# AQ19(06) Additional Guidance from Defra and the Welsh Assembly Government - Nov 2006

## Amendment of PG5/2(04) – cremation temperature

Row 6 of table 2 in PG5/2(04) specifies that the temperature in the secondary combustion zone should be a minimum of 850$^0$C. The cremation sector has suggested that a temperature of 800$^0$C should suffice.

Defra and WAG have considered this carefully and have consulted members of the PG5/2 working party. Defra and WAG have concluded that the fourth column of row 6 should be amended as follows:

"minimum of 1123K (850$^0$C) in the secondary combustion chamber where no mercury abatement plant is fitted and operating; minimum of 1073K (800$^0$C) in the secondary combustion chamber where mercury abatement plant is fitted and operating".

The consultation note for this issue is copied below by way of background.

**Queries**

If you have any queries about this note, please contact Defra or the Welsh Assembly Government (WAG)

For Defra:-


Imalka Oyewole imalka.oyewole@defra.gsi.gov.uk 020 7082 8389

Phil Pope phillip.m.pope@defra.gsi.gov.uk 020 7082 8391


For the Welsh Assembly Government:


Ross Hunter ross.hunter@wales.gsi.gov.uk 029 2082 3473


defra
Department for Environment Food and Rural Affairs

**Proposed Change to UK Crematoria operating conditions**

## Summary

A request to alter the operating temperatures within the secondary combustion chamber of UK cremators has been submitted to Defra. Justification for this case depends, in part, on a similar proposal being considered in Denmark. Consideration of the request leads to the conclusion that a relaxation for those crematoria fitting mercury removal systems can be justified, whereas a similar relaxation for those not fitting such abatement will require provision of further data relating to Carbon Monoxide and, possibly, dioxin emissions.

## Introduction

Since 1996 crematoria have been upgraded to ensure that combustion gases leaving the primary chamber are then retained in the secondary chamber for 2 seconds at 850$^{o}$C. Combined with improved control systems this has reduced dioxin emissions from these plants to very low levels. It has also eliminated the majority of problems associated with smoke and odour. The upgrading maintains the afterburner temperature at 850$^{o}$C throughout the cremation cycle, including the period prior to the coffin being introduced to the unit and concluding when the cremation cycle is complete.

The trade associations representing the crematoria have asked whether it would be possible to relax these operating requirements in order to reduce energy costs. In support of their case they quote the example of Denmark, where they suggest a relaxation to 800$^{o}$C for one second be already permitted. The Danish Crematoria Federation has presented a case that argues that the conditions required for dioxin formation during the initial and final phases of the cremation cycle are absent. During both phases, chlorine, necessary to form dioxins and furans, is absent from the combustion gases. During the middle phase, when chlorine may be present, the temperature in the secondary chamber exceeds 850$^{o}$C as a result of the additional calorific input from the materials being cremated. The Federation requests the change because they claim the lower preheat temperature will result in a) a reduction of oil or gas usage of about 25%, b) a reduction of $CO_2$ emissions, and c) longer life of the furnace refractory.

The Danish authorities are presently considering this proposal, with political agreement being anticipated within 2 - 3 months. Agreement will be subject to the crematoria meeting revised emission limits for certain pollutants; i.e. mercury, dust and carbon monoxide. The Table below compares the proposed Danish ELV's against those required for new/substantially changed plant in PG 5/02 (04).

| Pollutant | Danish Proposal, mg/m$^3$ | PG 5/02, new plant, mg/m$^3$ |
|---|---|---|
| Mercury | 0.05 | 0.01 |
| Dust | 10 | 20 |
| Carbon Monoxide | 50 | 100 |

The implication is that all crematoria will be fitted with mercury abatement. In such instances the abatement process will aid removal of any dioxin present in the exhaust gas stream. Where

abatement is not fitted the request for the afterburner temperature reduction is still being considered.

The present position in the UK is outlined in the Defra guidance on the Waste Incineration Directive, (WID). This discusses derogation from the 2 seconds at 850$^{o}$C requirement and concludes that this can be achieved by compliance with a) no increase in solid residues, and no increase in the TOC content of these residues, and b) compliance with WID emission limits, in particular that for carbon monoxide (CO). The Environment Agency is already considering this approach for A1 incinerators, as measurement of the residence time in an incinerator secondary combustion chamber is normally only possible at the design stage. Although WID does not apply to crematoria, compliance with the above criteria is seen as a requirement if derogation from the 2 seconds at 850$^{o}$C condition is to be granted.

