



## **Environmental Compliance – Details of Sampling Methods**

All stand-alone **Velocity** measurements and those made to support isokinetic sampling, will be made using **BS EN 16911-1:2013 & MID** and In-house technical procedure **ECL/TPD/022A**.

**Velocity** measurements for AMS (CEMS) calibrations, will be made using **BS EN 16911-1:2013 & PD CEN/TR 17078:2017** also taking into account the requirements of **BS EN 16911-2:2013 & MID**, and In-house technical procedure **ECL/TPD/022B**.

A Manual Stack Sampling Train (MST) or an unheated “stackmite” sampling train will be used for measuring concentrations of **Particulate Matter** in accordance with **BS EN 13284-1:2017 & MID** and In-house technical procedure **ECL/TPD/027 or 27A**. Isokinetic tests of at least ½ hour in duration are carried out for particulate matter. In accordance with the standard, appropriate field blanks will also be submitted for analysis. Analysis of filters and rinses is by gravimetric methods.

A Manual Stack Sampling Train (MST) or an unheated “stackmite” sampling train will be used for measuring concentrations of **Oil Mist/ Cyclohexane Extractable Materials** in accordance with **BS EN 13284-1:2017** and In-house technical procedure **ECL/TPD/094 or 94A**. Isokinetic tests of at least ½ hour in duration are carried out for oil mist. In accordance with the standard, appropriate field blanks will also be submitted for analysis. Analysis of filters and rinses is by gravimetric methods.

A Manual Stack Sampling Train (MST) is used for measuring concentrations of **PM<sub>10</sub> / PM<sub>2.5</sub>** in accordance with **BS ISO EN 23210:2009** and In-house technical procedure **ECL/TPD/095**. Isokinetic tests of at least one hour in duration are carried out for PM<sub>10</sub> / PM<sub>2.5</sub>. In accordance with the standard, appropriate field blanks will also be submitted for analysis. Analysis of filters is by gravimetric methods.



Continuous emissions monitoring for **oxides of nitrogen (as NO<sub>2</sub>), sulphur dioxide, carbon monoxide, carbon dioxide & oxygen** is carried out using an MCERTS certified **Horiba PG 250** in accordance with **BS EN 14792:2017, PD CEN/TS 17021:2017, BS EN 15058:2017, PD CEN/TS 17405:2020** and **BS EN 14789:2017** respectively and In-house technical procedure **ECL/TPD/033c**. In this method the stack gas is withdrawn and passed through the analyser where the gas stream is analysed by chemiluminescence, non-dispersive infrared and zirconium techniques to determine the concentrations of **oxides of nitrogen (as NO<sub>2</sub>), sulphur dioxide, carbon monoxide, carbon dioxide** and **oxygen** respectively. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.

Continuous emissions monitoring for **oxides of nitrogen (as NO<sub>2</sub>), carbon monoxide, carbon dioxide & oxygen** is carried out using an MCERTS certified **Horiba PG 350(E)** in accordance with **BS EN 14792:2017, BS EN 15058:2017, PD CEN/TS 17405:2020** and **BS EN 14789:2017** respectively and In-house technical procedure **ECL/TPD/033d**. In this method the stack gas is withdrawn and passed through the analyser where the gas stream is analysed by chemiluminescence, non-dispersive infrared and paramagnetic techniques to determine the concentrations of **oxides of nitrogen (as NO<sub>2</sub>), carbon monoxide, carbon dioxide** and **oxygen** respectively. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.

Continuous emissions monitoring for **oxides of nitrogen (as NO<sub>2</sub>), carbon monoxide, carbon dioxide & oxygen** is carried out using an MCERTS certified **Horiba PG 350(EU P-AMS)** in accordance with **BS EN 14792:2017, BS EN 15058:2017, PD CEN/TS 17405:2020** and **BS EN 14789:2017** respectively and In-house technical procedure **ECL/TPD/033d**. In this method the stack gas is withdrawn and passed through the analyser where the gas stream is analysed by chemiluminescence, non-dispersive infrared and paramagnetic techniques to determine the concentrations of **oxides of nitrogen (as NO<sub>2</sub>), carbon monoxide, carbon dioxide** and **oxygen** respectively. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.



