Sewardstone Park Crematorium
Sewardstone Road
London
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Part B Permit
Technical Application
May 2025

ehrc

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ehrc is a UK consultancy of over 15 years, providing Regulatory services to the Public sector, and environmental permitting assistance to the Private sector. ehrc currently assists 20 local authorities in London and the Home Counties, including over 15 crematoria (gas fired and electric). We have also completed a similar number of permit application for the private sector, all of which resulted in a permit being granted. Fay Rushby is the Director of ehrc and a fully qualified Environmental Health Officer of over 20 years. She is a voting member of the Chartered Institute of Environmental Health, and holds a Master's Degree in Industrial Pollution Control. Fay is an active participant in defra reviews of Process Guidance notes, including PG5/2 which at the time of writing is undergoing a detailed review.

Contents

1.0 The installation

Sewardstone Park Cemetery and Crematorium LTD (the Operator) plans to open Sewardstone Park Crematorium in late 2025. This supplementary information document details the equipment proposed in the crematorium, describes the cremation process and provides how the Operator intends to apply Best Available Techniques (BAT)* to prevent, or where that is not possible, to minimise emissions to air from the operation of the installation.

1.1 Description of the proposed installation

The installation is to comprise:

1 No. DFW double-ended computer controlled electric cremator, equipped with:

- Auto-insertion machine
- Primary cremation chamber with temperature interlocked charge door.
- Secondary combustion chamber (2.15m^3).
- Automated and integrated charging bier.
- Front door inspection window.
- Ash collection hopper.
- Emergency release vent (bypass) equipped with air injector fan (at least 7m).
- Lamtec LT1/LS1 secondary combustion chamber Oxygen analyser.

1 No. Flue Gas Cooling and Flue Gas Cleaning installation, comprising:

- Danstoker heat exchanger with automatic cleaning system.
- External dump cooler with cooling fans.
- DFW O 2-12 particulate abatement and dust collection hopper, with Kevlar/Nomex filtration.
- Fixed bed cartridge filter for mercury and acid gas abatement.
- Exhaust stack after flue gas cleaning (at least 7m).

1 set of emissions monitoring equipment, comprising:

- Dr. Födisch PFM13 Particulate Filter Monitor (or similar) dust probe.
- Dr. Födisch MGA12 multi gas analyser (or similar) for carbon monoxide.
- Extractive emissions monitoring ports.

1 set of ash processing equipment, comprising:

- DFW Europe Ash Processor.
- DFW Europe Ash transfer table with LEV.

* at the time of writing, Process Guidance Note 5/2(23) Statutory Guidance for Crematoria (and UK BAT for Crematorium) has completed the Public Consultation phase of technical review. The proposed publication date is not yet known. This means that the emission limits of PG5/2(12) remain in force until the guidance is issued. NOx abatement is proposed, and will be retrofitted in accordance with the requirements of the guidance when published.

1.2 Activity description

Full plant schematic diagrams of the components of the installation are provided in Appendix 1. Please refer to 3D view diagram (in Appendix 1 – Maps, Plans & Diagrams) in conjunction with the narrative in this activity description:

1 Auto Insertion machine

The coffin will be received in the crematory lobby from the catafalque in the chapel following the completion of the memorial service. A wheeled trolley will be used to safely and considerately move the coffin to the coffin store, or to the charging bier ready for cremation.

The cremator will be equipped with an Automatic Insertion Machine (AIM) which will be mounted in the floor in front of the cremator, and out of sight other than when in active use. When a coffin needs to be inserted into the cremator, the operator pushes the button on the Touch Screen and the AIM will rise from the floor to a pre-set level. The coffin will then be transferred to the AIM. When 'ready to cremate', the operator pushes the button on the Touch Screen and the AIM raises to the level of the primary chamber hearth. The charge door will then automatically open, and the AIM inserts the coffin directly into the primary chamber. Any heat or smoke released during charging will be ducted to the charge door LEV. After coffin insertion, the AIM withdraws, and the charge door closes. When 'ready to cremate', the secondary combustion chamber temperature is set to be >750°C, and the charge door will be interlocked to prevent coffin insertion below this temperature. The AIM will then automatically park itself out of sight in the floor.

