuous) should be investigated by the operator as soon as the monitoring data has been obtained/received. The operator should:
  - identify the cause and take corrective action
  - record as much detail as possible regarding the cause and extent of the problem, and the action taken by the operator to rectify the situation
  - re-test to demonstrate compliance as soon as possible; and
  - notify the regulator

Visible and odorous emissions

5.4 Visible and odorous emissions should be limited and monitored as follows. Abnormal emissions require action as described in paragraph **5.5**.

- Emissions from cremations should be free from visible smoke and in any case should not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:1969.
- There should be no offensive odour beyond the process boundary, as perceived by the regulator.
- Visual and olfactory assessments of emissions should be made frequently and at least once each day whilst the process is in operation. The time, location and result of these assessments should be recorded.
- All releases to air, other than condensed water vapour, should be free from persistent visible emissions.
- All emissions to air should be free from droplets.

Abnormal events

5.5 The regulator needs to be notified about certain events, whether or not there is related monitoring showing an adverse result, and the operator should respond to problems which may have an adverse effect on emissions to air.

- In the case of abnormal emissions, malfunction or breakdown leading to abnormal emissions the operator should:
  - investigate and undertake remedial action **immediately**
  - adjust the process or activity to minimise those emissions; and
  - promptly record the events and actions taken.
- The regulator should be informed without delay:
  - if there is an emission that is likely to have an effect on the local community; or
  - in the event of the failure of key arrestment plant, for example flue gas cleaning plant or use of the dump stack; or
  - continuous monitoring results exceed twice the specified emisison limit

Continuous monitoring

5.6 Continuous indicative monitoring can be used as a management tool. In conjunction with continuous recording it identifies any trends in emissions; for example, that emissions are gradually increasing, which may indicate a need for maintenance. It can also be used with or without continuous recording to trigger an alarm when there is a sudden increase in emissions; for example, if arrestment plant fails. For a given concentration of particulate the output level varies with the instrument. It should be noted that not all monitors provide a linear response to an increase in particulate matter. The monitor should be set up to provide a baseline output when the plant is known to be operating under the best possible conditions; i.e. such that emissions are fully compliant with the provisions. The instrument manufacturer should be able to set an output level which corresponds to around 95% of the emission limit, to trigger the alarms. Thus the alarms are activated in response to this significant increase in particulate loading above the baseline, so that warning of the changed state is given before an unacceptable emission occurs.

5.7 Where continuous monitoring is required, it should be carried out as follows:

- All continuous monitoring readings should be on display to appropriately trained operating staff.
- Instruments should be fitted with audible and visual alarms, situated appropriately to warn the operator of arrestment plant failure or malfunction.
- The activation of alarms should be automatically recorded.
- All continuous monitors should be operated, maintained and calibrated (or referenced) in accordance with the manufacturers' instructions, which should be made available for inspection by the regulator. The relevant maintenance and calibration (or referencing) should be recorded.
- All new continuous monitoring equipment should be designed for less than 5% downtime over any 3-month period.

5.8 For all continuous measurements, the mass of emissions per hour is calculated from the measured values from 2 minutes after the close of coffin loading door until the removal of calcined remains.

5.9 The operator should decide whether to report for periods of 4 weeks or 1 month.

- For each cremator, for carbon monoxide, and for particulate matter, the operator should report the following continuous monitoring values to the regulator every 6 months.
  - monthly or four weekly average from the first hour of each cremation
  - values that exceed the 95% limit for each substance in **Table 2** in that period for each cremation
  - 60 minute mean emission values that exceed the 100% limit for each substance in **Table 2** in that period for each cremation
  - a list of the highest 60minute mean emission value for each period
  - the 95-percentile value for each period. (The Example report in **Section 10** shows one way to select the 95-percentile value)
- For temperature, oxygen and residence time, the operator should report the following continuous monitoring values to the regulator every 6 months
  - secondary chamber entrance temperature, 4 weekly / monthly maximum and minimum
  - secondary chamber exit temperature, 4 weekly / monthly maximum and minimum
  - oxygen concentration, 4 weekly / monthly minimum
  - residence time, 4 weekly / monthly minimum

5.10 Where the combustion provisions in **Table 2** Rows 6, 7, and 8 are not met continuously, then more detailed reporting may be needed.

5.11 The results should be presented in a format that enables the regulator to check compliance for oxygen, temperature, carbon monoxide and particulate matter with **Table 2**.

5.12 In **Section 10**, an Example Report is included, though cremator manufacturers may vary in the format they provide. The example assumes that the cremator complies with the combustion provisions, though not all cremators do.

Calibration and compliance monitoring

5.13 Calibration of quantitative instruments and compliance monitoring should meet the following provisions as appropriate:

- No result should exceed the emission concentration limits specified, except where either:
  - (a) data is obtained over at least 5 sampling hours in increments of 15 minutes or less; or
  - (b) at least 20 results are obtained where sampling time increments of more than 15 minute are involved; AND in the case of (a) or (b)
  - (c) no daily mean of all 15-minute mean emission concentrations should exceed the specified emission concentration limits during normal operation (excluding start-up and shut-down); and
  - (d) no 15-minute mean emission concentration should exceed twice the specified emission concentration limits during normal operation (excluding start-up and shut-down).
- Non-continuous emissions monitoring of particulate matter should be carried out according to the main procedural requirements of BS ISO 9096: 2003, with averages taken over operating periods, excluding start-up and shutdown.

Varying monitoring frequency

5.14 Where non-continuous quantitative monitoring is required, the frequency may be varied. Where there is consistent compliance with emission limits, regulators may consider reducing the frequency. When determining "consistent compliance" factors to consider include:

(a) the variability of monitoring results, for example, results which range from 15 - 45 mg/m^3, against an emission limit of 50 mg/m^3 might not qualify for a reduction in monitoring.

(b) the margin between the results and the emission limit, for example, results which range from 45 - 50 mg/m^3 when the limit is 50 mg/m^3 might not qualify for a reduction in monitoring.

