H-CC 5-11a Installation Details

General

The new installation is to be built on undeveloped land which previously comprised part of the Bleak House open cast coal mine. Mining operations ended in 2001 and most of the land has been restored as open heathland.

It is proposed that the site be developed by Horizon Cremation (Cannock) Ltd to provide facilities for the cremation and burial of human remains. A single building is to be erected which will house: one chapel, office accommodation and a crematory containing the cremation equipment.

Initially, it is envisaged that one cremator will be installed, although a second cremator will be added at a later date as soon as cremation numbers exceed the capacity of a single cremator. The cremator(s) will be fitted with emissions to air abatement equipment which will serve either one or both cremators.

The only significant source of pollutant emissions from the development will be those directly associated with the cremation process, although traffic to and from the site will also increase and provide a second source of air pollution. These elements will have a detrimental impact on local air quality, but the extent of the impact will be minimal due to the use of modern, efficient cremators equipped with emissions abatement equipment; and the short length of time vehicles will be on site with their engines running. (*see Air Quality Assessment Ref H-CC AQ Final.pdf)*

CREMATION PROCESS

In most cases, coffins containing human remains will be delivered to the crematorium chapel and after a short service are transferred to the crematory prior to being the cremated. The coffin will then be placed on a coffin charging machine ready for insertion into the cremator. (In some instances, the coffins will be taken directly to the crematory with no service.)

Once the cremators have reached the required operating temperature, the cremator's charging door is opened and the coffin is inserted into the primary combustion chamber. The primary chamber will have been preheated to around 760^{o}C prior to charging, as this is sufficiently hot to initiate combustion of the coffin without the use of the main chamber burner. For approximately 40 minutes, combustion of the remains is solely dependent on the: residual heat in the cremator, the calorific content of the charge and careful control of combustion air. After the initial period, the main chamber temperatures start to fall, at which point gas burners are used to reduce what remains of the charge to a calcinated residue. The overall cremation time can vary between 1 to 3 hours depending upon the size of the coffin, but typically, the average time for the cremation process is around 90 minutes.

As soon as all combustion has been completed, the calcified remains are raked down into an ash chute where cold air is passed over them for approximately 60 minutes to cool them. Once cool, the remains are transferred from the cremator to a cremulator, which reduces the remains to a granular state ready for transfer to a polyurn or similar suitable receptacle. The final cremated remains are normally either: removed from site, interred on site or strewn on site.

EQUIPMENT

Most of the cremation and emissions abatement equipment is to be located inside the crematorium, although the secondary flue gas air cooler, will be located outside, at the rear of the building.

It is intended that eventually the crematorium will install two new Mathews Novus cremators both of which will be equipped with emission to air abatement equipment. The first cremator is to be installed in 2020 along with the abatement plant. It is intended that the crematorium will carry out 100% of all cremations via the abatement system from the start of operations.

The cremators will be single ended units i.e., both coffin charging and ash removal takes place at the same end of the cremator. Both cremators will have the same basic configuration, and will be capable of accommodating large coffins up to 1040mm (40") wide.

The cremators will each have two propane fired burners, one for the main combustion zone and a second serving the secondary combustion chamber. Although intended for operation with the abatement plant, the cremators are capable of operating in accordance with the Process Guidance Note conditions for unabated cremator operations and as such are capable of achieving a 2 second secondary chamber residence time whilst flue gases are held at 850^{o}C.

Each cremator has a Mathews Environmental developed PLC control system is capable of operating in conjunction or independently of the abatement plant controls.

The abated cremator installation will eventually comprise: two cremators, two flue gas coolers; one reagent dosing station, and a single fabric bag filter. Associated with the abatement plant will be a small plate heat exchanger and an external air blast/water cooler. The former recovers waste heat to provide space heating and the latter dumps the surplus heat generated by the cremation process to atmosphere. (The air blast cooler is a secondary cooler which operates in conjunction with the primary water/glycol cooled flue gas cooler.)

The proposed abatement plant is designed to reduce emissions to air of: particulate matter, hydrogen chloride, mercury and dioxin and furans. The plant being installed has sufficient capacity to ensure the emissions from two cremators running simultaneously will be below the PG5/2 (12) emissions limits specified for cremation operations. The system is designed to achieve the standards with either one or two cremators in use.

The hot flue gases leaving the cremators at >800^{o}C are ducted to a gas: water/glycol heat exchanger. The unit transfers the heat in the hot flue gas to a water / glycol liquid coolant, thereby reducing flue gas temperatures to approximately 150^{o} - 170^{o}C. Once the flue gas temperature has been lowered to this level, an active reagent is added to the flue gas and both components are allowed to mix prior to the flue gas being passed through a bag filter unit. The filter then removes both the particulate matter generated by the cremation process and the spent reagent, before the abated flue gas is returned to the main flue and discharged to atmosphere through a single crematorium chimney.

The reagent is supplied in powder form and contains activated carbon and sodium bicarbonate, in a

ratio of approximately 20:80. This is added to the gas stream to remove/reduce the emissions of: mercury, hydrogen chloride, and dioxin and furan.