2 Cremator

The proposed cremator is a double ended electric machine. The cremator will be entirely operated by electricity, and will not contain any auxiliary gas burners.

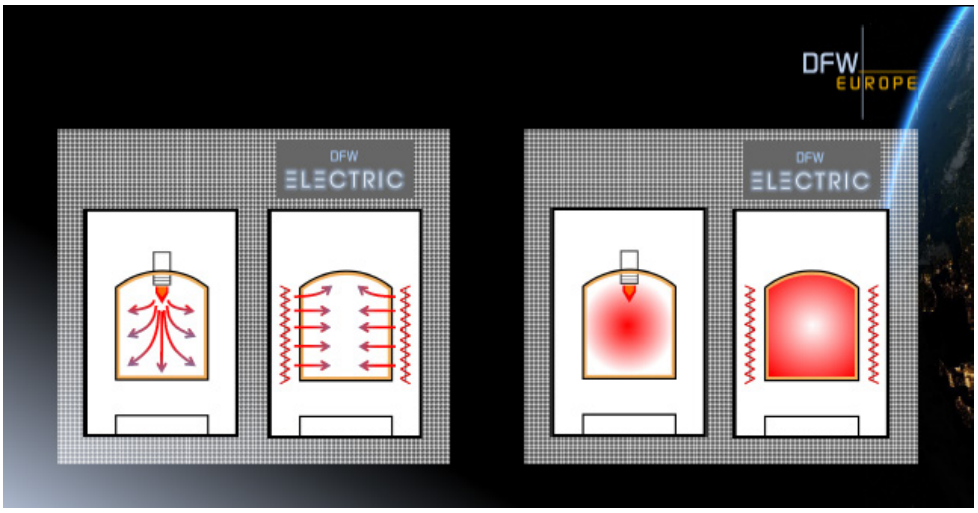

Figure 1: Gas Vs Electric heating.

Electric elements within the refractory linings will heat the cremator from the blockwork into the combustion chamber air space. This is different to a gas burner system, which first heats the air in the chamber, then the refractory lining as shown in Figure 1 above. The electric

crematorium will be highly insulated, and temperature will be maintained 24-hours a day, 7-days per week at all times other than for planned preventative maintenance.

Maintaining a hot machine aims to minimise the heating and cool cycling of the refractory (maximises refractory life) and to minimise the electrical demand to heat the oven from cool. The primary and secondary chambers are both heated: the primary chamber to at least 650°C, and the secondary chamber to at least 750°C. UK test reports confirm that all UK emission limits can be met at this operating temperature.

Combustion conditions will be controlled by bespoke software, enabling the fully automatic operation of the cremator. Electrical energy will be supplied to both primary and secondary chambers to maintain secondary combustion chamber temperature. Combustion air will be managed within pre-set operational parameters by the control system, using data from primary and secondary combustion chamber thermocouples and the Oxygen analyser.

3 Charge door LEV

Due to the elevated temperatures in the primary chamber, the charge door is equipped with LEV to expel heat from the crematory when a coffin is charged. It is not an emissions release point, but does vent heat to atmosphere.

4 Emergency release vent (Bypass)

The cremator will be equipped with an emergency relief vent to bypass the flue gas cleaning systems in the event of a problem. This serves to protect the filter system by ducting the very hot gases from the secondary combustion chamber to air. The bypass stack will only operate in an emergency: it is not possible to routinely cremate and release emissions via the emergency release vent.

5 Boiler / heat exchanger

Hot gasses from the secondary combustion chamber will pass through a heat exchanger though a refractory lined duct. The heat exchanger will be used to reduce the temperature of the flue gasses to around 120-150°C. The flu gas temperature needs to be reduced for the flue gas treatment system (mercury abatement) to work correctly. Recovered heat will be used to heat the chapel.

6 Particulate filter

Cooled combustion gasses will pass through a spark arrestor and then a dust filter comprising of 102m^2 of filtration area provided by Kevlar/Nomex filter units, which will be periodically and automatically cleaned by compressed air.