Consistent compliance should be demonstrated using the results from at least;

- three or more monitoring exercises within two years; or
- two or more monitoring exercises in one year supported by continuous monitoring

Any significant process changes, which might have affected the monitored emission, should be taken into account.

5.15 The frequency of testing should be increased, for example, as part of the commissioning of new or substantially changed processes, or where emission levels are near to or approach the emission concentration limits.

Sampling provisions

5.16 Care is needed in the design and location of sampling systems in order to obtain representative samples. BS ISO 9096 calls for sampling within a straight section of flue, about 7 to 10 diameters in length.

- The operator should ensure that adequate facilities for sampling are provided on vents or ducts.
- Sampling points on new plant should be designed to comply with the British or equivalent standards.

New processes

5.17 At new processes, arrestment plant for mercury and dioxin should be required.

5.18 For new processes only, **Table 3** contains an additional emission limit and provisions, and provisions that should replace provisions for particulate matter, hydrogen chloride and any dioxin provisions from **Table 2** above.

Table 3: New process additional provisions

	Substance/ Parameter	Mass limits per cremator	Concentration limits/	Type of monitoring	Monitoring frequency (subject to paragraphs 5.14, 5.15 and 5.19)
Additional to **Table 2**	Mercury	150mg for 4 cremations	50 micrograms/m^3	Extractive. See **Section 9**	Annual
Replaces row 6 in **Table 2**	PCDD/F On new processes [1] for cremators that don't meet the combustion provisions below	0.45 micrograms as ITEQ per 3 cremations	0.1nanograms/m^3 as ITEQ	Extractive. See **Section 9** Temperature, oxygen and any flow parameters that apply during the dioxin tests, should be required by the authorisation / permit	On commissioning and on rebuilding a cremator Continuous
Replaces row 1 in **Table 2**	Hydrogen chloride (excluding particulate matter)	45g an hour	30mg/m^3 averaged over an hour.	Extractive test. See **Section 9**	Annual
Replaces row 2 in **Table 2**	Total particulate matter from cremator	30g an hour for 95% of cremations and 60g an hour for all cremations	20 mg/m^3 averaged over an hour for 95% of cremations and 40 mg/m^3 averaged over an hour for all cremations.	Provide visual alarms and Record levels and alarms Manual extractive test See **Section 9** (capable of collecting 75% of particulate matter with a diameter of 0.1micron or less)	Continuous qualitative Annual
1. ie crematoria which are not existing processes on 1 October 2006					

5.19 At new processes, the frequency of non-continuous monitoring for mercury should not be reduced because the mercury load varies with each cremation.

6 Control techniques

Summary of best available techniques

6.1 The following table provides a summary of the best available techniques that can be used to control the process in order to meet the emission limits and provisions in **Section 5**. Provided that it is demonstrated to the satisfaction of the regulator that an equivalent level of control will be achieved, then other techniques may be used.

Table 4: Summary of control techniques

Release source	Substance	Control techniques
Flue gas	Odour	Good combustion and a secondary combustion zone
	Particulate matter	Good combustion, slow gas velocities and a secondary combustion zone
	Hydrogen chloride	existing and substantially changed processes - No control, but prevent condensation. New processes - arrestment
	Nitrogen oxides	No control
	Carbon monoxide	Good combustion and a secondary combustion zone
	Volatile organic compounds	Good combustion and a secondary combustion zone
	Mercury and its compounds	Arrestment required for new processes only
	PAH	Good combustion and a secondary combustion zone
	PCDD/F	Minimise chlorine combusted and particulate matter emitted, good combustion and a secondary combustion zone, Arrestment plant required for new processes only
Cremated remains size reduction machine	Particulate matter	Filter on machine or external dispersion and filter if needed.

Techniques to control emissions from contained sources

Odour

6.2 Odour is prevented by good combustion.

Particulate matter

6.3 Particulate matter in flue gases (including smoke) is controlled by good combustion and by gas flows that do not carry particles out of the cremator. Arrestment is not usually needed to meet the emission limit at existing and substantially changed processes. At new processes arrestment is needed.

Hydrogen chloride

6.4 Hydrogen chloride mostly arises from the salt content of bodies and is not arrested at existing and substantially changed processes but dispersed. Chlorine is avoided in coffins, shrouds, clothing and other materials burnt. Condensation is prevented by dilution and preheating stacks. At new processes hydrogen chloride is arrested.

Nitrogen oxides

6.5 Nitrogen oxides arising from coffins might be lessened by switching from coffins made using board made from wood and nitrogen-containing resins. However plain wood is considered too expensive to be required as BATNEEC/BAT. Cardboard caskets also contain nitrogen in the wet strength additives. Thermal NOx is minimal due to the secondary chamber temperature and because combustion is staged over primary and secondary chambers.

Carbon monoxide

6.6 Carbon monoxide is a pollutant but is also an indicator of incomplete combustion that emits unburnt hydrocarbons, PAH and PCDD/F, which are much more difficult to monitor. Arrestment of carbon monoxide is not BATNEEC/BAT but good combustion minimises emissions. Carbon monoxide emissions after the first 60 minutes ought to be minimal

Volatile organic compounds

6.7 Volatile organic compounds are also controlled by good combustion.

Mercury

6.8 At the time of writing, mercury emissions from existing and substantially changed crematoria, principally from dental fillings, are being considered. At new processes for crematoria, mercury arrestment is required.

Dioxins

6.9 Good combustion and low particulate matter emissions minimise the emission of PCDD/F (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, often referred to as 'dioxins and furans', or even just as 'dioxin'). At new processes, dioxin arrestment is required.

