

Monitoring Quick Guide 2

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RM-QG-02 Selecting continuous emission monitoring systems (CEMs) for incineration and co-incineration plant falling under Chapter IV of the Industrial Emissions Directive (IED)

1. Scope

This note describes the continuous monitoring requirements for installations falling under Chapter IV of the Industrial Emissions Directive (IED)(2010/75/EU) and the associated requirements of Annex VI of this directive. It covers the requirements for continuous emission monitoring systems (CEMs), and applies to both incineration and co-incineration installations.

2. Practical Guidance

2.1 Continuous monitoring guidance

The Environment Agency typically requires operators of installations with permits for incineration and co-incineration plant to monitor continuously the following determinands (but see section 2.2).

- Particulate matter (PM)
- Total organic carbon (TOC)
- Sulfur dioxide (SO₂)
- Nitrogen oxides (NO_x)
- Carbon monoxide (CO)
- Hydrogen chloride (HCl)

The Environment Agency may also require the following determinands to be monitored continuously, depending on specific circumstances.

Determinand	Justification
Nitrous oxide (N ₂ O)	If the installation uses fluidised beds in the combustion chamber, and/or there are indications that N ₂ O emissions may be significant.
Ammonia (NH ₃)	If the installation uses ammonia injection to control NO _x emissions, then the operator may be required to monitor for ammonia slip.
Hydrogen fluoride (HF)	If there is sufficient fluorine in the waste material, such that the incineration process creates HF.

Additionally, operators are required to continuously measure so-called *peripheral* determinands, which include: oxygen; moisture (if the gaseous monitors do not measure on a dry-basis); temperature and; stack-gas pressure. Peripheral determinands are needed to correct the emissions of pollutants to standard conditions to allow comparison with the emission limit value (ELV).

2.2 Exemptions

The operator may be allowed to perform periodic measurements of one or more of the following determinands instead of installing CEMs, if it can be demonstrated that the emissions limit values (ELVs) for these determinands will not be exceeded.

- HF
- SO₂
- HCl

2.3 Performance requirements of CEMS

The IED specifies performance requirements for CEMs in four ways:

- The application of international and national standards for monitoring, such as CEN and ISO standards.
- Availability requirements for data reporting.
- Specifications for accuracy and precision, through uncertainty budgets expressed as 95% confidence intervals.
- Compliance with BS EN 14181.

Our Monitoring Certification Scheme (MCERTS) applies the requirements of international and national standards, such as the QAL1 and QAL3 requirements of BS EN 14181. Therefore CEMs must meet the MCERTS requirements for the (i) applicable determinands and (ii) appropriate ranges. The range requirement assures that the CEMs, once installed, will meet the required uncertainty budgets.

2.4 Range requirements for MCERTS certified CEMS

MCERTS expresses performance as a percentage of a certified range. Therefore in simple terms, the lower the certified range, the better the accuracy, precision, stability and resolution of the CEM. Ideally, the certified range for a CEM for an incineration/co-incineration installation must be not more than 1.5x the daily average ELV. The table below shows some examples of typical daily average ELVs and the corresponding certified ranges for CEMs.

Determinand	Daily average ELV, mg.m ⁻³	Certified range, mg.m ⁻³
NOx ¹	200	0 – 200 mg.m ⁻³
SO ₂	50	0 – 75 mg.m ⁻³
CO	50	0 – 75 mg.m ⁻³

PM	10	0 – 15 mg.m ⁻³
TOC	10	0 – 15 mg.m ⁻³
HCl	10	0 – 15 mg.m ⁻³
NH ₃ ²	10	0 – 15 mg.m ⁻³
HF	1	Any available

¹ NO_x limits are expressed as emissions of NO₂, whereas the waste gas will be mostly NO_x, so operators may measure NO alone and then express the results as NO₂ using a conversion factor (see Section 2.7). The requirement for certified ranges takes this conversion into account.