The Dr. Födisch PFM13C Particulate Filter Monitor (or similar) dust probe will act as a gross filter failure detector.

Collected dust will fall into a sealed dust collection hopper for off-site disposal as hazardous waste.

7 Mercury abatement

All new crematoria are required to be equipped with 'mercury abatement': Cooled and filtered combustion gasses will then pass through a fixed bed flue gas cleaning system for the control of Mercury, Dioxins and Hydrogen Chloride. A stainless-steel perforated cartridge will contain a mixture of activated carbon and bicarbonate granules and will be mounted inside an insulted steel housing mounted-in line with the flue gas stream.

The filter bed is 'on-line' at all times unless physically removed from the system or if emissions are released vit the emergency release vent. A 'dummy filter' is available for engineers to use if cremations need to continue while work is undertaken on the filter cartridge.

8 Abated stack

Cooled, filtered and cleaned combustion gases will be released to air via an 7m chimney stack. This stack will be equipped with emissions monitoring ports and emissions monitoring equipment.

The stack height was derived using D1 chimney height calculation containing up to date information, and confirmed via detailed dispersion modelling.

9 Cremulator

Cooled cremated remains will be transported to the ash processing area, where they are checked for metal objects (such as artificial joints and metal pins) that would otherwise damage the processing equipment. The ash processor (cremulator) will process the remains to a consistent granular powder. This will be a fully enclosed unit.

9 Ash transfer cabinet LEV

Processed remains are prepared for spreading or interment on the ash table. The ash table does have an external vent, principally for operator protection, and is fully filtered prior to release. This is not an externally venting cremulator, and emission limits do not apply.

10 Aero cooler

Recovered heat will be used to heat the chapel, but more heat will be produced that the chapel can use, especially in the summer months. Excess heat will be dissipated via an externally located aero cooler.

2.0 Emissions

2.1 Foreseeable emissions

The foreseeable emissions from each stage of the cremation process are as follows:

2.1.1 Foreseeable emissions during cremator start-up

The cremator will be totally heated by electricity, meaning that there are no emissions at start-up.

2.1.2 Foreseeable emissions during cremation operations

During normal cremation operations the foreseeable contained emissions from the cremator will the products of combustion of the coffin and its contents. The principal emissions will be:

- Combustion emissions (NOx, SOx, CO).
- Particulate matter.
- Hydrogen chloride.
- Mercury (dependent on its presence in the human body).
- Steam plume (under certain climatic conditions).

2.1.3 Abnormal operations

Abnormal cremation operations will hopefully be rare, but in addition to the emissions from cremator operations, other foreseeable contained emissions could include:

- Visible smoke.
- Possible combustion odour.

2.1.4 Foreseeable emissions during cremator shut-down

The cremator will be maintained hot 24-hours a day, 7-days a week other than for planned preventative maintenance.

When the cremator is shut down, only heat will be released because the primary cremation chamber will be empty.

2.1.5 Foreseeable emissions during fly-ash removal

Fly-ash collected from the filtration system could give rise to fugitive emissions of particulate matter.

2.1.6 Foreseeable emissions during remains removal and preparation

After cremation, the fully calcined remains are dry and brittle, and could give rise to fugitive emissions of particulate matter.

2.2 Emissions quantification

Emissions from crematoria are generally contained emissions, and these can be quantified based on existing data for similar cremation equipment.

2.2.1 Quantification of contained cremator emissions

The proposed installation is not currently operational however, the manufacturer has provided emissions information from another UK DFW electric cremator installation in Hambleton (Table 1) and Appendix 2:

Parameter	Hambleton Crematorium[1]	Emission Limits		
		PG5 (12)	Possible future Limit (existing cremators)	Possible future Limit (new cremators)
Particulate Matter	1.4 mg/m^3	20 mg/m^3	10 mg/m^3	5 mg/m^3
Mercury	7.3 μg/m^3	50 μg/m^3	50 μg/m^3	30 μg/m^3
Dioxins	0.029 ng/m^3	0.1 ng/m^3	0.1 ng/m^3	0.1 ng/m^3
Carbon Monoxide	9.0 mg/m^3	100 mg/m^3	100 mg/m^3	100 mg/m^3
Hydrogen Chloride	0.092 mg/m^3	30 mg/m^3	30 mg/m^3	20 mg/m^3
Nitrogen Oxides	-	No emission limit	200 mg/m^3	200 mg/m^3