Coffin materials and cremator design

6.10 The emission limits and provisions specified in **Section 5**above may be achieved by careful use of materials in coffin construction and furnishing and by cremator design and operation (including arrestment at new processes). The range of materials used for coffin or casket construction has increased recently and now includes cardboard, wickerwork (made from willow) as well as wood composite board and solid wood. Shrouds are also available and often use natural fibres such as cotton and linen. A body in a shroud may be supported on a stiff baseboard. Materials to be avoided in coffin or casket construction, furnishings and body preparation/embalming include chlorinates, metals (except steel screws and staples), wax and more than a thin layer of water based lacquer on wood.

- PVC and melamine should not be used in coffin construction or furnishings.
- Cardboard coffins should not contain chlorine in the wet-strength agent. (e.g. not using polyamidoamine-epichlorhydrin based resin (PAA-E))
- Packaging for stillbirth, neonatal and foetal remains should not include any chlorinated plastics.
- Coffins containing lead or zinc should not be cremated.
- The cremator should be designed and operated in order to prevent the discharge of smoke, fumes, or other substances during charging.
- The charging system should be interlocked to prevent the introduction of a coffin to the primary combustion zone unless the secondary combustion zone temperature exceeds that specified for good combustion in the authorisation/ permit.
- The cremator and all ductwork should be made and maintained gas tight if under positive pressure to prevent the escape of gases from the ductwork or cremator to the air.

Good combustion

6.11 As one of the means of achieving good combustion, all new cremators should be designed so that there is adequate secondary air in the primary combustion zone to ensure good turbulence.

6.12 The secondary combustion zone starts after the last injection of combustion air. Air injected at support burners in the secondary combustion chamber is ignored, as long as there is no more than about 6% excess air for the fuel burnt.

- All cremators should be designed to ensure complete combustion and should be fitted with a secondary combustion zone.
- The manufacturer should state the volume of the secondary combustion zone.
- When rebricking a cremator, the convolutions of the secondary combustion chamber should be maintained and the volume of the chamber recalculated and restated.

6.13 Residence time in the secondary combustion zone should be demonstrated at commissioning. Residence time may be determined from the volume of the secondary combustion chamber and either:

- direct measurement of flowrate; and / or
- calculate the residence time continuously throughout cremations using measured combustion gas flows

Cremated remains

6.14 For all cremators

- The remains in the cremator should only be moved when calcination is completed.
- The removal of ash and non-combustible residues from the cremator should be undertaken carefully so as to prevent dust emissions via the flue.
- Cremated remains should be moved and stored in a covered container.

6.15 Many cremated remains treatment plants have an internal filter and discharge inside the building and for them an emission limit and testing are unlikely to be needed.

- Cremated remains treatment plant venting externally should be
  - arrested to meet the particulate matter limit in **Table 2**; and
  - testing should be needed at commissioning only
  - subsequent performance can be demonstrated indicatively, for example by the use of a pressure drop indicator on the bag filter

New processes

6.16 For crematoria at new processes, mercury and PCDD/F arrestment plant should be required. The mercury load in human remains varies significantly, and so testing during cremations with no mercury load would not demonstrate compliance adequately. The provisions are based on an arrestment system of cool, capture and collect. The hot exhaust gases are cooled using, for example water tube coolers. Injecting dry lime, activated carbon and sodium sulphide into the gas stream captures pollutants. A dry filter captures the particulate matter and a reduction of between 90 to 98% in mercury concentrations is expected. Alternatives with equal or better performance may be accepted. However, conditions in a permit stating a percentage reduction are not recommended

6.17 Where activated carbon is used as part of the arrestment technique, operators should be aware of potential health and safety risks arising from spontaneous combustion.

6.18 Where there is more than one gas cleaning system and one system fails, that system should not be used until it is repaired. Where there is only one gas cleaning system then cremations should continue, the regulator should be notified immediately (preferably by fax or e-mail) and repairs are expected within 24-48 hours. Dump stacks should not normally be used when cremation is underway. Occasions when the dump stack is used during a cremation should be notified to the regulator. Use of the dump stack during cremation more than once a year should be investigated and remedial action taken

- In the event of arrestment plant failure or use of a dump stack during cremation,
  - the failure, its cause and cure should be entered in the log; and
  - the regulator should be notified immediately (preferably fax or e-mail)

- Emergency process vents or arrestment equipment bypasses (dump stacks) should only be used
  - when the heat removal plant has failed and the arrestment plant would be damaged; or
  - during warm-up and shutdown, provided that compliance is demonstrated with the carbon monoxide limit
- Dusty materials, dusty wastes and wastes containg mercury should be kept tightly contained

(Waste materials collected from inside the arrestment plant will need to be disposed of in the same way as waste sorbent.)

(see also paragraph **6.27** about dispersion from dump stacks)

Standby cremators

6.19 Some crematoria may wish to retain a stand-by cremator for use in the event of breakdown of the main cremator or other occasional need for additional cremator capacity.

6.20 Such plant should be permitted if it meets all the following criteria
- capable of operating without causing a nuisance (as in the Environmental Protection Act 1990 Part III); and
- during any period of eight hours the aggregate of the periods of emission of dark smoke should not exceed five minutes; and
- no single emission of dark smoke should exceed two minutes; and
- no black smoke should be emitted

6.21 The following bullets and also the management paragraphs **6.30 - 6.33** should also be complied with:
- The standby cremator should be clearly identified.
- Standby plant should operate for no more than 100 hours in any 12-month period.
- All periods of operation and the reason for standby plant operation should be recorded in the log.
- The local enforcing authority should be notified by telephone, in advance if possible, of the operation of standby plant.
- Visual and olfactory assessments of emissions should be made at the start and at least once during each cremation cycle in standby plant, the location and result of the assessment should be recorded in the log. (The frequency of assessments can be reduced if a continuous particulate matter monitor is operating.)
- Remedial action should be taken immediately in the case of abnormal emissions.
- PVC and melamine should not be used in coffin construction and furnishings
- Cardboard coffins should not contain chlorine in the wet-strength agent (i.e. not using polyamidoamine-epichlorhydrin based resin (PAA-E)).
- Packaging for stillbirth, neonatal and foetal remains should not include any chlorinated plastics.
- Coffins containing lead or zinc should not be cremated.
- The remains in the cremator should only be moved when calcination is completed.

