Department for
Business, Energy
& Industrial Strategy

Offshore Emissions Monitoring Guidance

Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 (as amended) (PPC)

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Contents

Document Revision Record

Revision	Issue Date	Description of Changes
1	April 2007	Revision relating to offshore emission monitoring in support of the offshore IPPC combustion processes.
2	August 2009	Revision to provide clearer guidance on what constitutes “Best Practices” with respect to using BAT references and CEN / ISO techniques and procedures within the offshore context.
3	December 2016	Revision to provide offshore monitoring guidance in support of the updated LCP BREF expected to be agreed, early in 2017, and to reformat guidance.
4	August 2022	Revised to reflect 2018 amendment 2018 (SI No. 798) regulations and advances in monitoring standards and methodologies, and to incorporate specific guidance in relation to LCP and MCP.

Abbreviations

>	More Than
<	Less Than
≥	More Than or Equal to
≤	Less Than or Equal to
%	Percentage
AEL	Associated Emission Limit
AM	Alternative Method
AMAP	Asset Methane Action Plan
AMS	Automated Measuring Systems
BAT	Best Available Techniques
BATc	BAT Conclusions
BEIS	Department for Business, Energy and Industrial Strategy
BREF	BAT Reference Document
BS	British Standard
CA	Competent Authority
CAMs	Continuous Ambient Air Monitoring Systems
CEMs	Continuous Emission Monitoring System
CEN	European Committee for Standardisation
CH4	Methane
CO	Carbon Monoxide
CO2	Carbon Dioxide
DD	Draft for Development
EA	Environment Agency
EC	European Commission
EEMS	Environmental and Emissions Monitoring System

ELV	Emission Limit Value
EN	European
ETS	Emissions Trading Scheme
EU	European Union
GHG	Greenhouse Gases
HEMs	Handheld Emissions Monitoring Equipment
IEC	International Electrotechnical Commission
IED	Industrial Emissions Directive
IP	Implementation Period
IPPC	Integrated Pollution Prevention and Control
IRS	Integrated Reporting Service
ISO	International Organization for Standardization
JRC	Joint Research Council
K	Kelvin
kPa	Kilo Pascal
LCI	Large Combustion Installation
LCP	Large Combustion Plant
MCERTS	Monitoring Certification Scheme
MCI	Medium Combustion Installation
MCP	Medium Combustion Plant
MCPD	Medium Combustion Plant Directive
MW	Mega-Watt
MWe	Mega-Watt electrical
MWth	Megawatt thermal
NCN	Non-conformance Notification
NO	Nitrogen Monoxide
NO2	Nitrogen Dioxide

NOx	Nitrogen Oxides
O&M	Operations and Maintenance
O2	Oxygen
OCGT	Open Cycle Gas Turbines
OEM	Original Equipment Manufacturer
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
PD	Published Document
PEMS	Predictive Emission Monitoring Systems
PPC	Pollution Prevention and Control
RA	Risk Assessment
ROM	Report on Monitoring
SI	Statutory Instrument
SO2	Sulphur Dioxide
SRM	Standard Reference Method
SSP	Site Specific Protocols
T-CEM	Transportable Continuous Emission Monitoring System
TS	Technical Specification
UHC	Unburned Hydrocarbons
UK	United Kingdom
UKAS	United Kingdom Accreditation Service
VOC	Volatile Organic Compounds

Overview

Offshore operators holding a permit under the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 (as amended) ("the Regulations") are required to hold a monitoring plan under which they must undertake emissions monitoring of combustion plant, including periodic measurements (extractive sampling) from the exhaust stacks of their Large Combustion Plant (LCP) and their Medium Combustion Plant (MCP). Offshore combustion installations must also comply with annual reporting requirements of the emissions from the installation of the pollutants prescribed in their PPC permit.

The offshore monitoring plan and the associated monitoring programme shall meet quality requirements as defined in this guidance.

The Department for Business, Energy and Industrial Strategy (BEIS) is the regulatory authority for the Regulations, implemented by the Offshore Petroleum Regulator for the Environment and Decommissioning (OPRED), referred to in this Document as 'the Department'.

This Offshore Emissions Monitoring Guidance describes the Department's overall approach to emissions monitoring for compliance with the regulations and provides guidance on appropriate techniques and methods.

The Department recognises the challenges associated with conducting stack monitoring offshore compared to onshore, and this is reflected within the guidance.

The main pollutant emissions to atmosphere considered by the regulations are:

- Oxides of nitrogen (NOx);
- Sulphur dioxide (SO2);
- Carbon monoxide (CO); and
- Unburnt Hydrocarbons (UHC) including methane (CH4) and non-methane Volatile organic compounds (VOCs).
- Dust (only if covered by IED Annex V – Section 2.2.2, or MCPD Annex II)

It should be noted that the requirements for baseline emissions testing measurement surveys are expected to be comprehensive and to cover the above list of pollutants as relevant to each installation.

Baseline surveys include initial stack emissions testing of new plant / installations or the testing of existing plant / installations for the first time or where specifically directed by the Department. Subsequent periodic stack measurement and monitoring must meet the minimum requirements as laid out in this guidance in line with the regulations. Certain pollutants which will have been captured under baseline surveys may not be necessary as part of routine periodic testing, unless specifically directed by the Department.

Measurement of % Oxygen in the products of combustion, and measurement of ambient atmospheric temperature and pressure is required in parallel with measurement of pollutants in order to correct raw data to reference conditions. Both raw and corrected data must be reported as an auditable dataset.

There is no requirement under the PPC regulations to directly monitor pollutant emissions from flares and these are out with the scope of this document.

The monitoring and reporting of Carbon Dioxide (CO2) from combustion plant is out of scope of the PPC regulations and is covered under the UK ETS Order 2020 (S.I. number 1265) (as amended). The monitoring of other Greenhouse Gases (GHG) is also out of scope of the PPC regulations. For the purposes of PPC the monitoring of methane (CH4) relates to methane slip from combustion plant on the PPC permit, and not from other sources such as flares and vents on the offshore installation. These are expected to be covered comprehensively under Asset Methane Action Plans (AMAP) as part of GHG monitoring, falling outside of PPC regulations.

How to use this guidance

The audience for this document is those responsible for understanding and implementing monitoring strategies for offshore combustion equipment rather than technical emission monitoring practitioners. However, the document allows the former to guide the latter when scoping the details of any measurement campaign(s) within an Operator's monitoring plan.

Section 2 - Provides the legislative overview of offshore combustion installation PPC, and the scope of measurements required under the regulations; it highlights where the requirements for measurement and monitoring vary in scope in the light of different categories of combustion plant and their key attributes, such as rated net thermal input, fuel type, and operating loads, where relevant. These requirements largely stem from the Industrial Emissions Directive (IED) and the Medium Combustion Plant Directive (MCPD) which are transposed within the PPC regulations by the Offshore Combustion Installations (Pollution Prevention and Control) (Amendment) Regulations 2018/798.

Section 3 - Covers the main objectives of offshore PPC monitoring and provides an outline of the relevant measurement methods that are commonly employed for onshore monitoring programmes. It discusses their suitability for offshore including the applicability of measurement Standards and techniques;

Section 4 – The minimum requirements for offshore monitoring are laid out in alignment with the different categories of combustion plant under IED and MCPD criteria as incorporated into the regulations;

Section 5 – The required monitoring frequency and methodology for offshore combustion installations and;

Section 6 - The associated reporting requirements, use and development of emission factors.

Sector-specific guidance covering the monitoring of offshore emissions to air is given in relation to the general guidance that can be found in the 2018 JRC Reference Report on Monitoring (ROM) of Emissions to Air and Water from IED installations. The Department's guidance is aimed at being consistent with the principles in the JRC report whilst focusing on the legislative requirements under the PPC Regulations in so far as they relate to IED and MCPD. The guidance also aims to be consistent with the Department's established methods used to manage and report emissions to air of combustion pollutants from installations, whilst seeking - as a core objective - to aid continuous improvement in the fidelity and robustness of the monitoring and reporting of sector emissions as a whole.