Continuous emissions monitoring for **TVOC** is carried out using an MCERTS certified **Signal 3030PM** FID analyser and heated gas transport system to **BS EN 12619:2013** and In-house technical procedure **ECL/TPD/032A**. In this method the stack gas is extracted through a heated sample line maintained at 180°C. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.

Continuous emissions monitoring for **TVOC** is carried out using an MCERTS certified **Sick F3006** FID analyser and heated gas transport system to **BS EN 12619:2013** and In-house technical procedure **ECL/TPD/032B**. In this method the stack gas is extracted through a heated sample line maintained at 180°C. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.

Continuous emissions monitoring for **TVOC** is carried out using an MCERTS certified **SK-Elektronik UPAS-FID PT** FID analyser and heated gas transport system to **BS EN 12619:2013** and In-house technical procedure **ECL/TPD/032C**. In this method the stack gas is extracted through a heated sample line maintained at 180°C. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.



Sampling for **speciated VOCs** (limited to dry stacks or vents) is carried out in accordance with **CEN/TS 13649:2014** and In-house technical procedure **ECL/TPD/084**. In this method the stack gas is extracted through a short unheated sample probe and is then passed immediately through a standard charcoal tube. The charcoal tube is analysed for speciated VOCs (top ten most abundant or target species where known based on authorisation requirements). In accordance with the standard, appropriate field blanks will also be submitted for analysis. Analysis is by Gas Chromatography. Sampling can also take place for other species that are specifically listed in TGN M2 as allowed to be sampled using sorbent tubes (e.g. Hydrogen Sulphide).

Sampling for **Hydrogen Chloride (as HCl)** is carried out in accordance with **BS EN 1911:2010** and In-house technical procedure **ECL/TPD/081**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing DI H<sub>2</sub>O, with subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Sulphur Dioxide (as SO<sub>2</sub>)** is carried out in accordance with **BS EN 14791:2017** and In-house technical procedure **ECL/TPD/039**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing Hydrogen Peroxide solution, with subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Hydrogen Fluoride (as HF)** is carried out in accordance with **PD CEN/TS 17340:2020** and In-house technical procedure **ECL/TPD/081**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing DI H<sub>2</sub>O, with subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Halogens & Halides** is carried out in accordance with **US EPA Method 26/26A** and In-house technical procedure **ECL/TPD/035**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing appropriate Sodium Hydroxide & Sulphuric Acid solutions, with subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.



Sampling for **Ammonia (NH<sub>3</sub>)** is carried out in accordance with **BS EN ISO 21877:2019** and In-house technical procedure **ECL/TPD/034**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing Sulphuric Acid solution, and subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

**Dioxin & Furans** emission sampling (**Chlorinated & Brominated congeners**) is carried out in accordance with **BS EN 1948-1 to 3:2006 & MID** and In-house technical procedure **ECL/TPD/031**. In this method a minimum of 3.5 cubic metres of stack gas will be withdrawn isokinetically over a minimum period of 6 hours, filtered then passed through a XAD resin trap and a series of impingers to remove all condensables, with subsequent analysis by GC-MS. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

**PCB** emissions sampling is carried out in accordance with **BS EN 1948-4:2010** and In-house technical procedure **ECL/TPD/031**. In this method a minimum of 3.5 cubic metres of stack gas will be withdrawn isokinetically over a minimum period of 6 hours, filtered then passed through a XAD resin trap and a series of impingers to remove all condensables, with subsequent analysis by GC-MS. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

**PAH** emission sampling is carried out in accordance with **BS ISO 11338:2003** and In-house technical procedure **ECL/TPD/037**. In this method stack gas will be withdrawn isokinetically over a period of up to 6 hours, filtered then passed through a XAD resin trap, and a series of impingers to remove all condensables, with subsequent analysis by GC-MS. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **heavy metals** (particulate and vapour phase), including but not limited to antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, cadmium, thallium, & vanadium is carried using in-house technical procedure **ECL/TPD/028**, in accordance with **BS EN 14385:2004 & MID**.