Small-scale cremators

6.22 Small-scale cremators may be developed in order to cremate stillbirth, neonatal and foetal remains. Not all the standards for full-scale cremators are appropriate for such small-scale cremators because of the relatively small mass of pollutants emitted. For these purposes "small--scale cremators" should be taken to mean cremators with a maximum door opening of 300 x 300 mm and with a maximum length of primary chamber of 1,000 mm.

6.23 When stillbirth, neonatal or foetal remains are cremated in full-scale cremators, the guidance for those cremators should apply.

6.24 The following paragraphs, or parts of paragraphs, should apply to small-scale cremators;

- paragraph **5.4** but with visual and odour assessment once during each cremation
- paragraphs **5.5, 6.4, 6.10, 6.25 - 6.33**
- the reference to "coffins" in paragraph **6.4** includes packaging for stillbirth, neonatal and foetal remains

Air quality

Ambient air quality management

6.25 In areas where air quality standards or objectives are being breached or are in serious risk of breach and it is clear from the detailed review and assessment work under Local Air Quality Management that the Part B process itself is a significant contributor to the problem, it may be necessary to impose tighter emission limits. If the air quality standard that is in danger of being exceeded is not an EC Directive requirement, then industry is not expected to go beyond BAT to meet it. Decisions should be taken in the context of a local authority's Local Air Quality Management action plan. For example, where a Part B process is only responsible to a very small extent for an air quality problem, the authority should not unduly penalise the operator of the process by requiring disproportionate emissions reductions. More guidance on this is provided in paragraph 360 of the Air Quality Strategy which gives the following advice:

"The approach from local authorities to tackling air quality should be an integrated one, involving all strands of local authority activity which impact on air quality and underpinned by a series of principles in which local authorities should aim to secure improvements in the most cost-effective manner, with regard to local environmental needs while avoiding unnecessary regulation. Their approach should seek an appropriate balance between controls on emissions from domestic, industrial and transport sources and draw on a combination and interaction of public, private and voluntary effort."

Dispersion and dilution

6.26 Pollutants that are emitted via a stack require sufficient dispersion and dilution in the atmosphere to ensure that they ground at concentrations that are harmless. This is the basis upon which stack heights are calculated using D1. The stack height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure. It is necessary that the assessment also take into account the relevant air quality standards that apply for the emitted pollutants.

The calculation procedure of D1 is usually used to calculate the required stack height but alternative dispersion models may be used in agreement with the regulator. D1 relies upon the unimpeded vertical emission of the pollutant being addressed. A cone can increase the efflux velocity of emissions to achieve greater dispersion and dilution. A cap or other restriction over the stack impedes the vertical emission and hinder dispersion. For this reason where dispersion is required such flow impeders should not be used. A cone may sometimes be useful to increase the efflux velocity.

6.27 In order to maintain maximum advantage from thermal buoyancy and momentum, emissions should take place from the minimum practicable number of stacks. Each cremator should have its own flue in a multi-flue stack. For crematoria with arrestment plant, each arrestment plant can have one flue plus a dump stack. As the dump stack is used about once a year or less, the dump stack height can be the same as the arrested stack height.

An operator may choose to meet tighter emission limits in order to reduce the required main stack height, but the dump stack height may not be reduced.

Stacks

6.28 Liquid condensation on internal surfaces of stacks and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission. Adequate insulation will minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint. Stacks and ductwork should be leakproof.

6.29 The dispersion from all stacks and vents can be impaired by low exit velocity at the point of discharge, or deflection of the discharge. Unacceptable emissions of droplets could possibly occur from wet arrestment plant where the linear velocity within the associated ductwork exceeds 9 m/sec. The use of mist eliminators reduces the potential for droplet emissions.

- Where a linear velocity of 9 m/sec is exceeded in the ductwork of existing wet arrestment plant, it should be reduced to the extent that is practicable to ensure that droplet fallout does not occur.
- Flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.
- Exhaust gases discharged through a stack or vent should be designed to achieve an exit velocity of 15 m/sec during peak operating conditions to achieve adequate dispersion.
- Stacks or vents should not be fitted with any restriction at the final opening such as a plate, cap or cowl, with the exception of a cone which may be necessary to increase the exit velocity of the emissions.

Management

Management techniques

6.30 Important elements for effective control of emissions include:

- proper management, supervision and training for process operations
- proper use of equipment
- effective preventative maintenance on all plant and equipment concerned with the control of emissions to the air; and
- it is good practice to ensure that spares and consumables are available at short notice in order to rectify breakdowns rapidly. This is important with respect to arrestment plant and other necessary environmental controls. It is useful to have an audited list of essential items

- Spares and consumables - in particular, those subject to continual wear - should be held on site, or should be available at short notice from guaranteed local suppliers, so that plant breakdowns can be rectified rapidly.

Appropriate management systems

6.31 Effective management is central to environmental performance; It is an important component of BAT and of achieving compliance with permit conditions. It requires a commitment to establishing objectives, setting targets, measuring progress and revising the objectives according to results. This includes managing risks under normal operating conditions and in accidents and emergencies. It is therefore desirable that processes put in place some form of structured environmental management approach, whether by adopting published standards (ISO 14001 or the EU Eco Management and Audit Scheme [EMAS]) or by setting up an environmental management system (EMS) tailored to the nature and size of the particular process. Operators may also find that an EMS will help identify business savings.

Regulators should use their discretion, in consultation with individual operators, in agreeing the appropriate level of environmental management. Simple systems which ensure that LAPC considerations are taken account of in the day-to-day running of a process may well suffice, especially for small and medium-sized enterprises. While authorities may wish to

encourage wider adoption of EMS, it is outside the legal scope of an LAPC authorisation/LA-PPC permit to require an EMS for purposes other than LAPC/LA-PPC compliance. For further information/advice on EMS refer to EMS Additional Information in **Section 8**.