1 Introduction

The operation of combustion plant offshore results in emissions to air which contribute to local, regional and global environmental impacts. Consequently, emissions from combustion plant are regulated and appropriate monitoring of emissions must be carried out. This guidance summarises the reasons for carrying out stack monitoring including the relevant regulatory and associated reporting requirements. Applicable standards and techniques for stack monitoring are outlined and discussed in the context of offshore operations. Finally, the guidance defines how stack monitoring results should feed into reporting requirements.

The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 ("the PPC Regulations") were amended in 2018 to transpose obligations in Directive (EU) 2015/2193 on the emissions of certain pollutants ("the MCPD") and Part III of Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (Recast) ("the IED"), insofar as those obligations apply to offshore combustion installations. The obligations are retained under UK law.

The Pipelines, Petroleum, Electricity Works and Oil Stocking (Miscellaneous Amendments) (EU Exit) Regulations 2018/1325 were made in exercise of the powers conferred by section 8(1) of the European Union (Withdrawal) Act 2018 (c.16) in order to address failures of retained EU law to operate effectively and other deficiencies arising from the withdrawal of the United Kingdom from the European Union. This Statutory Instrument amends the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 (S.I. 2013/971) insofar as is necessary to ensure the effective application of the regulations on and after Implementation Period (IP) Completion Day. IP Completion Day means 31 December 2020 at 11.00 p.m. (see s39(1) to (5) of European Union (Withdrawal Agreement) Act 2020).

The Department for Business, Energy and Industrial Strategy (BEIS) is the regulatory authority for the Regulations, via the Offshore Petroleum Regulator for the Environment and Decommissioning (OPRED).

2 Legislative Overview

2.1 Offshore Combustion Installations (PPC) Regulations

2.1.1 UK Secondary Legislation

The UK secondary legislation transposes relevant EU directives relating to pollution prevention and control; the links to EU directives have been retained as part of UK law following the departure of the UK from the EU at 11pm on 31 December 2020.

The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013, UK Statutory Instrument 2013 No. 971 [Ref 1] as amended by UK Statutory Instrument 2018 No. 798 [Ref 2] transposes two main EU directives, with respect to their specific relevance to the UK offshore PPC environment; and retained in the EU Exit Regulations 2018, UK Statutory Instrument 2018 No. 1325.

Firstly, the regulations transpose the appropriate provisions of Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention and Control), commonly referred to as the

Industrial Emissions Directive (“the IED”) [Ref 3], in respect of offshore installations undertaking oil and gas production, gas and carbon dioxide unloading and storage operations, where the combustion equipment on the installation has an aggregated thermal capacity of 50MWth or more. Such offshore combustion installations are defined within the regulations as Large Combustion Installations (LCI).

Within an LCI, there are general requirements for all combustion plant that are listed on the permit. There are additional requirements (transposed from the IED) that must be met by any combustion plant operated on the LCI which individually has a rated thermal capacity of 50MWth or more. Such combustion plant are defined in the regulations as a Large Combustion Plant (LCP). LCP equipment item(s) on the PPC permits have unique requirements under the PPC regulations, that are separate to other permit items. These requirements incorporate the LCP Best Available Techniques (BAT) reference document (BREF) and the relevant BAT conclusions for the offshore sector [Ref 5]. The LCP BREF was published in August 2017 [Ref 6] and supersedes the previous version published in 2006. This provided a comprehensive update to the BREF for IED purposes.

An offshore combustion installation which is not an LCI but which is equipped with combustion plant that has a rated thermal input which is equal to or greater than 1 megawatt and less than 50 megawatts is defined as a Medium Combustion Installation (MCI). It should be noted that by definition any combustion plant classed as an LCP under the regulations can only be located on an LCI and not on an MCI.

Secondly, the regulations as amended transpose the requirements of Directive (EU) 2015/2193 [Ref 4] commonly referred to as the Medium Combustion Plant Directive (“the MCPD”). The requirements transposed into UK law from the MCPD, regulate pollutants from the combustion of fuels in combustion plants with a rated thermal input equal to or greater than 1MWth and less than 50MWth. In accordance with the MCPD, Article 2(3)(h), the requirements of the directive shall not apply to gas turbines and gas and diesel engines when used on offshore platforms. Nor do they apply to combustion plant in which gaseous products of combustion are used for the direct heating, drying or any other treatment of objects or materials. Any offshore combustion plant with a rated thermal input equal to or greater than 1MW and less than 50MW and that is not exempted, is defined within the PPC regulations as a Medium Combustion Plant (MCP). For offshore platforms, MCP includes boilers, dual fuel engines and heaters that are not used for direct heating or drying; and such combustion plant need to comply with the appropriate provisions of the regulations.

It should be noted that any offshore combustion installation that is classified as an LCI or an MCI may or may not have combustion plant that is eligible to be classed as an MCP within the PPC Regulations. For example, the installation may have combustion plant of the appropriate rated thermal capacity (greater than 1 megawatt and less than 50 megawatts) – such as a boiler or a dual fuel engine that qualifies as MCP and/or other combustion plant that is exempt.

LCP and MCP combustion plant have unique emissions compliance requirements including emissions monitoring and reporting obligations under the regulations. Combustion plant smaller than LCP (<50MWth) and also exempt from the MCPD, do not need to meet the LCP and MCP compliance requirements but they will need to meet any general compliance requirements under the PPC permit for any LCI or MCI on which they are installed, as appropriate to the general conditions of the permit. Therefore, it is best to consider the regulations by applying the following hierarchy; there are general conditions that relate to an LCI, specific conditions that relate to any eligible LCP, specific conditions that relate to any eligible MCP, and other requirements that may relate to combustion plant that is neither LCP nor MCP.

This guidance document summarises the offshore regulatory requirement from the perspective of emissions monitoring only, and what constitutes BAT for monitoring and reporting. The Department can be contacted separately in relation to the permitting process itself.

Regulations 9 and 9A stipulate the conditions that may be included in a permit for an LCI and an MCI. These relate to prescribed pollutants emitted from combustion plant on the installation, waste generated on the installation, monitoring and reporting requirements of pollutants and their specific monitoring which may be required. A number of these conditions relate to Emission Limit Values (ELV) and to the monitoring and reporting of emissions to allow comparison of the actual emissions from the combustion plant with the relevant ELV and BAT for those pollutants.

2.1.2 Prescribed Pollutants

Within the Regulations “pollution” means the direct or indirect introduction as a result of human activity, of a pollutant listed in Schedule 2 of the Regulations which may be; a) harmful to human health or the quality of the environment; b) result in damage to material property; or c) impair or interfere with amenities and other legitimate uses of the environment.

For LCI, in accordance with Regulation 9(2)(a), a condition of the PPC permit is that the operator of an LCI complies with the principles in Regulation 7(3). These principles, state requirements for operation of an LCI in relation to the prevention of pollution including via the application of BAT, the principle that no significant pollution will be caused, avoidance of non-gaseous waste where possible (otherwise its proper management via reuse, recycling, recovery, or disposal), energy efficiency, prevention of accidents which may affect the environment, and appropriate decommissioning of the combustion plant. These general principles and requirements apply to all the combustion plant items listed on the PPC permit for the LCI.

Under Regulations 9(2)(b) and 9A(2) are additional conditions in the PPC permit in respect of a pollutant listed in Schedule 2 of the regulations which is likely to be emitted from the offshore combustion installation in significant quantities. This includes controls on the emissions of the pollutant in the form of an ELV for specific plant. Where the Department considers it appropriate, equivalent controls (values, parameters, or measures) may be included as conditions in the permit that have regard for the total mass of emissions from the installation, the nature of the pollutant, or the transfer potential of the pollutant from one medium (e.g. air) to another medium (e.g. water). In practice this means that the permit for an LCI may contain plant specific ELV (in particular in relation to eligible LCP or MCP) as well as mass emission limits for the LCI as a whole; together these conditions aim to provide control of any significant emissions.

