Replacement of Technical Guidance Note (Monitoring) **M5**

Monitoring of stack gas emissions from medium combustion plants and specified generators

Monitoring stack emissions: low risk MCPs and specified generators

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Foreword

How to monitor emissions from low risk medium combustion plants (MCPs) and specified generators (SGs). This document was previously known as TGN M5.

This guidance provides a standardised approach to monitoring stack gas emissions from low risk plants regulated under the:

- Medium Combustion Plant Directive(MCPD) 2015/2193/EU Directive on the limitation of certain pollutants into the air from medium combustion plant
- Specified Generator Regulations (SGRs) EPR 2018 Schedule 25B 2 (1) – Specified Generators

This guidance is for operators of:

- low risk MCPs and SGs with standard rules permits
- MCPs and SGs that are not low risk but have a condition in their permit that says they must use this guidance when monitoring compliance with emissions limits

Contents

1. Monitoring approach

The MCPD states you need reliable, representative and comparable results for:

- sampling and analysing polluting substances
- measuring process parameters
- any alternative monitoring methods you use

Where available and practical to do so, you should use methods that comply with European standards.

Sulfur dioxide (SO_2) emissions can be calculated using sulfur in fuels analysis instead of periodic stack gas monitoring.

The MCPD and SGRs specify that you must standardise your emissions monitoring results to a dry gas, at a standard temperature and pressure (273.15K and 101.3kPa).

You must also report your results corrected to a reference oxygen (O_2) concentration of:

- 3% for liquid or gaseous fuels
- 6% for solid fuels
- 15% for engines and gas turbines

You may use continuous emissions monitoring systems (CEMS) as an alternative to periodic measurements. You must use CEMS that are:

- appropriately MCERTS certified
- calibrated against parallel periodic measurements and by an organisation with MCERTS accreditation for these measurements

MCERTS is our monitoring certification scheme. You can find more information in TGN M20 and at Monitoring emissions to air, land and water (MCERTS).

2. Sample Locations

If you only need to sample gas concentrations, you can sample at a single point and from a location close to the MCP or SG where the gases are well mixed. For example, you can assume a downstream location that is close to the combustion zone is well mixed.

3. Measuring system requirements

If you use portable monitoring systems we recommend they meet the requirements of the MCERTS certification for emissions monitoring systems. This includes the MCERTS schemes for:

- handheld emissions monitoring systems
- transportable emissions monitoring systems

Until 1 January 2025, you may continue to use monitoring systems assessed against the requirements of EN 50379-2 ‘Specification for portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances – Part 2: Performance requirements for apparatus used in statutory inspections and assessment’.

The assessment must be made by an organisation accredited for these performance requirements.

Replacement portable analysers must have MCERTS certification.

From the 1 January 2025, all portable analysers must have MCERTS certification. The certified range must be no more than 2.5 times the emission limit value (ELV).

Where sample probes are exposed to gases at high temperatures (for example, more than 250°C) they must be made of temperature resistant material.

4. Annual quality control

You must carry out a lack of fit (linearity) test annually, or after a major repair to the portable analyser (for example, changing an electrochemical sensor). This must be done by a service organisation or other suitable organisation (for example, a calibration laboratory or the analyser's manufacturer).

You must carry out the test following the procedures in EN 15267-4 ‘Performance criteria and test procedures for automated measuring systems for periodic measurements of emissions from stationary sources’. You must assess against the performance criteria for laboratory tests specified by this standard.

You must produce an annual service report for each analyser. You must include a summary of the service work carried out on the analyser and the test results for analyser performance.

If an annual service report shows that a measuring system has failed an annual test, you must review the potentially affected monitoring results. You must send the review to MCPDHelp@environment-agency.gov.uk

5. Ongoing analyser performance checks

You must check and performance test analysers using the manufacturer’s instructions.

If any checks or tests fail, you must review the potentially affected monitoring results. You must send the review to MCPDHelp@environment-agency.gov.uk.

6. Sample strategy and process operating conditions

The sample strategy may vary depending on the type, age and availability of the MCP or SG.