Sampling for **mercury** is carried out in accordance with **BS EN 13211:2001** and In-house technical procedure **ECL/TPD/030**. Samples are analysed by ICP/MS. (Continuous Flow CVAFS is for mercury analysis). In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Isocyanates** is carried out in accordance with **USEPA CTM 36** and In-house technical procedure **ECL/TPD/096 or 096A**. A sample of air is withdrawn from the stack isokinetically onto a 1-(2-pyridyl)piperazine (1,2-PP) pre-treated filter, Isocyanates are collected on the filter. Following testing the filter is combined with upstream rinses made using Acetone and a mix of 80% Acetonitrile / 20% DMSO, before subsequent analysis by HPLC to determine the amount of isocyanate captured. Appropriate field blanks will also be submitted for analysis.



Sampling and analysis of gaseous species by **FTIR** is carried out in accordance with **PD CEN/TS 17337:2019** and In-house technical procedure **ECL/TPD/097 or 098**, for **SO<sub>2</sub>, NO, NO<sub>2</sub>, CO, CO<sub>2</sub>, NH<sub>3</sub> & N<sub>2</sub>O** by extractive direct interference Fourier Transform Infrared spectroscopy. Sampling is for a minimum of **one** hour with data being logged as minute averages. (Oxygen is also measured in accordance with **BS EN 14789:2017**, via the on-board zirconia cell).

Continuous emissions monitoring for **oxygen** is carried out using a **VALIDATED Testoterm 350 XL** analyser in accordance with **BS EN 14789:2017** and In-house technical procedure **ECL/TPD/086**. In this method the stack gas is withdrawn and passed through the analyser where the gas stream is analysed by electrochemical cell. Calibration of the system will be direct to the analyser and then via the probe through the entire gas transport system.

Testing for **Moisture** is carried out using a Universal Stack Sampling system in accordance with **BS EN 14790:2017** and In-house technical procedure **ECL/TPD/082**.

Sampling for **Ammonia (NH<sub>3</sub>) (UKAS Only)** is carried out in accordance with **USEPA Method 26** and In-house technical procedure **ECL/TPD/038**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing Sulphuric Acid solution, and subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.



Sampling for **Formaldehyde (Not Accredited)** is carried out in accordance with **USEPA Method 316** and based on In-house technical procedure **ECL/TPD/o81**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing DI Water and subsequent analysis by ion chromatography. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Hydrogen Cyanide (Not Accredited)** is carried out in accordance with **USEPA OTM 29** and based on In-house technical procedure **ECL/TPD/o81**. In this method the stack gas is extracted either isokinetically or non-isokinetically nominally over a period of 1 hour, filtered and passed through a series of impingers containing 0.1M NaOH and subsequent analysis by colorimetry. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Sulphuric Acid Mist (Not Accredited)** is carried out in accordance with **US EPA Method 8**. In this method stack gas is extracted through a heated probe and through an impinger containing 80% Isopropanol. The sample is then passed through a glass fibre filter and then through two impingers containing 3% Hydrogen Peroxide. Subsequent analysis is by colorimetry. In accordance with the standard, appropriate field blanks will also be submitted for analysis.

Sampling for **Particulate Phase Chromium (vi) (Not Accredited)** is carried out based on **BS EN 13284-1:2017**. In this method, a measured volume of sample gas is withdrawn from the stack isokinetically, through a sampling nozzle and through a NaOH treated 37mm PVC filter, positioned in an unheated housing inserted into the stack. The filters are subsequently analysed based on **NIOSH 7605/7600**, to determine the amount of Chromium (vi) captured. In accordance with the standard, appropriate field blanks will also be submitted for analysis.