The responsibility of the permit applicant / holder is to establish at the point of LCI PPC permit application / review which of the pollutants listed in Schedule 2 of the regulations are relevant to the activities that are undertaken at the installation, and their significance. In reviewing and accepting a permit application, the Department shall identify the appropriate control measures which need to be stipulated as conditions in the PPC permit, in relation to the prescribed pollutants identified by the applicant. This also includes pollutants identified as emitted in significant quantities.

Prescribed pollutants within Schedule 2 of the Regulations that are of most relevance to LCI are expected to include: sulphur dioxide (SO2), oxides of nitrogen (NOx), carbon monoxide (CO), volatile organic compounds (VOCs) and dust including fine particulate matter. VOCs including unburned hydrocarbons (UHC) can conveniently be divided into Methane (CH4) and

non-Methane VOCs; these may or may not be emitted in significant quantities, depending on the nature of the equipment, fuels, and operating practice of specific plant. Whilst other pollutants are listed in Schedule 2 of the Regulations these may not be typical of combustion plant offshore and they should be considered by the applicant on a case-by-case basis in consultation with the Department. The prescribed pollutants should be assessed by the applicant at the time of PPC permit application / variation, in relation to the fuels used in the combustion process and the combustion efficiencies at normal plant operating duty and combustion modes. They should also be reviewed periodically (at least annually) by the permit holder in the light of any process changes.

As general examples:

a) Combustion processes involving fuel sources with significant levels of hydrogen sulphide (H2S) may emit significant quantities of SO2 and other sulphur compounds (relative to air quality standards).
b) With respect to VOCs; combustion processes involving inefficient operating modes – such as gas turbines operating for prolonged periods at low percentage of rated load – may emit much higher quantities of UHC including methane slip. For gas, diesel, and dual fuel engines the extent of methane slip may also be a strong function of the thermodynamic cycle associated with the specifics of engine design and operation. Monitoring of UHC should be expressed as Methane and non-Methane UHC.
c) The operator should assess fuel composition to determine whether combustion plant may emit high quantities of non-methane VOCs and where this is the case the relevant non-methane VOCs should be monitored. The Department does not expect monitoring of non-methane VOCs to be required for combustion plant normally burning gaseous fuels unless operator assessment suggests significant levels may be present.
d) Emissions of SO2 can be expected to be insignificant when controls are in place to operate combustion plant on low sulphur diesel or ultra-low sulphur diesel.
e) Ultimately, however, it is the responsibility of the operator and permit applicant to assess the relative significance of the prescribed pollutants in Schedule 2 for the combustion plant on their permit.
f) Where in any doubt, for new plant the combustion plant original equipment manufacturer (OEM) advice on expected emissions to air when burning expected fuels should be sought by the operator and used at the application stage in lieu of site operating data.

2.1.3 Monitoring Requirements

The relevant requirements of Regulations 9, 9A and 11G are replicated below for ease of reference and highlight the requirement for an operator to have a suitable monitoring plan that incorporates compliance monitoring and reporting, in accordance with the conditions in the PPC Permit.

Regulation 9(2)

> (d) in respect of a pollutant which may be emitted from the large combustion installation, there are suitable emission monitoring requirements for such an emission, which include—
>
> > (i) measurement methodology, frequency and evaluation procedure;
> >
> > (ii) where the Secretary of State intends to set less strict emission limit values as provided by regulation 10(1), that the results of emission monitoring are provided for the same periods and with the same reference conditions as would apply to emission levels associated with the best available techniques; and

(iii) the provision at least annually of information on the basis of the results of emission monitoring under paragraphs (i) and (ii) and such other data which enables the Secretary of State to verify compliance with the permit;

(e) in respect of subparagraph (d)(ii) where it applies, there are requirements to provide a summary of the results of emission monitoring which allows a comparison with the emission levels associated with the best available techniques;

Regulation 9A

(1) Where a permit relates to a medium combustion plant, the Secretary of State must set conditions in a permit to secure the matters in paragraph (2).

(2) The matters referred to in paragraph (1) are that—

(a) the operator carries out monitoring of emissions in accordance with, as a minimum, Part 1 of Annex 3;

(b) the operator monitors emissions while firing a fuel or fuel mix that is likely to result in the highest level of emissions and during a period representing normal operating conditions;

(c) the emissions do not exceed the emission limit values set out in Annex 2;

(d) the operator keeps a record of and processes all monitoring results in such a way as to enable the verification of compliance with the emission limit values in accordance with Part 2 of Annex 3;

Regulation 11G Emission limit values: compliance

11G. The emission limit values shall be regarded as having been complied with if the results of monitoring conducted in accordance with the conditions of the permit show that the emissions for the combustion installation and the pollutant concerned do not exceed the emission limit value which applies in respect of that installation and that pollutant.

Note that the references to Part 1 of Annex 3, Annex 2, and Part 2 of Annex 3, in Regulation 9A, is to the Medium Combustion Plant Directive (See Section 2.3 of this guidance).

In line with the above paragraphs of the regulations, the Department highlights the following:

1. The requirement under regulation 9(2)(d) is for each LCI to have an emissions monitoring plan, and to report at least annually on the results of that monitoring undertaken in accordance with the plan. This includes such other data that the Department considers necessary to enable it to verify compliance of emissions with the permit. Further sections of this document provide practical guidance on these requirements, including the specific requirements for monitoring and reporting of emissions emitted from LCP and MCP installed and permitted on an LCI, and for MCP installed on an MCI.
2. Regulation 9(2)(e) for LCP on an LCI for which less strict ELV have been set by the Department as provided under regulation 10(1) – that is for an installation with LCP that has been granted a derogation from the Department. There is a requirement for the permit holder to provide results of emissions monitoring intended to facilitate comparison with the emission levels associated with BAT, for compliance monitoring with respect to the derogated ELV(s).

3. Regulation 9A, the requirement for MCP to meet the sampling and monitoring conditions in the permit, as aligned with the MCPD, in so far as emission monitoring and reporting shall comply with Part 1 and Part 2 of Annex 3, and compliance shall comply with the ELV in Annex 2.

2.2 Industrial Emissions Directive

The IED aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions, in particular through better application of Best Available Techniques (BAT).

- Chapter I of the IED (Article 1 through Article 9) covers common provisions of the IED.
- Chapter II of the IED (Article 10 through Article 27) covers provisions for activities listed in Annex I of the IED. The Annex I activity for the offshore PPC regulations is “Energy Industries – Combustion of fuels in installations with a total rated thermal input of 50MW or more”.
- Chapter III of the IED (Article 28 through Article 41) covers special provisions for large combustion plant applying to individual plant of total rated thermal input which is equal to or greater than 50 MW, irrespective of the type of fuel used. However, Article 28(i) specifically excludes gas turbines and gas engines used on offshore platforms. Therefore, the provisions apply to boilers, heaters and diesel engines on offshore platforms.
- Chapters IV, V, and VI cover provisions that are not relevant to the offshore oil and gas sector.

2.2.1 IED Chapter II – General Applicability in Relation to Monitoring

The emissions monitoring requirements in IED Chapter II are transposed inherently within the PPC regulations mainly in regulation 9(2). This includes transposition of the monitoring requirements of IED Article 14(1)(c), Article 14(1)(d) and Article 14(3); the latter states that BAT conclusions shall be the reference for setting the permit conditions.

The Regulations mean that IED Chapter II requirements apply to all offshore combustion plant on an LCI covered by the LCP BREF – see section 2.2.3 for further detail.

2.2.2 Chapter III and Annex V – Large Combustion Plant

Regulation 11A ensures compliance with a number of provisions within the IED for categories of LCP that fall under the scope of Chapter III – special provisions of the IED and Annex V for associated ELV. Under Chapter III Article 28 gas turbines and gas engines used on offshore platforms are excluded from the scope of Chapter III and hence are excluded from the following requirements of Regulation 11A, which apply only to LCP within scope of Chapter III.