You can measure performance and emissions at different operating conditions that reflect the MCP's ability to follow the load. For example, you can measure a:

- burner with 5:1 turndown at 20% and 100% output, along with a number of intermediate steps
- simpler, older MCP at low and high fire, taking a medium fire measurement if the MCP can be set for this

You should take each measurement at 30 minute intervals. You must report the maximum value.

Because some MCPs operate intermittently, you can limit the sample periods to a few minutes at a time. This means you will need to adapt the sample strategy to shorter time periods.

You must not include measurement results taken during periods of start-up and shutdown.

7. Emission test procedure

You must follow this procedure.

1. Assemble the sampling system and warm up the analyser according to the manufacturer's instructions.
2. Before the start of the test, carry out the checks required by the manufacturer's instructions at the sample location (near the sample port).
3. Insert the sample probe into the sample location. Extract the sample gas at the same rate used during the performance checks. Maintain a constant sample rate during the test.
4. At the end of the test, remove the sample probe from the stack and carry out any checks required by the manufacturer's instructions, including any zero and span checks.
5. Do not break any seals in the sampling handling system until after you have completed any zero and span checks after the test.

8. Reporting results

The monitoring report must record the following information for each test:

- permit number
- name of the operator and installation
- date of the monitoring visit
- report version number
- site address
- name of the organisation carrying out the monitoring
- date of the report
- unique identification of each emission point
- date and start and finish times of each test
- determinands measured
- emission limit value (mg/m^3)
- concentration measured (mg/m^3)
- reference conditions (dry gas, 273.15K, 101.3kPa, O2 of 3%, 6% or 15%)
- a description of process and operating conditions
- the analyser's name model number and serial number
- MCERTS certification of the measurement system
- the calibration due date of the analyser

The operator must keep this information for a minimum of 6 years.

9. Quality Assurance

The organisation carrying out the monitoring must have procedures that meet the requirements of this guidance.

They must include these procedures in a management system, such as ISO 9001, 'Quality management systems – Requirements'. The management system must be certified by a UKAS (United Kingdom Accreditation Service) accredited certification body.

We may audit onsite emissions monitoring to check that you are following the procedures described in this guidance. We may also audit the organisations that carry out the annual service and calibration checks of the measurement system.

Organisations that carry out monitoring must provide us with their monitoring procedures, records and work schedules, if requested.

10. Measurement uncertainty

Measurement uncertainty is the range of values in which you will find the true value of an analytical result with a specified level of confidence.

Every measurement has an uncertainty associated with it. This uncertainty can be from errors in sampling and analysis and from imperfect knowledge of the factors affecting the result.

If you are following the monitoring approach in this guidance, you must use a fixed expanded measurement uncertainty of ±20% for nitrogen oxides. This is derived from the measurement uncertainty from MCERTS performance tests and the effect of oxygen correction.

You should correct monitoring results to the required reference conditions and report them to us, without subtracting the measurement uncertainty. After you have reported monitoring results we will consider the measurement uncertainty when we assess compliance with an emission limit.

11. Reporting sulfur dioxide emissions based on fuel sulfur content

Calculating the SO_2 emission from the fuel sulfur content, assuming complete oxidation of the fuel sulfur, is often used in place of directly measuring SO_2 in flue gas. But this is only for plants that are not fitted with flue gas desulfurisation abatement.

The MCPD requires that you carry out emissions monitoring when firing a fuel (or fuel mix) that is likely to result in the highest level of emissions. Therefore, you must calculate the SO_2 emission from sulfur at the highest representative fuel sulfur content fired during the compliance period.

11.1 Liquid fuels

The sulfur content of gas oil is regulated under the Environmental Protection Regulations 2007 Sulfur Content of Liquid Fuels Regulations.

The MCPD does not specify an SO_2 ELV for gas oil. This also applies to other similar low sulfur fuels with a sulfur content less than 0.1% by mass, such as biodiesel and burning oil.