Compliance with the first of these criteria is already achieved during cremation, this being a prerequisite of the process. The CO emission limit suggested by WID is 50 mg/m3, coincidentally the limit being proposed by Denmark. The visit made by the Local Authority Unit to a modern crematorium indicated that this limit could be achieved, but it would be prudent to verify this applies to other units. It is considered unlikely that a change to the operating temperature would have a detrimental effect on emissions of other pollutants, in particular smoke and odour.

Additional issues raised during the visit were a) positioning of the temperature probes within the secondary chamber and b) the type of equipment used to obtain a negative pressure within the furnace chambers.

a) It was noted that the proximity of the probe to the secondary chamber afterburner will directly affect the temperature reading, i.e. the probe should not be in a position where the secondary afterburner flame impinges directly onto the probe. Such a situation gives the impression of compliance, but it is the flame, rather than the chamber, temperature that is indicated.
b) The crematorium visited was using a venturi system to create the negative pressure required in the cremator chambers. This has the effect of both diluting and rapidly cooling the exhaust gases from the unit, with the indicated temperature of these gases being 350$^{o}$C. This is within the window required for dioxin formation, somewhat negating the impact of the 850$^{o}$C, two second residence time.

**Recommendations**

It would appear that there is a move away from the strict time/temperature criteria but only when associated with either further abatement, and/or implementation of other emission criteria. For the UK it is suggested that where mercury abatement is to be fitted a relaxation of the time/temperature criteria be permitted once such abatement is in place. Changes to the limits for particulate and carbon monoxide in PG 5/02 (04) should be discussed.

For those units where abatement is not proposed the Federation should be requested to supply monitoring data relating to operating conditions and emissions for consideration by the LAU.
This data would consist of: -

Gas temperature in the secondary chamber of the units, including the position and number of measurement points.
Carbon Monoxide (CO) concentration exiting the secondary chamber
If available, Total Organic Carbon (TOC) content of this gas stream
TOC content, (or Loss on Ignition, (LOI)) of the ash residue from the cremator.

Dependent upon the information received it may be necessary for this to be followed by selection of suitable cremators where monitoring for dioxins and furans when operating to this revised specification can be carried out. The results can then be compared with those previously obtained in order to confirm the acceptability of the proposal. The LAU would then provide Defra with potential new conditions to be used by the local regulators for crematoria to demonstrate compliance. The cost of such monitoring would be in the range £5 -10k per test.

However, before finalising this requirement discussions of the details required should be made with the industry. Provision of other data could be useful, but not essential, for the evaluation.

Martin Leach
Technical Advisor
Local Authority Unit
Environment Agency
17/02/06

Annex

**Impact of temperature change on fuel costs.**

In order to assess the impact the proposal would have on the fuel costs, information was obtained relating to a) fuel use for the cremation and b) the operating costs of the mercury abatement equipment.

Bedford Crematoria supplied gas consumption data for the period July - October 2005, that indicated the average cost per cremation was around £27.50. Using the Danish Federation estimate of a 25% reduction in fuel consumption[1], this would represent a saving of £6 -7 per cremation. From the LAU report on mercury removal, the average operating cost of a cremation is £100 -360. Using £250 as an average then the reduction in secondary chamber temperature would lead to a saving of 2.4%. This figure should be treated with caution as it is based on minimal data, but at least supplies a figure for discussion purposes.

With regard to the additional cost of mercury abatement, the LAU report indicated the running costs of the equipment would be around £8.80 per cremation, of which £2.40 was allocated as energy cost. The report also quotes the additional cost per cremation, (when capital cost is included), as in the order of £47 - 67. Thus a twofold increase in fuel cost would lead to a rise in additional cost per cremation of the order of 5%.

When assessed against the total cost per cremation the change in fuel cost will impact on the energy associated with the cremation as well as the operation of abatement equipment. (From the above the abatement energy cost appears to be around 8% of the total fuel cost). Based on

an average of £250, then a doubling of fuel prices would give an increase of £30 per cremation, an increase of around 12%.

**PB No 9052A**

**Nobel House**
**17 Smith Square**
**London SW1P 3JR**

**www.defra.gov.uk**


**PB No 9052A**

**Nobel House**
**17 Smith Square**