All reported at 11% O_2

Table 1: Emissions Quantification
([1]ERO-3503 DFW Europe Ltd @ Hambleton Crematorium - Cremator)

The possible future limits are yet to be confirmed and should not appear in any permit relating to this application. New guidance will also confirm what constitutes an existing / new cremator. Note: As this application is being made before the new guidance has been published, it is possible that the cremator subject to this application will be an 'existing creator'.

2.2.2 Quantification of fugitive emissions

It is not possible to quantify fugitive emissions, however these will be contained and controlled as far as practicable in accordance with site specific Best Available Techniques.

Any off-site impact of fugitive emissions is highly unlikely.

3.0 Controlling emissions

Contained and potentially fugitive emissions from the installation will be controlled as follows:

3.1 Controlling combustion emissions

The temperature and composition of the combustion gasses in the primary chamber are highly variable from charge to charge, so the secondary combustion chamber is designed to treat these gases at a consistent temperature and for a consistent period of time, effectively providing a controlled incineration process for gasses from the primary combustion chamber (Figure 2).

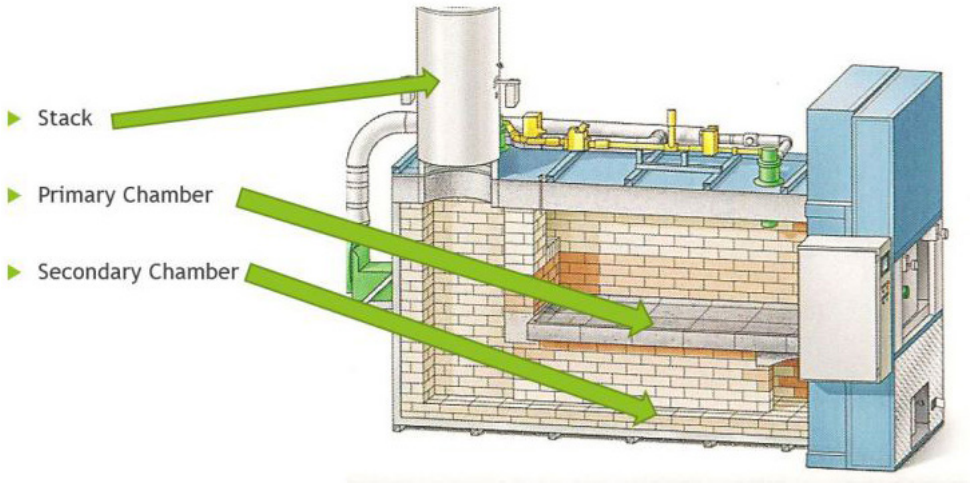

Figure 3: Secondary combustion chamber diagram.

Electrical energy will be supplied to elements in the secondary chamber to maintain secondary combustion chamber temperature. Thermocouple(s) will continuously monitor secondary combustion chamber temperature to ensure that the required temperature is maintained. The secondary combustion chamber will have a proposed volume of 2.15 m^3, and will be designed such that the gasses from the primary chamber are held at a 750°C or more for at least two seconds (known as the residence time). The charge door will be interlocked to prevent machine loading below 750°C.

750°C is used instead of 800°C because the most significant effect on the control of emissions is now the flue gas treatment plant. The slightly reduced temperature presents an energy saving on the electrical support 'fuel', given that heat removal happens immediately after the secondary chamber. This is particularly important for the first cremation of the day, after which cremation activities generally maintain cremator chamber temperatures well above charge door interlock temperature. All DFW electric machines operate in this manner and emissions compliance for dioxin supports the acceptability of the change in operating temperature.

A Lamtec LT1 oxygen analyser (Figure 3) will continuously monitor secondary combustion chamber Oxygen, and the control software will manage the provision of combustion air, with the aim of maintaining a minimum average Oxygen of 6% and minimum Oxygen of 3% for good combustion.