Regulation 11A(a) covers the aggregation rules set out in IED Article 29. It applies to LCPs that have a total rated thermal input equal to or greater than 50MWth, irrespective of the type of fuel used. In cases where the waste gases of two or more combustion plants are, or could be, discharged through a common stack, the aggregation rules apply. Where such a combination of plant occur, they are considered as a single combustion plant. For calculating the total rated thermal input to be considered as an LCP with a common stack, individual combustion plant with a rated thermal input below 15 MW are not included.

Regulation 11A(b) sets the minimum requirements control standard for certain pollutant emissions from LCPs with reference to relevant parts of IED Annex V. The emission controls in terms of Emission Limit Values (ELV's) are set in a permit as required by Regulation 11A(b) (which are set a maximum limit stated in either Part 1 or Part 2 of Annex V depending upon when a permit was first granted. The Regulations states that these ELV do not apply to diesel engines (aligned with Article 30(8)(a)).

Parts 1 and 2 of Annex V outline ELVs for applicable plant for four pollutants namely; NOx, SO2, CO and Dust. These are therefore applicable to all eligible Chapter III plant.

Regulation 11A(d) implements IED Article 38, and imposes Part 3 of Annex V, which states requirements for emissions monitoring dependent on the total rated thermal input of the combustion plant.

Equipment ≥100MWth

Part 3 (1) of Annex V requires that for combustion plant >100MWth the concentrations of the four pollutants is measured continuously.

There is the option for the regulator to not require continuous monitoring for specific cases listed in Part 3 (2) including:

> (a) for combustion plants with a life span of less than 10 000 operational hours;
>
> (b) for SO2 and dust from combustion plants firing natural gas;
>
> (c) for SO2 from combustion plants firing oil with known sulphur content in cases where there is no waste gas desulphurisation equipment;

Part 3 (3) notes that 'Where continuous measurements are not required, measurements of SO2, NOx, dust and, for gas fired plants, CO shall be required at least once every 6 months.'

In line with the above, an applicant with offshore LCP equipment that satisfies Part 3 (1) of Annex V is encouraged to hold discussions with the Department very early in the permit application process so as to demonstrate relevant operating parameters and to seek the Department's agreement to any deviation from the continuous monitoring requirements of the IED.

Equipment <100MWth

Part 3 (3) of Annex V states that 'Where continuous measurements are not required, measurements of SO2, NOx, dust and, for gas fired plants, CO shall be required at least once every 6 months.'

Combustion plant of <100MWth are not covered by the continuous monitoring requirements in Part 3 (1) or (2) and are thus required to undertake periodic compliance monitoring a minimum of at least once every 6 months.

NB. This excludes LCP gas turbines and gas engines which are specifically exempt from IED Chapter III (see Art.28(i). It does however include boilers, heaters and diesel engines rated at or above 50MWth but less than 100MWth.The minimum requirements apply without prejudice to the provisions of Chapter II.

2.2.3 LCP BREF and BAT Conclusions

The BAT Conclusions are set out at Chapter 10 of the LCP BREF and in EU Commission Implementing Decision 2017/1442 [Ref 5]. Regulation 9 of the PPC regulations requires compliance with BAT.

In 2017 the LCP BREF [Ref. 6] was published. It applies under the regulations and assists in defining what BAT is for LCP and what the levels of BAT-AEL are for LCP. The BREF is applicable to individual open cycle gas turbines (OCGT) (single or dual fuel) on offshore installations with a maximum rated thermal input of 50MW or more. The LCP BREF sets BAT associated emission levels (BAT-AELs) which must be implemented by 18 August 2021, 4 years after the publication of the LCP BREF. Therefore, from August 2021 the Department is required to ensure that the LCP BATc are implemented, in full, for all applicable plant offshore within installation permits [Ref 2].

Therefore, from August 2021 (or earlier, subject to permit requirements) all existing applicable LCP must have permit conditions with the required minimum BAT-AEL, unless a derogation under Reg 10 of the regulations has been granted by the Department. In addition, monitoring requirements will have to have been met, by means of stack emissions sampling, in compliance with both the IED and BATc. Plant excluded from Chapter III and any plant with noted derogations are still required to comply with the monitoring requirements of the BATc. Information related to derogations can be found in the Department's guidance note [Ref. 11].

BAT 1 defines Environmental Management System requirements under 'General BAT Conclusions' which apply to all combustion plant. This includes BAT 1 (v)(a) which requires checking performance with particular attention to 'monitoring and measurement (see also the JRC Reference Report on Monitoring of emissions to air and water from IED-installations — ROM, [Ref. 7])'

BAT 4. states 'BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN (European "Norm") standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality'. The relevant section of the table is summarised in Table 3-1.

Substance	Type of Combustion Plant	Total Rated Thermal Input	Standards (1)	Minimum Monitoring Frequency (2)	Monitoring Associated with
NOx	Combustion plants on offshore platforms	All sizes	EN 14792	Once every year (3)	BAT 53
CO	Combustion plants on offshore platforms	All sizes	EN 15058	Once every year (3)	BAT 54

Table 3-1 - Extract of BATc, BAT4 Table of monitoring requirements

(1) Generic EN standards for continuous measurements are EN 15267-1, EN 15267-2, EN 15267-3, and EN 14181. EN standards for periodic measurements are given in the table.
(2) The monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement.
(3) PEMS may be used instead

NB. The EN standards in the table correspond to the Standard Reference Methods (SRM) for periodic measurement of NOx and CO. Regarding Note (3) above, there is more background discussion in the LCP BREF [Ref 6] in relation to continuous and periodic monitoring. PEMS is put into the context of the Regulations in Section 3.2.2 of this guidance.

No other pollutants are specified for offshore combustion equipment within the BAT 4 table by virtue of the monitoring being associated with various BAT requirements that themselves specifically exclude offshore equipment. Therefore, for offshore LCP it is BAT to focus on NOx and CO measurements under the installation's annual monitoring plan, where other pollutants in Schedule 2 of the regulations have already been determined as insignificant in the permit application or via an initial baseline assessment for the installation.

The BAT-AELs for NOx emissions to air from the combustion of gaseous fuels in open-cycle gas turbines on offshore platforms are defined under Table 10.32 of the 2017 LCP BREF (Ref 6. These NOx BAT-AEL are based on >70% of baseload power available on the day. LCP permitted items will have ELV parameters set within the conditions of the permit for compliance with these BAT-AEL or for compliance with values set by the Department under the formal derogation process [Ref 11].

In terms of duration of sampling for averaging, each AEL has a specified averaging period. These will not be discussed in full here other than to highlight that for periodic sampling the term 'Average over the sampling period' is defined in the BATc as 'Average value of three consecutive measurements of at least 30 minutes each' which is the minimum period.

Thus, the minimum requirement for all LCP combustion plant is by periodic (annual) stack sampling to the standards indicated, or continuously by a Predictive Emissions Monitoring System (PEMS, see Section 3.2.2 for associated conditions) unless more stringent requirements are noted to applicable plant under IED Annex V, Part 3 (refer to Sections 2.2.2 of this guidance) by way of an LCP being subject to the Chapter III special provisions.

2.2.4 Monitoring Requirements Where no BAT-AEL Applies

For an LCI, the minimum requirement for the monitoring of NOx and CO for all LCP combustion plant on offshore installations outlined above in relation to BAT 4 is required irrespective of the operating load of the LCP equipment and its relationship to the specification of the BAT-AEL in Table 10.32 of the LCP BREF. This is the minimum monitoring requirement of BAT 4, a general requirement of the LCP BREF whereas the compliance of emissions with the permit ELV relative to the BAT-AEL is a specific additional compliance requirement of the regulations - in line with the BREF - when operating at certain conditions; for the NOx ELV this is when operating at loads above 70% of ISO baseload duty [Ref 9], given by the maximum power output specified on the permit.

