Facultatieve Technologies
Cremation & Incineration Equipment

PLANT TESTING TO PROVE COMPLIANCE WITH THE REQUIREMENTS OF PG5/2(12)

The Process Guidance Note PG5/2(2012) gives details of the emissions and other test requirements to demonstrate compliance with the required standards.

There are tests that need to be conducted following initial commissioning that do not necessarily need to be repeated in subsequent years, namely determination of the emissions of dioxins & furans, and measurement of the cremator secondary combustion chamber gas residence times.

The tests proposed are:

Total Particulate Matter

A flue gas sample will be extracted and filtered to collect total particulate matter. A Whatman QM-A filter paper or similar will be used with a particle retention of not less than 99.5% at a particle size of 0.3 micron. The flue gas extraction employed techniques given in BS EN 13284 Part 1 shall be used.

The tests shall comprise three distinct samples of 60 minutes duration, undertaken at the outlet of the bag filter.

Particulate matter emissions shall be determined by weighing the filter and probe rinse collection on a calibrated balance, with the media being dried and weighed prior to and following the test.

Hydrogen Chloride

A flue gas sample shall be extracted and filtered. A Whatman QM-A filter paper or similar will be used, with a particle retention of not less than 99.5% at a particle size of 0.3 micron. The flue gas extraction employed techniques shall be in accordance with BS EN 13284 Part 1.

The gas sample shall be passed through an absorption medium of de-ionised water to collect hydrogen chloride.

The method employed shall be as given in BS EN 1911 Parts 1-3.

The tests shall comprise three distinct samples of 60 minutes duration, undertaken at the outlet of the bag filter.

Laboratory analysis for hydrogen chloride shall be carried out on the absorption medium using Ion Chromatography (IC).

Mercury

A flue gas sample shall be extracted and filtered to collect solid phase mercury.

A Whatman QM-A filter paper or similar will be used with a particle retention of not less than 99.5% at a particle size of 0.3 micron. The flue gas extraction employed techniques shall be as given in BS EN 13284 Part 1.

The filtered gas sample will then be passed through an absorption medium of acidified potassium dichromate to collect vapour phase mercury.

The method employed shall be BS EN 13211.

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The tests shall comprise three distinct samples of 60 minutes duration, undertaken at the outlet of the bag filter, or a single longer test covering a number of successive cremation cycles depending on the requirements of PCC.

Laboratory analysis for solid and vapour phase mercury will be carried out on the filter and absorption medium using Inductively Cold Vapour Atomic Fluorescence Spectroscopy (CVAFS).

Dioxins and Furans

A flue gas sample will be extracted and filtered to collect total particulate matter and hence solid phase dioxins and furans. A Whatman QM-A filter paper or similar will be used with a particle retention of not less than 99.5% at a particle size of 0.3 micron. The flue gas extraction techniques given in BS EN 13284 Part 1 will be employed.

The gas sample will be cooled by means of a water-cooled condenser before being passed through a pre-spiked XAD trap along with condensate collection to collect vapour phase dioxins and furans.

The method employed shall be BS EN 1948 Part 1 and BS EN 13284 Part 1.

Laboratory analysis for dioxins and furans will be carried out on the filter, XAD trap and condensate / washings collection using high-resolution gas chromatography and high-resolution mass spectrometry (GC/MS (HR)).

The test will comprise a single test run of 5 -6 hours duration.

Carbon Monoxide

A flue gas sample will be continuously extracted, filtered and dried before being passed through a pre-calibrated infrared analyser for the on-line measurement of carbon monoxide.

The method employed shall be BS EN 15058.

The carbon monoxide concentration of the flue gases will be continuously monitored and recorded.

Total Organic Compounds

A flue gas sample will be continuously extracted and filtered before being passed via a heated line through a pre-calibrated Flame Ionisation Detection (FID) analyser for the on-line measurement of volatile organic compounds.

The method employed shall be BS EN 12619.

The analyser output will be continuously monitored and recorded.

Oxygen

A flue gas sample will continuously extracted from the flue, filtered and dried, before being passed through a pre-calibrated electrochemical cell analyser for the on-line measurement of flue oxygen.

The method employed shall be BS EN 14789.

The analyser will be calibrated using a standard reference gas.

The output of the analyser will be continuously monitored and recorded.

Moisture

A flue gas sample will be extracted and filtered. The gas sample was then passed through an absorption medium to collect any water vapour.

The method employed shall be BS EN 14790.

Flue gas moisture will be determined gravimetrically by weighing the absorption medium and final gas drier prior to and following each test.

Temperature

Flue gas temperature will be measured by the use of a calibrated Type K thermocouple.

The method employed shall be BS EN 13284 Part 1.

The flue gas temperature will be continuously monitored and recorded.

Velocity and Volumetric Flow

Flue gas velocity will be measured by inserting a calibrated s-type pitot tube into the flue. The pitot head pressure will then be measured using a calibrated electronic manometer.

The method employed shall be BS EN 13284 Part 1.

The electronic manometer output will be continuously monitored and recorded.

Flue gas velocity will be calculated from Bernoulli's equation as the density of the flue gas is known (from measurements of flue gas moisture and temperature).

Flue gas volumetric flow rate will be calculated from the measurement of the flue duct size and hence its area and corrected to normalised conditions (again from measurements of flue gas moisture and temperature).

Secondary Combustion Chamber Gas Residence Time

The stated secondary chamber volume to the secondary chamber outlet thermocouple divided by the calculated gas volumetric flow exiting the secondary combustion zone gives the secondary combustion zone gas residence times, which will be expressed as one-minute averages.

The plant arrangement is such that the flue gas volume is measured at the outlet of the abatement plant. The gas volume at this location is a combination of the waste gases leaving the cremator secondary combustion zones, and air introduced via the reagent feeder system and other in-leakage.

In order to calculate the gas volume from the cremator only, the oxygen content of the gases will be monitored at the point of flow measurement and at the outlet of the cremator. An oxygen balance calculation is performed to subtract the additional air contribution to the waste gas volume as a result of the reagent feeder and in-leakage in order to calculate the secondary combustion chamber gas residence time.

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