Training

6.32 Staff at all levels need the necessary training and instruction in their duties relating to control of the process and emissions to air. In order to minimise risk of emissions, particular emphasis should be given to control procedures during start-up, shut down and abnormal conditions.

Training may often sensibly be addressed in the EMS referred to above. The Crematorium Technicians Training Scheme operated by the Institute of Cemetery and Crematorium Management should be adequate for this purpose, as should the Training and Examination Scheme for Crematorium Technicians which is run by the Federation of British Cremation Authorities.

- Training of all staff with responsibility for operating the process should include:
  - awareness of their responsibilities under the permit, and in particular maintenance of monitoring equipment
  - minimising emissions on start up and shut down
  - action to minimise emissions during abnormal conditions
- The operator should maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an impact on the environment. These documents should be made available to the regulator on request.

Maintenance

6.33 Effective preventative maintenance should be employed on all aspects of the process including all plant, buildings and the equipment concerned with the control of emissions to air. Cleaning of cremator ducts and flueways is considered part of preventative maintenance eg raking out twice a year. Additional advice on good maintenance practice is being prepared and is likely to be issued as an AQ note shortly. In particular:

- A written maintenance programme should be provided to the regulator with respect to pollution control equipment, including control instrumentation and the cremator secondary chamber, and ducts and flues;
- A record of such maintenance should be made available for inspection.
- Cleaning schedules should be available on site to the regulator.

7 Summary of changes

Reasons for the main changes are summarised below.

Table 5: Summary of changes

Change	Reason	Comment
Emission limits, monitoring and other provisions		
Mercury and dioxin arrestment for new processes for crematoria,	To reduce the mercury and dioxin emitted	Arrestment plant is being considered separately for existing and substantially changed processes
Criteria for reliability of monitoring plant	To increase consistency of monitoring	
provisions for temperature and retention time differently expressed	Increased understanding of process	
Monitoring methods updated and results expressed using 95% confidence limits	The published methods have been revised	For each pollutant, three samples needed instead of two, but revised methods are quicker to use than old methods
Primary monitoring methods changed from US to current British / European methods	UK monitoring houses are increasingly using BS / EN methods, which have been recently revised	
Control techniques		
Additional advice on coffin construction and content	To reduce pollutants emitted	Reflects new and improved cremation practices

8 Definitions and further information

This guidance	Process Guidance Note 5/2(04)
Previous guidance	Process Guidance Note 5/2(95) which in its turn replaced PG5/2(91)
LAPC	explained in the Introduction of this guidance
LAPPC	explained in the Introduction of this guidance
Permit	the written permission to operate an installation prescribed for LAPPC – (the replacement for authorisation under LAPC)
Authorisation	the written authority to operate a process prescribed for LAPC - (will be replaced by permit under LAPPC)
Local enforcing authority	is replaced by the word 'regulator' in LAPPC
Regulator	replaces the phrase 'local enforcing authority' from LAPC
Existing process	should be taken to have the following meaning (which is based on paragraph 14 of Schedule 3 to SI 1991 /472): • a process which was being carried on at some time in the 12 months immediately preceding the first day of the month following publication of this guidance note • a process which is to be carried on at a works, plant or factory or by means of mobile plant which was under construction or in the course of manufacture or in the course of commission on the first day of the month following publication of this guidance note, or the construction or supply of which was the subject of a contract entered into before that date For the purposes of paragraph **5.17** of this note ("at new processes, arrestment plant for mercury and dioxin should be required"), for "the first day of the month following publication of this note" in the above two bullets, substitute "from 1 October 2006
New process	not an existing process.
Authorised person	under section 108 of the Environment Act 1995, "authorised person" has replaced the term "inspector"
Installation	should be interpreted in accordance with the guidance contained in the the General Guidance Manual on Policy and Procedures for A2 and B Installations. www.defra.gov.uk/environment/ppc/manual/index.htm
Process	the term "process has been used in this guidance note to refer to both "processes" under the Environmental Protection Act 1990 and "installations" under the Pollution Prevention and Control Act 1999
"calcination is completed"	The Federation Of British Cremation Authorities' Code of Cremation Practice contains advice on when calcination is complete.

Health and safety

Operators of processes and installations must protect people at work as well as the environment:

- requirements of a permit or authorisation should not put at risk the health, safety or welfare of people at work
- equally, the permit or authorisation must not contain conditions whose only purpose is to secure the health of people at work. That is the job of the health and safety enforcing authorities

Where emission limits quoted in this guidance conflict with health and safety limits, the tighter limit should prevail because:

- emission limits under the Environment Protection Act 1990 or Pollution Prevention and Control Act 1999 relate to the concentration of pollutant released into the air from prescribed activities
- exposure limits under health and safety legislation relate to the concentration of pollutant in the air breathed by workers
- these limits may differ since they are set according to different criteria. It will normally be quite appropriate to have different standards for the same pollutant, but in some cases they may be in conflict (for example, where air discharged from a process is breathed by workers). In such cases, the tighter limit should be applied to prevent a relaxation of control

EMS additional information

Further information/advice on EMS may be found from the following:

- Envirowise at **www.envirowise.gov.uk** and **www.energy-efficiency.gov.uk** and Environment and Energy Helpline freephone 0800 585794
- ISO 14001 **www.bsi.org.uk** or telephone BSI information centre (020 8966 7022)
- EU Eco Management and Audit Scheme (EMAS) **www.emas.co.uk** or telephone the Institute of Environmental Management and Assessment (01522 540069)

Regulators and process operators may also like to be aware of:

BS 8555: a new standard to help SMEs implement an EMS, by offering a five-phase approach, is contained in BS 8555 which was published in 2003 following on from work undertaken by the Acorn Trust. The Institute of Environmental Management and Assessment, which has taken over the Trust's activities, is developing a scheme of accredited recognition for companies achieving different phases of BS 8555. BS 8555 can be used to achieve ISO 14001 and registration to the higher standard, EMAS.