² Although there is not an ELV for NH₃, a value of 10 mg.m⁻³ is given for practical purposes.

2.5 New and existing CEMs

New CEMs shall meet the above requirements for ranges, in that the certified range must not be higher than those listed the table above. CEMs with such certified ranges can typically measure higher ranges. Sometimes manufacturers have a second, higher certified range as extra assurance. Those which do not have a higher certified range will require more linearity checks on site to assure the capability of the CEMs to measure higher ranges.

If existing CEMs do not meet the above requirements for ranges, then there is a greater chance that they may not meet the required performance specifications, as a lower certified range means a lower uncertainty, and hence better performance. However, in order to give operators the benefit of the doubt, especially in borderline cases, operators may continue to use such CEMs to the ends of their design lives so long as the CEMs meet the QAL2 and QAL3 requirements specified in BS EN 14181.

2.6 Application of BS EN 14181

The QAL1 and requirements of BS EN 14181 are initially applied through MCERTS certification. Operators will need to perform a QAL2 test:

- At least every three years.
- After significant changes to the process which affect the emissions.
- After significant changes to the CEMs, which affect calibration.

Additionally, operators have to perform an Annual Surveillance Test (AST) at yearly intervals between each QAL2 test, and apply a QAL3 procedure. The QAL3 procedure is a means of checking the stability and precision of the CEM, through regular zero and span checks. The results of such zero and span tests must be plotted and analysed using control charts.

2.7 Monitoring of nitrogen oxides

The IED specifies ELVs for NO_x as total NO_x expressed as NO₂. The NO_x will comprise mostly NO, plus a small proportion of NO₂ and possibly some N₂O for specific types of application. For practical purposes, operators may measure NO alone provided that they can demonstrate that the proportion of NO_x does not exceed a specified amount, and then express the results as total NO_x as NO₂.

For example, if the NO_x does not comprise more than 5% NO₂, then:

- To convert to total NO_x as NO₂, for the NO portion of the emissions – multiply by the ratio of the molecular weight of NO₂ over the molecular weight of NO, i.e. $(46/30) = 1.53$.
- To convert to total NO_x taking into account the maximum proportion of NO₂ (e.g. 5%), divide by the ratio of 100% over 95%, i.e. 0.95.

If the operator is required to measure N₂O, then as there are no MCERTS certified CEMs available, the operator may use any system capable of measuring N₂O so long as its performance has been validated using a Standard Reference Method (SRM).

2.8 Availability requirements for CEMs

2.8.1 Availability and data validity

The IED specifies availability requirements for the CEMs at incineration/co-incineration installations; for a daily average value to be valid, an operator may discard no more than five half hourly average values in any day due to malfunction or maintenance of a CEM. This includes periods when the CEMs are out of calibration or conducting zero and span checks.

Without prejudice to the requirements of Clause 1.2 of Part 8 of Annex VI of the IED, the operator may discard no more than ten daily average values per year due to malfunction or maintenance of the CEM.

For practical purposes, the Environment Agency considers that 20 minutes in any given half-hourly period is representative of a half-hour monitoring period. Therefore operators do not have to invalidate the daily average value if:

- There are no more than five half-hourly periods with less than 30 minutes of valid data, although more incomplete periods may be permitted provided that the Operator can justify this, and;
- The half-hourly periods contain at least 20 minutes of valid data.

3. Further information

3.1 Quick Guides

- RM-QG-01 Selecting continuous emission monitoring systems (CEMs)
- RM-QG-04 Monitoring for incinerators and co-incinerators when CEMs are not available

3.2 Technical Guidance Notes

- TGN M2 – Monitoring of stack emissions to air
- TGN M20 – Quality assurance of continuous emissions monitoring systems

3.3 MCERTS Method Implementation Documents (MIDs)

- MID EN 14181

4. Feedback

If you have any comments or suggested improvements to this note please contact our National Customer Contact Centre at:

Email: enquiries@environment-agency.gov.uk