Figure 3: Lamtec LT1 oxygen analyser

The Lamtec system is an accredited monito and has automatic check and calibration functions, and the product information is supplied as Appendix 3.

3.2 Controlling particulate matter emissions

Particulate matter emissions will be controlled by a filter system, which will comprise a filter housing containing 102m^2 of Kevlar/Nomex filter cartridges (Figure 4).

Figure 4: Dust filter unit with collection drum.

The filter cartridges will be frequently and automatically cleaned with a pulse of compressed air. This will displace the dust that has accumulated on the outside of the filter element.

3.3 Controlling emissions of mercury, dioxins and hydrogen chloride

The key control measure is the secondary combustion chamber of 750°C or more during the cremation. Noted that that this is a departure from the guidance in PG5/2 however the PG note has not yet been updated for New Generation electric cremators, and as Table 1 clearly demonstrates, the dioxin and HCl emission limits can comfortably be met at this temperature. The lower temperature also means that the electrical energy input requirements are lower, and NOx emissions (although not currently regulated but an important pollutant nonetheless) are also lower.

Whilst the overall contents of the coffin cannot be controlled, funeral directors will be instructed in writing to ensure that the following are not presented for cremation due to their potential for unwanted emissions:

- PVC or melamine in coffin construction or furnishings, and cardboard coffins containing chlorine in the wet strength agent (e.g. not using polyamidoamine epichlorhydrin based resin (PAA-E)).

Emissions of mercury, dioxin and hydrogen chloride will be limited in a closed system via a cartridge pre-filled with a mixture of activated carbon and bicarbonate granules.

Cooled and de-dusted combustion air is drawn through the packed bed of granules where the abatement takes place. Service life depends on the installation and the number of cremations undertaken.

The carbon/bicarbonate cartridge can be replaced by a 'dummy filter' to allow the Operator to continue to cremate if necessary in the event of a problem with the carbon/bicarbonate filter. The Regulator will be notified whenever this is the case. Emissions will remain filtered for dust and will release via the main stack, but will not count for the purposes of trading abated cremations if the Operator elects to participate in the CAMEO scheme.

3.4 Controlling particulate emissions during fly-ash removal

Dust displaced from particulate abatement drops into a sealed collection hopper at the bottom of the filter housing for disposal as hazardous waste containing Mercury. Drums will be stored sealed prior to collection.

Waste consignment notes will be obtained and retained on site as part of the Duty of Care process for waste handling.

3.5 Controlling particulate emissions during remains preparation

A DFW Cremulator is proposed for the for the preparation of remains after cremation.

A power magnet removes metallic items, and 20 stainless steel clappers reduce the cremated remains to a uniform granular powder.

The cremulator is a fully contained unit with no particulate emissions to atmosphere. The transfer table does have filtered LEV, this is for workplace ventilation and is not subject to emission limits as it is not a cremulator.

4.0 Other than normal operating conditions (OTNOC)

Good management controls, maintenance and operational standards will mean that unintentional emissions or 'other than normal operating conditions' (OTNOC)are rare.

The most common (but still rare) OTNOC event is flue gas treatment (FGT) system bypass, which happens to protect the cremator and the flue gas treatment system or because of a power outage. The bypass butterfly valve is held shut pneumatically under normal operations, meaning that it will fail to safe (i.e. to bypass) in the event of a problem, including power outages.

In a bypass event, the emissions from the cremator will be released to air via a separate, large diameter steel emergency release vent located on the crematorium roof, directly above the cremator.

Figure 5: Emergency release vent with Injector Air Fan.

The emergency release vent will contain an injector air fan (Figure 5), supplying additional air for the dispersion and dilution of emissions.

If possible, and depending on the stage of cremation and the cause of the bypass event, the flue gas treatment system can be re-set to maintain abated emissions without undue delay. The worst case scenario is that the cremation finishes unabated.