Some of the **High Street banks**, such as NatWest and the Coop, now offer preferential loan rates to organisations that can demonstrate they are committed to improving their environmental performance. The NatWest also produce a self help guide for SMEs, 'The Better Business Pack', focusing on waste, utilities, transport and supply chain issues. It gives tools, guidance and examples. Contact: WWF-UK on 01483 426444.

References

(a) Secretary of State's Guidance (England and Wales): General Guidance Manual on Policy and Procedures for A2 and B Installations , March 2003 - available from the Defra web-site and, in hard copy, from the Defra Publications line 08459 556000 **www.defra.gov.uk/environment/ppc/index.htm**

(b) Scottish Executive Guidance: The Practical Guide for Part B Activities Issue 1 - available from the SEPA web-site. **http://www.sepa.org.uk/pdf/ppc/guidance/practical_guide_part_b_activities.pdf**

(c) DOE/WO Additional Guidance AQ17(94), issued to local authorities by the Air and Environment Quality Division of DEFRA and by the Welsh Office, provides further advice on the assessment of odour. The Scottish equivalent of AQ17(94) is SN 11(94).

(d) Current air quality objectives are specified in:
- The Air Quality (England) Regulations 2002 SI 3043
- The Air Quality (Wales) Regulations 2002 WSI 3182 (W.298)
- The Air Quality (Scotland) Regulations 2002 SSI 297

(e) HMIP Technical Guidance Note D1: "Guidelines on Discharge Stack Heights for Polluting Emissions", published by The Stationery Office, ISBN 0-11-752794-7.

(f) M1 Sampling requirements for monitoring stack emissions to air from industrial installations, Environment Agency July 2002 **(EA website)**

(g) M2 Monitoring of stack emissions to air. Environment Agency May 2003 **(EA website)**

Web addresses

The final consultation drafts and final published versions of all guidance notes in this series can be found on **www.defra.gov.uk/environment/index.htm**.

Welsh Assembly Government web-site **www.wales.gov.uk**.

Local Authority Unit of the Environment Agency for England and Wales. **www.environment-agency.gov.uk**.

Scottish Environment Protection Agency (SEPA) **www.sepa.org.uk**.

Energy saving and environmental management measures can increase industry profits. Envirowise (formerly ETBPP) show how at **www.envirowise.gov.uk** (or freephone 0800 585794).

9 Sampling

9.1 Every effort has been taken to ensure that this section is correct at the date of publication, but readers should note that the Regulations are likely to be subject to periodic amendment, and this section should not therefore be relied upon as representing the up-to-date position after the publication date.

9.2 The table below specifies the preferred test methods to be used in monitoring emissions from crematoria for each particular pollutant in PG5/2(04).

Table 6: Suggested test methods for monitoring of differerent substances

Substance	Suggested test method
Particulate	BS EN 13284 part 1 for particulate below 50 mg/m^3 BS ISO 9096:2003 for particulate above 20 mg/m^3
Hydrogen Chloride	BS EN 1911 parts 1 to 3
Organic matter excluding particulate matter	BS EN 12619 up to 20mg/m^3 BS EN 13256 over 20mg/m^3
Oxygen	BS ISO 12039
Carbon Monoxide	BS ISO 12039
Polychlorinated dibenzo-p-dioxins and furans	BS EN 1948 parts 1 to 3
Mercury	BS EN 13211

Protocol

Preferred sampling location

9.3 In most crematoria in the UK, the cremators have been designed to fit into an existing building. Thus, even those built to be compliant with the Environmental Protection Act tend to have very few locations where a sampling point can actually physically be placed, and fewer still have sampling points which are the correct number of flue diameters away from bends and other obstructions. Given the choice, sampling points located in the "hot-leg" of the flue - that is, prior to the introduction of dilution air - are to be preferred, since the oxygen concentration at such points will be lower, and thus the correction to 11% oxygen will be better defined given a constant error on an oxygen determination. However, when sampling for polychlorinated dibenzo dioxins and furans, the sampling point should if possible be located such that the temperature of the flue gases is below 200°C-that is, outside the temperature range where reformation or de novo synthesis takes place-and remains so until discharge to atmosphere. Where this is not possible, the operator should notify the authority of the minimum temperature at which the measurement can practically be made, and the reason why this cannot be below the maximum temperature, before sampling takes place.

Sampling points

9.4 For each pollutant to be measured, calculation of the location and number of sampling points should be carried out as specified in the relevant standard. The general requirements for sample point location is given in BS EN13284-1 and BS ISO 9096:2003. The new standards relate the sampling time to the limit of detection of the analysis method. Increasing the number of sampling points on the sample plane does not increase the sample time.

Modifications due to the batch nature of a process

9.5 Cremation is a batch process consisting (neglecting pre-heating and shut-down) of
(i) the brief "flash" caused by volatization of the veneer on the outside of the coffin,
(ii) burning of the coffin,
(iii) after the coffin breaks open, burning of the coffin and cremation of the body.
(iv) calcification of the remains and
(v) ashing.

The timescales involved for these processes are typically (i) 1 minute, (ii) 20 minutes, (iii) 40 minutes, (iv) 30 minutes, and (v) 2 minutes, although observation of the process or asking the manufacturers or operators should provide installation-specific times for these. In order to take into account the batch nature of the process, at least one complete traverse across the flue should be made during each of processes (ii) to (iv). Process (i) has too short a duration for a complete traverse and so sampling should not commence until at least two minutes after the coffin is charged. Similarly, sampling should stop before ashing; again, it is not practical to traverse during ashing, and the turbulence caused by the open ash door may bias the results.