For combustion plant on an LCI that is not LCP and that is not classified as MCP (as described in section 2.1), the minimum monitoring requirements of the LCP BREF do not apply. Monitoring requirements (scope and frequency) for such permit items will be set at the discretion of the Department. The following two guidelines may be considered when requiring stack monitoring to be done:

1. Where Non-LCP combustion plant items on an LCI permit constitute a relatively significant proportion (e.g., >5% of LCI mass emissions) of NOx or CO, then the Department may require such equipment to be periodically monitored for NOx and CO at a reduced frequency to be stated in the permit. Such a requirement by the Department will be discussed with the permit holder based on the specifics of the installation and the technical data in the PPC application, including estimated emissions of prescribed pollutants and the results of air dispersal modelling, and reviewed periodically. The potential relevance of PEMS should also be considered by the permit holder in relation to guidance in Section 3.2.2.
2. Where Non-LCP combustion plant items on an LCI permit constitute a relatively insignificant proportion (e.g., <5% of LCI mass emissions) of NOx or CO relative to the contribution to mass emissions from any LCP on the permit, then the Department is not likely to require such equipment to be periodically monitored for NOx and CO.

The above guidelines are specific only to non-LCP that are exempt from the MCPD requirements under the regulations. The monitoring requirements for MCP in accordance with the regulations are highlighted in section 2.3 below.

2.3 Medium Combustion Plant

2.3.1 General Applicability in relation to Monitoring

The amended PPC Regulations of 2018 (SI. No. 798) [Ref 2] introduced the requirements of the Medium Combustion Plant Directive ((EU) 2015/2193) [Ref 4] on the limitation of emissions of certain pollutants (SO*2*, NOx and dust) into the air from medium combustion plant ("the MCPD"), in order to regulate pollutant emissions from plant with a rated thermal input equal to or greater than 1 Megawatt (MWth) and less than 50 MWth. The controls aim to reduce those pollutants and the resultant risks to human health and the environment. It also requires monitoring of carbon monoxide (CO) emissions, and this has no limitation to be applied. Under the PPC regulation 11B ELVs set in Annex II of the MCPD apply from 20 December 2018 for new MCP and for existing MCP shall apply from 1st January 2025 (for existing MCP rated at or above 5MWth but below 50MWth) or from 1st January 2030 (for existing MCP rated above 1MWth but below 5MWth).

The PPC regulatory requirements for MCP impacts on relatively few offshore installations due to the exclusions within the MCPD, that are implemented in Regulation 11B:

> Article 2. This Directive shall not apply to:
>
> (a) combustion plants covered by Chapter III or Chapter IV of Directive 2010/75/EU;
>
> (d) combustion plants in which the gaseous products of combustion are used for the direct heating, drying or any other treatment of objects or materials;
>
> (h) gas turbines and gas and diesel engines, when used on offshore platforms;

Qualifying MCP for offshore, applies to boilers and heaters and dual fuel engines which are <50MWth except for any plant between 15MWth and 50MWth which fall within the IED aggregation rules and is considered LCP, and therefore not regulated under MCP requirements.

2.3.2 MCP Monitoring Frequency

Regulation 9A (2)(a) sets the compliance requirements in line with Annex III, Part 1, of the MCPD, which defines the monitoring requirements by the operator whereby:

> 'Periodic measurements shall be required at least:
>
> - every three years for medium combustion plants with a rated thermal input equal to or greater than 1 MW and less than or equal to 20 MW,
> - every year for medium combustion plants with a rated thermal input greater than 20 MW.'

There are reduced frequency options available for certain equipment detailed in paragraph 2, Part 1 of Annex III, due to small size and low operational hours.

Under paragraph 6, Part 1 of Annex III, the regulator may require increased monitoring, up to and including continuous emissions monitoring systems (CEMS). These are also subject to checking by means of parallel measurements with reference methods at least once per year.

2.3.3 Monitoring Standards for MCP

The monitoring standards required are flexible as referred to in paragraph 3, Part 1 of Annex III, which provides that measurements are required for CO for all plant, and for other pollutants if a specific ELV is required. It states; 'Sampling and analysis of polluting substances and measurements of process parameters as well as any alternatives used as referred to under points 5 and 6 shall be based on methods enabling reliable, representative and comparable results. Methods complying with harmonised EN standards shall be presumed to satisfy this requirement. During each measurement, the plant shall be operating under stable conditions at a representative even load. In this context, start-up and shut-down periods shall be excluded.'

Unlike the IED and LCP BATc the MCPD does not state a requirement to monitor to EN Standards nor specify a Standard Reference Method (SRM). This provides a degree of flexibility in line with being affordable for Small to Medium Enterprises (SME) and provides long-term certainty whilst minimising the administrative burden. The consequence is to require the regulator to determine the criteria for sampling and analysis to assess compliance. Note – start-up and shut-down periods are further defined in Decision 2012/249/EU [Ref 8] but are not discussed further in this document.

3 Offshore Monitoring Requirements

Operators of LCI or MCI installations, which comprise of LCP or MCP combustion plant, should utilise this section as a central resource aid to compiling and updating the installation's monitoring plan in such a manner that the plan demonstrates:

a. Clear monitoring objectives;
b. Adherence to the appropriate monitoring standards:
c. Use of the appropriate certified measurement equipment, and competent personnel: and
d. Appropriate reporting.

The discussion of objectives and standards should be matched alongside the minimum requirements outlined in Section 4 and with the appropriate monitoring frequency and methodology summarised in Section 5. Data and information reported to the Department should meet the requirements in Section 6.

3.1 Monitoring Objectives

Across industry sectors in general, the objectives of emissions monitoring are many and diverse, as described in the JRC report [Ref 7]. However, within the offshore oil and gas sector there are clearly defined objectives when monitoring the main pollutants emitted. These objectives reflect the nature of the combustion plant used, the fuels used, the offshore production operating processes, and the logistics of monitoring to appropriate standards. The objectives for emissions monitoring under the regulations are designed to match these factors, and to address the monitoring requirements within the conditions in the permit. The objectives include several areas:

- Monitoring Objectives for Large Combustion Installations – General
- Monitoring Objectives for Large Combustion Plant
- Monitoring Objectives for Medium Combustion Plant

The Department considers the main objectives of a PPC monitoring plan should include the following details relating to each of these areas:

3.1.1 Monitoring Objectives for Large Combustion Installations – General

- Where LCP or MCP on an offshore combustion installation are first being operated, there is a key objective to conduct an emission baseline survey of a full suite of relevant pollutants, in order to obtain an accurate set of baseline data for the installation. The scope of the survey should aim to characterise the most significant sources of emissions, including emissions from burning standby alternative fuels (where relevant).
- Compliance with the permit conditions: To undertake periodic emission stack monitoring surveys to determine the levels of polluting substances in the emissions from the combustion equipment authorised under the permit. To determine the suitability of the emission projections that form the basis of the total permitted annual emissions and the suitability of the emission factors used to calculate the total annual emissions of polluting substances.

- Monitoring via periodic measurement (stack sampling) of pollutants, combined with continuous monitoring of combustion plant parameters allows original equipment manufacturers (OEM) specification data on the levels or profiles of emission pollutants to be verified under site conditions. Comparisons of industry data may be used to improve the levels of uncertainty in the use of emissions factors.
- Monitoring of emissions are required to be reported to the correct reference conditions as per the measurement standards(s).
- Determine the efficiency of the monitored combustion equipment.
- Utilise the results of monitoring to determine subsequent monitoring requirements, taking account of the quality of the baseline data, including overall uncertainty; repeatability of measurements; and the degree of consistency with existing good quality baseline data across similar combustion plant types when burning similar fuels.
- Utilise the results of stack monitoring to set up (calibrate) or to periodically verify predictive emissions monitoring systems (PEMS) as a supporting means of compliance, where the permit holder has identified this as a desirable part of their monitoring plan in line with Section 3.2.2.