In a bypass event, the cremator operator will keep a record of the incident, equipment information, and whether or not any visible smoke or cremation odour was experienced

Fully bypassed and therefore unabated cremations will not count towards emissions trading scheme operated by Crematoria Abatement of Mercury Emissions Organisation (CAMEO) if the operator decides to participate in the scheme.

NB: A cremation cannot commence with the machine in full bypass to the emergency release vent.

5.0 Monitoring emissions

A combination of continuous emissions monitoring and extractive emissions monitoring will be undertaken in order to ensure that compliance with emission limits is demonstrated:

5.1 Non-continuous monitoring

Extractive emissions monitoring will be undertaken after commissioning the system, and then once every year thereafter. Sampling ports will be provided and will be located in the ductwork in accordance with Environment Agency Guidance M1 as far as practicable.

Extractive emissions monitoring will be undertaken in accordance with Table 2 (or equivalent standard), and results reported at reference conditions of 273K, 101.3kPa, dry gas, 11% oxygen.

Parameter	Test method	Emission limit mg/m^3 (unless stated otherwise)	Notes
Total Particulate Matter	EN 13284-1	20	Annual
Hydrogen Chloride	EN 1911	30	Annual
Mercury	EN 1948, Parts 1, 2 and 3	50$\mu g/m^3$	Annual
Dioxins & Furans	EN 1948	0.1 ng/m^3	Commissioning only
Total VOCs (as Carbon)	EN 12619	20	Annual
Carbon Monoxide	EN 15058	100	Annual 2 x 30-minute averages
Secondary combustion chamber residence time		2 seconds or more	Commissioning only

Table 2: Proposed emissions monitoring.

5.2 Continuous monitoring

Continuous emission monitoring will be undertaken for particulate matter and carbon monoxide on the abated stack:

5.2.1 Particulate matter continuous monitoring

The Dr. Födisch PFM 13 Particle Monitor (Figure 6) is a an accredited qualitative particulate monitor acting as a gross filter failure detector. The device uses a tribo-electric probe in the cleaned exhaust gas flow. The action of a dust particle impacting on the probe creates and electrical signal, which the monitor equates to an emission percentage. The product information is supplied as Appendix 4.

Figure 6: Dr. Födisch PFM 13 Particle Monitor.

The output is displayed directly on the device, and is also linked to the computer control system where results and warnings are automatically recorded. Note that there is no requirement to present particulate monitoring data on the PG5 monthly reports, and the reporting system is not set up to do so.

5.2.2 Carbon monoxide continuous monitoring

The Dr. Födisch MGA 12 multi gas analyser (Figure 7) is proposed for measuring the concentration of carbon oxides (CO & CO_2) in cold dry gas conditions. It is an accredited monitor and will be linked to the cremator display and CEM reporting software. The product information is supplied as Appendix 5.

Figure 7: Dr. Födisch MGA 12 multi gas analyser.

It has an in-built auto-calibration function, meaning that it can easily be calibrated on site with ambient air, without the need for certified calibration gases. The output is linked to the computer control system where results and warnings are automatically recorded.

6.0 Environmental management techniques

In addition to the technical controls described, the crematorium proposes to operate in accordance with a documented Environmental Procedures Manual. The Draft procedures are provided in Appendix 6 and contain examples of the information and recording systems detailed below:

6.1 Daily operations

A daily documented health check will be performed on the cremator and analytical equipment.

6.2 Emissions reporting & notifications of alarm events

The data from the monitoring and control systems on the cremator and the exhaust gas flue are collected to provide operational information on the performance of the cremator during each cremation.

6.1.1 Emissions reporting

The DFW cremator software automatically records the following information to produce what is referred to as the PG5/2 report:

- Average, minimum and maximum secondary combustion chamber inlet and outlet temperatures (5-minute averages).
- Average and minimum secondary combustion chamber oxygen (5-minute averages).
- The highest 60-minute mean emission values (particulates and CO).
- Details of any excursion events.

An example of the monthly PG5 report is provided in Appendix 7.

6.1.2 Notifications & alarm events

The DFW cremator software automatically records alarm events and a history is retained on the computer for inspection by the Regulator as required.