Sampling time

9.6 Sampling should last for one complete cremation, commencing as soon as stable conditions are achieved inside the machine-at least 2 minutes after the coffin is charged-and ceasing just before the operator rakes down the machine. One must decide the total sampling time before commencing sampling, in accordance with the requirement of the relevant standard that is to be used, refer Environment Agency Technical Guidance note M2. Unfortunately, it is not possible to know beforehand how long a charge will take to cremate, as this depends on the construction of the coffin, the weight of the body and what the deceased died of. A cancerous body will take longer to cremate, for example. In order that the result from different cremations may be meaningfully compared, we suggest the following procedure. Learn either from observation of the cremator in operation, or from the operators, the duration of an average of light, average and heavy charges, and take this as the definition of "cremation". Sample for this amount of time. If a significant amount of remains are left at the end of this period, then continue to sample if possible, or void the test. If the cremation finishes significantly before the completion of testing, then stop if possible or again void the test. In any case, sampling should not be for less than 1 hour. Sampling for dioxins and furans should cover the time needed to meet the limit of detection specified by the analytical laboratory, refer BS EN1948. The requisite number of whole cremations to achieve this sampling time should be sampled and could well be from 2 to 4 cremations.

Minimum volume of gas sampled

9.7 The volume of gas sampled will depend on the size of the charge, the standard used for the testing, the type of machine (i.e., electric cremators will have a smaller volumetric flow rate) and whether sampling is performed before or after the introduction of dilution air. European standards, e.g BS EN 1384 -1 and BS EN1948, state that the sample time is calculated by the limit of detection of the analysis method employed. .

Concurrent oxygen readings

9.8 Oxygen readings will be required, which are concurrent with the monitoring of the other pollutants, in order to make the correction to standard conditions.

9.9 These readings should be made in the same sampling plane in which the other samples are being taken; if not, extra dilution air could be introduced into the flue, changing the oxygen concentration at a point downstream. Care must be taken, however, that any probe used to extract the sample of gas for oxygen analysis should not cause interference to other sampling equipment in the flue, and vice-versa.

Minimum equipment standards

9.10 The equipment used in the sampling should meet as a minimum the standards laid out in the relevant standards specified in **Table 6**.

Minimum number of samples

9.11 For a valid statistical treatment of the results to give a 95% confidence result a minimum of three samples is required, and should generally be available in one working day from all but the least used crematoria. The size of the 95% confidence interval should not exceed the following percentage of the emssion limit value

- carbon monoxide: 10 %
- particulate matter: 30 %
- total organic carbon: 30 %
- hydrogen chloride: 40 %

Minimum standard of reporting

9.12 Reports should contain as a minimum the following information:

- the name of the crematorium
- the identification of the units under test with make and model numbers
- the identification of the version of computer software used to control the unit under test
- for each test the report should show the date, the cremation number, the test duration, an estimate of the mass of the deceased (light, average, heavy) and any unusual features of the coffin (for example, heavily varnished or of foreign make) or cremation. Coffins of unusual construction or extreme mass should not be tested
- a brief summary of each test method referencing standard documents where necessary
- a full summary of non-standard test methods with justifications for their use
- the raw data obtained from non-standard test methods
- any deviations from standard test methods with justifications
- results calculated via the formulae given for each test method with estimates of the errors on each parameter- the effects on the errors of deviations from the standard methods should be fully investigated if possible
- a summary of the results and errors in comparison to the PG5/2(2004) values

9.13 In addition, the section of the report dealing with PCDD/F results should also detail as a minimum

- the concentration of each congener detected, in addition to the final toxic equivalent, since two tests producing different relative concentrations of each congener may produce an identical toxic equivalent
- the recovery of pre-sample spikes as an indication of sampling performance and method compliance; these numbers may be summarised as a maxi-mum, minimum and average recovery of the pre-sample spikes
- the toxic equivalent with the equivalence factors used in the calculations
- the details of the processing of laboratory method blanks with the results expressed identically to the sample results. From these the detection limits for each congener should be determined and reported (vital in the cases of non-detection)

9.14 The inclusion of raw data should not be considered mandatory. However, the testing house providing the report should guarantee to keep the raw data for one year longer than the report remains a part of the public record

10 Example report

Monthly/four weekly report for [crematorium name]

Cremator number [ ]

Report for the month / four weeks period starting[date]

Total number of cremations =

Number of cremations with results not reported =

(due to instrument faults or other reasons)

Table 7: Emission and combustion provisions: average, minimum and maximum values

	PG5/2 Criteria	Average value for period	Minimum value	Maximum value
Secondary Chamber Start Temperature °C	850°C			
Secondary Chamber End Temperature °C	850°C			
Oxygen % measured wet or dry	Average 6% Minimum 3%			N/A
Carbon Monoxide				
Particulate matter				
The units for carbon monoxide and for particulate matter should be mg/m^3 or g per first hour of cremation				
Carbon monoxide and particulate matter values are corrected to 273K, 101.3kPa, 11 % oxygen, dry gas (correction for dry gas can be by fixed correction factor based on commissioning measurements)				
Values are reportable from 2 minutes after coffin loading to the start of calcined remains removal				

Table 8: Emission limit exceedances

	PG5/2 criteria	Carbon monoxide	Particulate matter	PG5/2 criteria
Percentage of cremations over Emission Limit:	<5%			<5%
Number of cremations over Twice the Limit:	nil			nil

Monthly / four weekly 95 percentiles of Cremation Values: For each of carbon monoxide and particulate matter;

How to select the 95 percentile value

For 19 cremations or less in the period, enter the highest emission values.

For 20 to 39 cremations in the period, enter the 2nd highest emission values

For 40 to 59 cremations, the 3rd highest emission values

For 60 to 79 cremations, the 4th highest

For 80 to 99 cremations, the 5th highest

For 100 to 119 cremations, the 6th highest

And so on. For each additional hundred cremations add 5.