3.1.2 Monitoring Objectives for Large Combustion Plant (LCP)

- Periodic monitoring for compliance with permit conditions: satisfy the regulatory requirement for monitoring of LCP set out in Regulation 9(d) and where applicable Regulation 11A(d) (which apply to boilers, diesel engines or heaters, but not to gas turbines or gas engines on offshore platforms), to be carried out in accordance with Annex V part 3 of the IED.
- Continuous Monitoring of LCP operations for compliance purposes: Monitoring of the standard instrumented parameters of LCP which are OCGT must be carried out routinely daily in order to record data and information of the operation of **each** LCP relative to its 100% base load power. i.e. continuous monitoring of daily average load. The objective is to ensure that the operator monitors and records sufficient data on the operation of each LCP (including the operating power output of the LCP in MW) to be able to determine compliance daily in relation to the ELVs and for the LCP BAT-AEL as stated within the permit. For OCGT, where the LCP power output in MWe cannot be determined directly by electrical (e.g. generator) or mechanical (e.g. torquemeter) means, the objective should be to monitor surrogate parameters on each LCP and to calculate (infer) the power output instead based on plant performance. This objective enables compliance to be demonstrated in relation to operation above or below the 70% of ISO base load power for which NOx ELV’s are set in the permit.
- Maintain monitoring records of LCP including records of taking and analysis of emissions samples, instrument measurements (periodic and continual), calibrations examinations, tests and surveys and any assessment or evaluation made on the basis of such data. Copies of these records must be made available to the Department upon request and retained for a period of ten calendar years.

3.1.3 Monitoring Objectives for Medium Combustion Plant (MCPD)

- Periodic monitoring for compliance with PPC permit conditions: satisfy the regulatory requirement for monitoring of MCP to be carried out in accordance with the provisions of the MCPD discussed in Section 2.3. This is required to demonstrate that emissions do not exceed the emission limit values set out in the permit.
- Monitoring of MCP emissions while firing a fuel or fuel mix that is likely to result in the highest level of emissions and during a period representing normal operating conditions.

Keep records of all monitoring results in such a way as to enable the verification of compliance with the emission limit values in accordance with Part 2 of Annex III (Regulation 9A(2) (d).

3.2 Standards

3.2.1 Overview of Relevant Standards

All EN standards developed by the European Committee for Standardisation ("Comité Européen de Normalisation") (CEN) need to be converted into national standards without any alteration, in order that UK Standards remain aligned with the CEN. Additionally, all conflicting national standards are to be withdrawn.

As part of the CEN, the Technical Committee (TC) 264 "Air Quality" prepares EN standards in the field of air quality. EN standards issued by TC 264 describe validated measurement methods which enable repeatability and comparability.

In accordance with Regulation 11A(d) for LCP that are ≥100MWth under Chapter III of the IED (paragraph 8, Part 3, Annex V) states:

> Sampling and analysis of relevant polluting substances and measurements of process parameters as well as the quality assurance of automated measuring systems and the reference measurement methods to calibrate those systems shall be carried out in accordance with CEN standards. If CEN standards are not available, ISO, national or other international standards which ensure the provision of data of an equivalent scientific quality shall apply.
>
> The automated measuring systems shall be subject to control by means of parallel measurements with the reference methods at least once per year.

Further, as noted in Section 3.1, BAT 4 (applicable to all offshore LCP combustion equipment), states 'BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality'.

Table 3-1 to 3-3 outline the relevant generic standards applicable for continuous and periodic monitoring as well as the Standard Reference Methods applicable to offshore stack monitoring based on the above requirements. These are quoted as the adopted British Standard of the relevant EN / ISO standard and are derived from the JRC ROM [Ref 7] – see section 3.2.3. Further information and guidance to supplement the ROM is available from relevant Environment Agency (EA) MCERTS guidance documents [Ref 12, Ref 13, Ref 14, Ref 15] as discussed in Section 3.3.

Standard	TITLE
BS EN ISO 9169:2006	Air quality – Definition and determination of performance characteristics of an automatic measuring system (ISO 9169:2006)
BS EN 14181:2014	Stationary source emissions – Quality assurance of automated measuring systems
BS EN 15267-1:2009	Air quality – Certification of automated measuring systems – Part 1: General principles
BS EN 15267-2:2009	Air quality – Certification of automated measuring systems – Part 2: Initial assessment of the AMS manufacturer's quality management system and post certification surveillance for the manufacturing process
BS EN 15267-3:2007	Air quality – Certification of automated measuring systems – Part 3: Performance criteria and test procedures for automated measuring systems for monitoring emissions from stationary sources
BS EN 15259:2007	Air quality – Measurement of stationary source emissions – Requirements for measurement sections and sites and for the measurement objective, plan and report
BS EN ISO/IEC 17025:2005	General requirements for the competence of testing and calibration Laboratories

Table 3-1 – Generic standards relevant for continuous measurements of emissions to air

Standard	TITLE
BS EN 14793:2017	Stationary source emissions – Demonstration of equivalence of an alternative method with a reference method
BS EN 15267-4:2017	Air quality – Certification of automated measuring systems Part 4: Performance criteria and test procedures for automated measuring systems for periodic measurements of emissions from stationary sources
DD CEN/TS 15674:2007	Air quality – Measurement of stationary source emissions -Guidelines for the elaboration of standardised methods
BS EN 15259:2007	Air quality – Measurement of stationary source emissions – Requirements for measurement sections and sites and for the measurement objective, plan and report
BS EN ISO/IEC 17025:2005	General requirements for the competence of testing and calibration Laboratories
DD CEN/TS 15675:2007	Air quality – Measurement of stationary source emissions -Application of EN ISO/IEC 17025:2005 to periodic measurements

Table 3-2 – Generic standards and technical specifications relevant for periodic measurements of emissions to air

Standard title	SRM / AM	Parameter	TITLE
BS EN 15058:2017	SRM	CO	Stationary source emissions – Determination of the mass concentration of carbon monoxide (CO) Reference method: non-dispersive infrared (NDIR) spectrometry
PD CEN/TS 17337:2019	AM	CO / NOx / SO2	Stationary source emissions. Determination of mass concentration of multiple gaseous species. Fourier transform infrared spectroscopy
BS EN 14792:2017	SRM	NO/NO2	Stationary source emissions. Determination of mass concentration of nitrogen oxides. Standard reference method. Chemiluminescence
BS EN 13284-1:2017	SRM	Dust / Particulate	Stationary source emissions. Determination of low range mass concentration of dust. Manual gravimetric method
BS EN 14791:2017	SRM	SO2	Stationary source emissions. Determination of mass concentration of sulphur oxides. Standard reference method
PD CEN/TS 17021:2017	AM	SO2	Stationary source emissions. Determination of the mass concentration of sulphur dioxide by instrumental techniques

Table 3-3 – SRMs and AMs relevant for periodic measurements of specified pollutants emitted to air.

There exist a multiplicity of sampling equipment and methodologies, however those noted in Table 3-1 to 3-3 are the only noted, relevant, Standard Reference Methods (SRM) from BATc and Alternative Methods (AM) as identified in the Environment Agency (EA) approved techniques [Ref 16, Ref 19].

The relative limitations of any specified method are not discussed further here nor are the specific requirements. Only that the SRMs or AM methods must be adhered to in providing accepted testing for compliance purposes where they are specifically noted in BAT 4.

3.2.2 Predictive Emissions Monitoring System (PEMS)

Within the LCP BREF PEMS is defined as a:

“System used to determine the emissions concentration of a pollutant from an emission source on a continuous basis, based on its relationship with a number of characteristic continuously monitored process parameters (e.g. the fuel gas consumption, the air to fuel ratio) and fuel or feed quality data (e.g. the sulphur content).”

PEMS is identified within the LCP BATc, BAT 4, as an alternative to the SRMs defined for NOx and CO for offshore combustion plant.

PEMS is further identified in the LCP BREF, Table 7.28, as a technique that should be considered offshore. It furthermore recommends the development of an EN standard for PEMS systems for standardisation. This has subsequently led to the development and publishing of draft PD CEN/TS 17198:2018 – Stationary source emissions – Predictive Emission Monitoring Systems (PEMS) – applicability, execution, and quality assurance [Ref 18].