Table 1 provides the approximate liquid fuel sulfur equivalence to ELVs specified in the MCPD. These are for firing liquid fuels (but not gas oil) for combustion plants (at 3% O_2) and engines or gas turbines (at 15% O_2) that do not have flue gas desulfurisation abatement.

In order to demonstrate compliance, the sulfur content of the fired fuel must be lower than the applicable threshold values.

Table 1 applies to petroleum fuels, ranging from light to heavy fuel oil with a net calorific value in the range 39.5 to 42.5 MJ/kg.

As an alternative to flue gas measurement, you can report SO_2 emissions using the maximum value of the fuel sulfur during the compliance period. Obtain the fuel sulfur content from the supplier as either a measured value, or as a maximum fuel sulfur specification.

Alternatively, you can use sulfur results of fired fuel samples from an appropriately accredited analytical laboratory.

Table 1 Liquid fuels other than gas oil: fuel sulfur equivalence to ELVs

Fuel sulfur % by mass	ELV SO_2 (mg/m³) at 3% O_2	ELV SO_2 (mg/m³) at 15% O_2
0.2%	350	120
0.5%	850	290
1.0%	1700	570

11.2 Solid fuels

Table 2 provides the approximate solid fuel sulfur equivalence to ELVs specified in the MCPD. These are for firing solid fuels at combustion plants (at 6% O_2) that do not have flue gas desulfurisation abatement.

In order to demonstrate compliance, the sulfur content of the fired fuel must be lower than the relevant threshold values. Table 2 applies to biomass and Table 3 to commercially traded hard coal.

There will be some absorption of SO_2 by the fuel ash. This will depend on the composition of the ash and the type of dust abatement plant installed. Coal ash typically absorbs up to 5% of the released SO_2. Biomass ash can absorb much higher proportions of the released SO_2. The fuel sulfur thresholds given in Table 2 and Table 3 are therefore conservative.

In situations where the fuel sulfur is higher than this threshold but there is significant ash absorption, you must measure the flue gas emission to demonstrate compliance.

Table 2 Solid biomass: fuel sulfur equivalence to ELVs

Fuel sulfur % by mass (as received)	SO_2 ELV (mg/m³) at 6% O_2
0.058%	200
0.087%	300

Table 3 Hard coal: fuel sulfur equivalence to ELVs

Fuel sulfur % by mass (as received)	SO_2 ELV (mg/m^3) at 6% O_2
0.174%	400
0.477%	1100

There are no ELV and reporting requirements for plants firing exclusively woody biomass. Dried biomass pellets can be assumed to contain 10% moisture.

The solid fuel sulfur content is based on the 'as received' fuel at the applicable moisture content, not the dry or dry, ash-free fuel. To determine the 'as received' sulfur content, multiply the dry sulfur content by (1 − % moisture ÷ 100%).

11.3 Determining the reportable SO_2 concentration

You can determine the reportable SO_2 concentration in mg/m^3 at 273K, 101.3kPa by scaling the SO_2 concentrations, equivalent to 0.1% fuel sulfur, by the following factors:

- Fuel oil factor at 3% O_2 is 169
- Fuel oil factor at 15% O_2 is 56
- Solid biomass factor at 6% O_2 is 344
- Hard coal factor at 6% O_2 is 230

For example:

- boilers firing liquid fuel with a sulfur content of 0.25% will emit an SO_2 concentration of 422.5 mg/m^3 at 3% O_2 [= (0.25%/0.1%) × 169 mg/m^3]
- gas turbines firing liquid fuel with a sulfur content of 0.05% will emit an SO_2 concentration of 28 mg/m^3 at 15% O_2 [= (0.05%/0.1%) × 56 mg/m^3]
- boilers firing dried biomass, with a sulfur content of 0.02%, will emit an SO_2 concentration of 68.8 mg/m^3 at 6% O_2 [= (0.02%/0.1%) × 344 mg/m^3]

11.4 Using factors for other fuel types

If you want to report SO_2 emissions based on fuel sulfur content of other types of fuels, you must get approval from us before doing this, contact MCPDHelp@environment-agency.gov.uk.