For example: for 130 cremations, enter the '2nd+5' highest emission values, i.e. the 7th highest values for carbon monoxide and particulate matter

Table 9: 95 percentile values for carbon monoxide and particulate matter

Substance	95 percentile mg/m^3
Particulate matter	
Carbon monoxide	

Table 10: Cremations exceeding the 100% limits: (CO 300g or 240g/m^3, particulate matter 240g or 160mg/m^3

Parameter	Value	Date	Time

Table 11: Cremations above the 95% limits: (CO 150g or 100mg/m^3, particulate matter 120g or 80mg/m^3

Parameter	Value	Date	Time

Appendix 1: Extract from LAPPC regulations

Definition of Waste Management Activities in Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973 as amended[8]

(The processes for local air pollution prevention and control are listed under "Part B". The"Part A1" processes are for national regulatory control. The "Part A2" processes are subject to local authority integrated pollution prevention and control.)

Section 5.1 - Incineration and Co-incineration of Waste

Part A(1)

(a) The incineration of hazardous waste in an incineration plant.

(b) Unless carried out as part of any other Part A(1) activity, the incineration of hazardous waste in a co-incineration plant.

(c) The incineration of non-hazardous waste in an incineration plant with a capacity of 1 tonne or more per hour.

(d) Unless carried out as part of any other activity in this Part, the incineration of hazardous waste in a plant which is not an incineration plant or a co-incineration plant.

(e) Unless carried out as part of any other activity in this Part, the incineration of non-hazardous waste in a plant which is not an incineration plant or a co-incineration plant but which has a capacity of 1 tonne or more per hour.

Part A(2)

(a) The incineration of non-hazardous waste in an incineration plant with a capacity of less than 1 tonne per hour.

(b) Unless carried out as part of any other Part A activity, the incineration of non-hazardous waste in a co-incineration plant.

Part B

(a) The incineration of non-hazardous waste in a plant which is not an incineration plant or a co-incineration plant but which has a capacity of 50 kilogrammes or more per hour but less than 1 tonne per hour.

(b) The cremation of human remains.

Interpretation of Section 5.1

In this Section -

"co-incineration" means the use of wastes as a regular or additional fuel in a co-incineration plant or the thermal treatment of waste for the purpose of disposal in a co-incineration plant;

"co-incineration plant" means any stationary or mobile plant whose main purpose is the generation of energy or production of material products and:

8. Every effort has been taken to ensure that this Appendix is correct at the date of publication, but readers should note that the Regulations are likely to be subject to periodic amendment, and this Appendix should not therefore be relied upon as representing the up to date position after the publication date

- which uses wastes as a regular or additional fuel; or

- in which waste is thermally treated for the purpose of disposal.

If co-incineration takes place in such a way that the main purpose of the plant is not the generation of energy or production of material products but rather the thermal treatment of waste, the plant shall be regarded as an incineration plant.

This definition covers the site and the entire plant including all co-incineration lines, waste reception, storage, on site pre-treatment facilities, waste-, fuel- and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack devices and systems for controlling incineration operations, recording and monitoring incineration conditions; but does not cover co-incineration in an excluded plant;

"excluded plant" means -

(a) a plant treating only the following wastes -

(i) vegetable waste from agriculture and forestry;

(ii) vegetable waste from the food processing industry, if the heat generated is recovered;

(iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered;

(iv) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste;

(v) cork waste;

(vi) radioactive waste;

(vii) animal carcasses as regulated by Council Directive 90/667/EEC laying down the veterinary rules for the disposal and processing of animal waste, for its placing on the market and for the prevention of pathogens in feedstuffs of animal or fish origin and amending Directive 90/425/EEC; or

(viii) waste resulting from the exploration for, and the exploitation of, oil and gas resources from off-shore installations and incinerated on board the installation; and

(b) an experimental plant used for research, development and testing in order to improve the incineration process and which treats less than 50 tonnes of waste per year;

"hazardous waste" means any solid or liquid waste as defined in Article 1(4) of Council Directive 91/689/EEC on hazardous waste except for -

(a) combustible liquid wastes including waste oils as defined in Article 1 of Council Directive 75/439/EEC on the disposal of waste oils[9] provided that they meet the following criteria -

(i) the mass content of polychlorinated aromatic hydrocarbons, for example polychlorinated biphenyls or pentachlorinated phenol, amounts to concentrations not higher than those set out in the relevant Community legislation[10];

9. OJ No. L194, 25.7.75, p.23
10. See, in particular, Council Directive 96/59/EC (OJ No. L243, 24.9.96, p.31).

(ii) these wastes are not rendered hazardous by virtue of containing other constituents listed in Annex II to Council Directive 91/689/EEC on hazardous waste in quantities or in concentrations which are inconsistent with the achievement of the objectives set out in Article 4 of Council Directive 75/442/EEC on waste[11]; and

(iii) the net calorific value amounts to at least 30 MJ per kilogramme;

(b) any combustible liquid wastes which cannot cause, in the flue gas directly resulting from their combustion, emissions other than those from gasoil as defined in Article 1(1) of Council Directive 93/12/EEC relating to the sulphur content of certain liquid fuels or a higher concentration of emissions than those resulting from the combustion of gasoil as so defined;

"incineration plant" means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated. This includes the incineration by oxidation of waste as well as other thermal treatment processes such as pyrolysis, gasification or plasma processes in so far as the substances resulting from the treatment are subsequently incinerated.

This definition covers the site and the entire incineration plant including all incineration lines, waste reception, storage, on site pre-treatment facilities, waste-fuel and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack, devices and systems for controlling incineration operations recording and monitoring incineration conditions; but does not cover incineration in an excluded plant;

"non-hazardous waste" means waste which is not hazardous waste;

"waste" means any solid or liquid waste as defined in Article 1(a) of Council Directive 75/442/EEC on waste";

11. OJ No. L194, 25.7.75, p.39 amended by Council Directives 91/156/EEC (OJ No. L78, 26.3.91, p.32) and 91/692/EEC (OJ No. L377, 31.12.91, p.48) and Commission Decision 96/350/EC (OJ No. L135, 6.6.96, p.32).