The request by an Operator within a PPC permit, for the use of PEMS for compliance monitoring, shall require the PEMS to undergo periodic surveillance testing against a recognised SRM / AM as directed by the Department. Following testing, the successful demonstration of a PEMS system for annual monitoring and reporting - once presented by the permit holder and approved by the Department – may be used for compliance with the relevant BAT requirements. This may become the primary basis for extending the frequency between required periodic SRM testing, in favour of PEMS plus periodic AM testing. This is in-line with the monitoring objectives as defined by the Department in Section 3.1.

Operators wishing to implement PEMS as a primary means of compliance should present a high-level description of the proposed PEMS within their annual PPC monitoring plan. The operator should hold discussions with the Department before embarking on any certification programme of a PEMS to a recognised standard (e.g., EN or US-EPA). The Department shall expect the operator to demonstrate – via a number of periodic (e.g., annual) surveillance tests – that the PEMS is providing satisfactory results before it can be accepted by the Department as the primary method for reporting of combustion plant emissions.

PEMS should be considered by operators as good practice and can be used for overall emissions monitoring and control. However, PEMS must be specifically approved within PPC permits to be used for compliance monitoring.

Where automated measuring systems (AMS) are used (e.g., for IED Chapter III LCP), the AMS shall be subject to control by means of parallel measurements with the standard reference methods at least once per year, when used for compliance monitoring.

3.2.3 JRC Reference Report on Monitoring of Emissions

The JRC Reference Report on Monitoring (ROM) of Emissions to Air and Water from IED Installations [Ref 7] provides practical guidance for the application of the BATc on monitoring. As noted, it is specifically identified in BAT 1 of the BATc as a reference document and can therefore be seen as BAT in itself.

The ROM does not interpret the IED. According to Article 16(1) of the IED, monitoring requirements in permits shall be based on the conclusions on monitoring as described in the BAT conclusions. In this framework, the ROM can act as a reference to enhance the consistent application of the BAT conclusions and the IED by providing additional guidance on monitoring standards, strategies and practices.

Table 3-1 to 3-3 in Section 3.2.1 are derived from the ROM.

The BAT-AELs, as defined in Article 3(13) of the IED, refer to specified reference conditions, but the IED does not provide a definition of the term reference conditions out with those plant required to comply with Annex V. In the context of the IED and the BREFs, the terms reference conditions and standard conditions are often used in the same sense and are thus interchangeable. This usually means that the measured emission concentrations are corrected to a temperature of 273.15 K and a pressure of 101.3 kPa after the deduction of the water vapour content (thereby referring to dry gas). In many cases, the standard conditions also

include a reference oxygen level (e.g., for flue-gases from combustion or incineration processes). The BATc contains these reference conditions and defines the reference oxygen levels for differing fuels and/or types of combustion plant. It is important that emissions are reported to the correct reference conditions.

Section 3.4 of the ROM provides a review of the role of quality assurance noting that:

Data quality is the most critical aspect of monitoring. Reliable data are needed for assessing and comparing the performances of emission control techniques, for decision-making concerning allowable levels of emissions, and for the prevention of accidents, etc. Thus, quality assurance is essential for the whole data production chain and for any type of monitoring.

It highlights that the EN standard used for the accreditation of testing laboratories is EN ISO/IEC 17025:2017 and this requires that each laboratory applies a proven quality management system [Ref 25]. This also covers the validation of methods, data treatment, the evaluation of the measurement uncertainty and the reporting of results. Applying the rules given in EN ISO/IEC 17025:2017 guarantees a certain level of quality assurance in accredited laboratories and of the results provided by them.

Whilst not noted in the ROM this is expanded further in DD CEN/TS 15675:2007 (Air quality – Measurement of stationary source emissions – Application of EN ISO/IEC 17025:2005 to periodic measurements) which provides clarity and additional information of the application of EN ISO/IEC 17025:2017 to periodic measurements.

It is the ROM that directs to, for the measurement of emissions to air, EN 14793:2017 as a validation procedure to show if an alternative method (AM) can be used instead of a standard reference method (SRM) [Ref 26].

The ROM highlights that operators and regulators should have a clear understanding of the objectives of the monitoring before monitoring begins- (see section 3.1). This is critical in developing a monitoring plan (see section 4.1).

3.3 MCERTS

The EA has developed a monitoring certification scheme, MCERTS, for equipment, personnel and organisations. The scheme ‘provides a delivery vehicle for compliance with European Directives which regulate industrial emissions, monitoring data, equipment and personnel. The scheme is built around proven International and European standards to ensure monitoring data is of a high standard’.

The certification scheme is managed on behalf of the EA by the CSA Group (under Sira Certification Service) who provide certification of equipment, personnel and inspection services. Sira is accredited by the United Kingdom Accreditation Service (UKAS) according to the ISO/IEC 17000 series of conformity assessment standards, specifically ISO/IEC 17065:2012 ‘Requirements for bodies certifying products, processes and services’.

Operators are directed to the EA MCERTS certification and associated guidance as best practice for minimum monitoring requirements. The Department requires the use of MCERTS certified equipment and personnel for demonstration of compliance of emissions with ELV set within permits in relation to the LCP BAT-AEL, as part of periodic monitoring of pollutants in line with minimum requirements (per Section 4 of this guidance). In addition, for the purposes of initial or repeat baseline monitoring surveys the Department requires the use of a UKAS

accredited laboratory organisation as outlined above. Following acceptable baseline surveys, UKAS laboratories are not required for periodic monitoring, but MCERTS is required. Any deviation from use of MCERTS will be required to be justified to the Department by the operator and equivalence demonstrated prior to any compliance-based emissions testing.

3.3.1 Equipment and Methods

The MCERTS product certification scheme provides for the certification of products according to the EA performance standards, based on relevant CEN, ISO and national standards.

The Environment Agency has published performance standards for CEMs [Ref. 16], Continuous Ambient Air Monitoring Systems (CAMs), Handheld emissions monitoring equipment (HEMs) [Ref. 17] and Continuous Water Monitoring equipment.

For LCP and MCP with permit ELV conditions, monitoring must be undertaken using equipment which holds an MCERTS certificate. Through the MCERTS certification process the equipment must be demonstrated to be both an SRM and in compliance with the relevant MCERTS equipment performance standard. Alternatively, to an SRM, equipment would be required to demonstrate equivalency to an SRM by demonstrating that it can be operated as an AM and accredited as such to BS EN 14793:2017 [Ref 26].

Note that for Periodic Monitoring, the EA has published additional web-based guidance ‘Monitoring stack emissions: techniques and standards for periodic monitoring’ [Ref 15] and specific ‘Method Implementation Documents’ [Ref 14]. These identify specified SRMs and AM recognised by the EA as part of MCERTS. See also Table 3.3 for examples of relevant SRM and AM for offshore monitoring.

LCP stack monitoring equipment used for SRM purposes will generally be transportable emission-monitoring systems, which are variants of CEMs, designed to perform to the same high standards as required for CEMs. The specifications for these systems, referred to as transportable CEMs (T-CEMs), are included in the MCERTS Performance Standards and Test Procedures for CEMs and Transportable-CEMs (TCEMs) [Ref 16]. By comparison some equipment suitable for AM purposes may be more portable by design.

For MCP there is greater flexibility for equipment selection as compatible with Section 3.3.2 below. The Department requires monitoring for MCPD plant, >20MWth, with permit ELV conditions, to be undertaken with equipment that is MCERTs certified for the pollutant required. This requires the equipment to be used in compliance with the SRM/AM techniques as this represents the highest standards. The Department will allow for handheld instruments, which have demonstrated compliance as an Alternative Method (AM) in accordance with BS EN 14793:2017 [Ref 26]

For monitoring of MCP >1MWth but ≤20MWth, the Department may permit operators to use Handheld Emissions Monitoring equipment (HEMs). HEMs are instruments that are used to make measurements in a wide variety of applications. For example, stack emissions monitoring for indicative purposes, monitoring for compliance purposes for the applicable MCP, fugitive emissions and gaseous releases from discrete parts of the hydrocarbons process. Where such equipment is to be used for MCP compliance it requires to be certified under the MCERTS Performance Standard for HEMs [Ref 17]. This performance standard is less rigorous than that for CEMs / T-CEMs and does not require to be to an SRM or AM. This approach reduces the administrative and cost burdens on operators of low risk, low impact, and limited operation.