A specific notification will be made to the regulator under the following circumstances:

- Flue gas treatment system by-pass.
- Double emission limit exceedances.
- 7-days prior notification of extractive emissions monitoring.
- Reporting extractive emissions monitoring within 8 weeks of testing.

6.3 Maintenance

A service agent will provide ongoing maintenance support and servicing for the cremator and flue gas treatment systems. A maintenance/service report will be retained following every visit.

The following spares and consumables are held in any event:

- Thermocouples (all sizes).

6.4 Training

All cremator Operators will be trained by the cremator manufacturer and to ICCM certification standards. ICCM Certificates will be displayed in the crematory area.

6.5 Mass fatalities

In the event of circumstances giving rise to mass fatalities (such as pandemic) the Operator has an outline procedure in place to guide site operations.

7.0 Environmental impact

Emissions from abated cremators are tightly controlled by emission limits in Secretary of State's Process Guidance Note PG5/2, these emissions and emissions from the development and use of the site as a whole were assessed and approved as part of the planning application process. The assessment process also established the minimum acceptable stack height and the calculated impact of emissions on the local environment, see: Air and Environmental Impact Assessment in Appendix 8.

7.1 Determination of chimney height

The approach to stack height determination for planning and preliminary permitting applications remains the 1993 HMIP 'D1' methodology. This is a calculation-based approach, using pollutant emission rates, release temperature, stack diameter and information on site building dimensions and applying ground level pollution concentration standards to derive a minimum acceptable release height.

Fully updated information was used in the assessment, resulting in a stack height of 7m above the chapel finished floor level (FFL). The details of the D1 calculations are provided in Section 9.9 and Appendix E of the Air and Environmental Impact Assessment in Appendix 8.

The main stack/chimney has been designed to be 7 m above the chapel finished floor level (FFL), which is also more than 3 m above the roof deck of the cremator hall. This stack height is meet the chimney heigh requirement in accordance with 'Environmental Protection Act 1990, Technical Guidance Note (Dispersion), D1, Guidelines on Discharge Stack Heights for Polluting Emission, HMIP, June 1993'.

NB: Due to the sloping nature of the land, the final stack height may appear taller than 7m as detailed on the DFW drawings, in any event the stack will not be less than 7m above the chapel finished floor level (FFL).

7.1 Local air quality impacts

The proposed cremation equipment performs better than the emission limits contained within the statutory guidance for the cremation sector for abated plant, however as a matter of good practice, detailed dispersion modelling was undertaken to confirm the proposed minimum stack height at maximum permitted limits.

The details of the dispersion modelling assessment are provided in Section 10 of the Air and Environmental Impact Assessment in Appendix 8.

The report concludes that: the predicted cumulative long-term and short-term pollutant concentrations at the selected receptor locations are all below the relevant AQOs for the protection of human health. The significance of cumulative effects on the emissions on the ground level receptors from the operations with respect to long-term pollutants is determined to be 'negligible'.

7.2 Designated sites

Part B permit applications require that all designated sites within 500m of the proposed regulated activity be assessed in terms of environment impact. There are no statutory designated withes within

500m of the prosed activity. Epping Forest SCA and SSSI is approximately 1,150m to the east of the proposed emission release point, and a habitats assessment was carried out.

Habitats assessment concluded that proposed operations are below the relevant critical level for the protection of vegetation and Ecosystems. The percentage change in long-term process concentrations relative to the AQAL is below 1% of the relevant critical level for the protection of vegetation and ecosystem and NOx impacts from the proposed development on the ecological receptors are insignificant.

The details of the dispersion modelling assessment are provided in Section 11 and the conclusions of the Air and Environmental Impact Assessment in Appendix 8.

Appendices

Appendix 1 - Maps Plans & Diagrams
Appendix 2 - Emissions Monitoring Report: Hambleton Crematorium
Appendix 3 - Lamtec Product Information
Appendix 4 - Dr. Födisch PFM 13 Product Information
Appendix 5 - Dr. Födisch MGA 12 Product Information
Appendix 6 - Draft Environmental Procedures
Appendix 7 - Example monthly report
Appendix 8 - Air and Environmental Impact Assessment