Each cremator will work in conjunction with a flue gas cooler/heat exchanger which will be a horizontally mounted shell and tube design. The hot flue gas from the cremator passes through tubes within the heat exchanger, whilst coolant is circulated around the tubes. The unit(s) will be sized to ensure the flue gas temperature into the abatement plant is within the plants operating limits, even when the cremator(s) are operating at their maximum capacity. The coolant is essentially water based, but contains 25% glycol to: provide improved heat transfer performance, minimise corrosion problems, and provide frost protection for the external air cooler.

In some installations, flue gas coolers of this type have encountered operational problems due fouled heat transfer surfaces which restricts the amount of heat that can be removed from the flue gases. Under these circumstances the abatement plant is liable to go into by-pass mode leaving the cremators to operate unabated. In this installation, the potential problem has been minimised by the installation of automatic tube cleaning equipment which should ensure that there is no significant drop in plant performance even with extended use. This cleaning system operates by regularly blowing compressed air through the flue gas tubes after cremations have been completed. The cleaning process is fully automatic and any material dislodged from the cooler tubes is carried through the exhaust duct to be collected in the filtration plant.

An air blast cooler will be installed which will operate in conjunction with the primary flue gas heat exchanger and its purpose is to remove heat from the primary heat exchanger coolant. This unit is a conventional, proven design, comprising a series of finned tubes, through which coolant from the flue gas cooler flows. Six fans blow air across the fins to remove heat, with each fan operating independently according to demand. The coolant is circulated through the tubes at between 60^{o}C and 90^{o}C.

The particulate filter unit comprises a Dustoflex bag filter having a filter area of around 104 m^2. The PTFE filter material employed has good temperature and abrasion resistance properties and incurs a relatively low pressure drop. Collection efficiencies are good at 99% for particulate sizes greater than 0.6 micron. As with the primary heat exchanger, the bag filter unit incorporates a compressed air cleaning system which is controlled automatically in response to the pressure drop across the filter. This prevents the filter from becoming blocked and should ensure optimum plant performance. The particulate material from the bag filter is collected in a dust-tight 45-gallon (205 lite) container, which will be sealed to the filter during normal operation. When full, the spent reagent drum will be exchanged for an empty drum and the full drum sealed with a lid for on-site storage before collection by a licenced waste disposal company.

The gas flow through the abatement plant is controlled by means of an induced draught fan, which will be located within the crematory. This fan will be controlled by means of an inverter speed control unit which will vary fan speed in response to the suction requirements at the cremators.

All flue gases from the cremator will be discharged from a single chimney located above the cremators (*as shown in H-CC Site Location_Layout3 and H-CC Plant layout 1*).

The cremator secondary chamber design and operation is critical in reducing emissions of a number of pollutant and has been sized to provide a flue gas residence time of greater than 2 seconds at 850°C. This will minimise emissions of: carbon monoxide, unburnt volatile gases and dioxin and furan. During abated operations, the secondary chamber temperature, will be reduced to 800°C (as specified in the PG 5/2 (12). The decrease in temperature has no significant impact on emission of carbon monoxide or volatile organic compound and any slight increase in emission of dioxin and furan are offset by the activated carbon added in the abatement process. The main charging door is interlocked to prevent charging until the specified secondary chamber temperature has been achieved.

A cremation can only take place once the cremator been preheated to ensure it has reached specified operating temperatures. In particular, the secondary combustion chamber has to reach an operating temperature at, or above, 800°C and this minimum temperature has to be maintained throughout a cremation cycle. (This is condition is specified the Process Guidance PG5/2 (12) 'Crematoria'.) This temperature has to maintained whenever the cremator is operating in conjunction with emissions abatement equipment. Should, in the event of emergency, the cremator be required to operate unabated, the minimum secondary combustion chamber temperature has to be increased to 850°C.

Secondary chamber temperatures and oxygen levels will be recorded for both cremators.
The abatement line will be equipped with emissions monitoring equipment for oxygen, carbon monoxide and particulate matter.

EMISSIONS

There are no significant pollutant emissions to land or water from this process. The main pollutants to air from the cremation process comprise: -

- Particulate Matter (PM)
- Hydrogen Chloride (HCl)
- Carbon Monoxide (CO).
- Volatile Organic Compounds (VOC).
- Mercury (Hg)
- Dioxins and Furans (PCCD/F)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NOx)
- Carbon Dioxide (CO_2)

In the case of abated cremators, six of the above pollutants have emissions limits imposed under the terms of the Secretary of State's Guidance for Crematoria, PG5/2(12). These are:

- particulate matter
- carbon monoxide
- volatile organic compounds
- hydrogen chloride,
- mercury
- dioxins and furans.

The cremators and abatement equipment which are being installed at Cannock Crematorium have been designed to ensure the required emissions performance is achieved at all times and for most pollutants the level of emissions will be well below the permitted level. This will ensure that the equipment will have minimal impact on local air quality.