For MCP ≤20MWth the Department does not require monitoring equipment to be accredited to a AM or an SRM.

3.3.2 Monitoring Organisations and personnel

The MCERTs scheme also applies to organisations and personnel.

For LCP plant, the Department requires that initial baseline survey stack monitoring (or subsequent 'full suite' repeat monitoring as specifically requested by the Department) must be undertaken by an organisation that adheres to EN ISO 17025 and EN ISO 15259. The EA Technical Guidance Note M1 (Ref. 12) covers general sampling and safety requirements as an expansion of the requirements within EN ISO 15259. This is supplemented by the requirement for monitoring organisations to be accredited to MCERTS under the Performance Standard for Organisation carrying out manual stack emission monitoring [Ref 13]. This performance standard is built on the structure of ISO 17025 and stipulates additional controls in terms of both health and safety and technical issues specific to stack monitoring.

Accreditation by UKAS is required for both EN ISO 17025 and MCERTS for laboratories.

Not only is the monitoring organisation required to be MCERTS accredited but the personnel undertaking the monitoring are also required to be individually MCERTS certified under the Performance Competency Standard for Manual Stack-Emission Monitoring [Ref 20]. As noted, the CSA Group runs the scheme for the EA and is accredited to do so by UKAS. The standard is supported by a training syllabus [Ref 21] and defines three levels of personnel competence – an entry level (trainee), Level 1 (technician) and Level 2 (team leader).

For MCP >20MWth the MCERTS requirements noted above for personnel are maintained, consistent with those for equipment and methods in 3.3.1.

For MCP ≤20MWth the Department will accept reduced competency requirements and allow operators to follow the principles such that it permits organisations that service and maintain MCPs to carry out compliance monitoring where the plant is operated below a maximum net rated thermal input, use agreed fuels or operate below a minimum number of hours. This risk-based approach is based on the following:

- individually they present a lower risk to the environment;
- the emissions monitoring procedure is relatively straightforward;
- they often only operate intermittently, so it is more practical to use the monitoring results from a routine service visit; and
- emissions monitoring makes up a small part of the work of service engineers, who service and maintain MCP.

Such personnel do not need to be registered or certified by MCERTS

3.3.3 Extension of MCERTS personnel certification for offshore oil and gas sector

The Environment Agency (EA) has developed an extension of the MCERTS personnel certification scheme on behalf of the Department, to assist offshore operators (permit holders) to fulfil the regulatory compliance requirements under the Regulations; specifically, those aspects associated with periodic stack monitoring. For offshore compliance purposes this only applies once an initial baseline monitoring campaign has been undertaken by a UKAS-approved laboratory to the satisfaction of the Department.

Personnel who only carry out stack emissions monitoring work at offshore locations can obtain MCERTS certification, but the scope of their certification is limited only to offshore work. All the requirements of the scheme, with the exception to the differences listed in the EA MCERTS guidance for personnel competency standards [Ref 20], apply to individuals who work offshore.

This extension to MCERTS has been agreed between the Department, the EA, and the offshore industry body OEUK in order to facilitate competent personnel working on offshore installations to be trained in the areas of the MCERTS certification scheme that are relevant to the scope of offshore combustion plant stack testing. This is especially related to gas turbines, boilers, and other LCP/MCP combustion plant equipment found in the offshore UKCS sector. This will allow such personnel to work offshore in providing compliance with the Department's requirements for MCERTS certification, enabling them to undertake those elements of testing that do not require testing to be carried out by a UKAS accredited organisation. Note that such personnel will be expected to use MCERTS approved equipment where required by the guidance, to SRM/AM standards, and they will be expected to complete the appropriate Site Specific Protocols in line with the installation-specific monitoring plan that is in force under the PPC permit for the relevant offshore installation. The Department requires compliance reports relating to periodic monitoring conducted in this manner by offshore personnel to be signed-off by the HSE Manager for the relevant offshore installation for which the PPC permit applies; this includes a statement confirming that the personnel undertaking the testing have a valid and current MCERTS competency certificate issued to them by the EA's training provider.

In summary, the Department mandates the use of MCERTs accredited organisations and competent MCERTS certified personnel for compliance monitoring as detailed in Section 3 above. Any deviation from this requirement must demonstrate equivalence and must be approved in writing with the Department prior to undertaking monitoring. Without such agreement, any results will not be accepted for compliance purposes.

4 Minimum Requirements

The following stipulates the minimum required monitoring stipulated by the Department for offshore combustion plant under the permitting process.

4.1.1 Emissions Monitoring Plan and Good Practice

Operators should have a clear understanding of the objectives of monitoring set out in Section 3.1 before commencing monitoring. The objectives and the monitoring plan and associated combustion plant interfaces should also be clear for any operator personnel and/or third party involved, including contractors, and accredited testing laboratory. The monitoring objectives and the corresponding monitoring plan are key inputs to guiding MCERTS test personnel in writing the Site Specific Protocol (SSP) and Risk Assessment (RA) for a given monitoring test campaign. The objectives should be clearly stated and be considered in a monitoring plan and in the reporting of the monitoring results (see Section 6).

A new permit application or a variation to an existing permit with LCP or new MCP must include an emissions monitoring plan. This must clearly define the monitoring objective, be based on standardised methods (e.g. EN standards) and a quality assurance system, e.g. in accordance with EN ISO/IEC 17025:2017, to help to ensure accurate, reliable, representative and comparable monitoring data.

This plan must set out a high-level approach which clearly states the combustion plant to be monitored, the status of plant with respect to sampling ports and the intention to monitor specific plant in line with the permit conditions and associated guidance.

The monitoring plan should be frequently revisited to ensure that the objectives remain current and appropriate for the installation and any changes in operating mode that could affect compliance with permit conditions.

It should be noted that operators are encouraged to undertake a monitoring programme that is wider than simple compliance monitoring and in practice, not all measurements taken in any given calendar year are necessarily related to a compliance assessment. For monitoring not specific to compliance objectives (e.g. for internal company reporting), it is not necessary to use the standardised methods outlined in this guidance. It is up to the operator to decide what level of accuracy, repeatability and reproducibility is appropriate in such cases.

The Department has made available an emissions monitoring plan template for the purpose of facilitating operator compliance with their PPC permit. The template can be downloaded from the OPRED website. The monitoring plan template is provided for operators to manage compliance monitoring under their PPC permit for the respective LCP and MCP. The monitoring plan template should be used for each installation with LCP and MCP and includes guidance that will assist the operator in how to complete and submit the information to the Department. It also clarifies and distinguishes the information that needs to be included in the monitoring plan from the information that needs to be included under the Site Specific Protocol (SSP) for a MCERTS-compliant test campaign being undertaken as part of the monitoring plan.

This monitoring plan should be completed and submitted to the Department as supporting documentation by applying to vary the PPC permit in the UK Energy Portal Environmental

Tracking System (PETS). The document should be reviewed annually by the permit holder and updated as appropriate.

The Department recognises that emission monitoring plans will need to dovetail with Operations and Maintenance (O&M) requirements and constraints. Should a permit holder be unable to plan and conduct the required LCP or MCP periodic compliance testing in each calendar year due to O&M constraints these should be discussed with the Department proactively in advance. The Department would rather that monitoring undertaken to comply with permit conditions is planned optimally each calendar year for when LCP equipment is available for testing, rather than on a strict rolling 12-month rotation.

4.1.2 Baseline and Periodic Monitoring Reports

An initial baseline emissions monitoring survey should be conducted within 12 months of equipment start up for new plant and should be reflective of normal and stable operation conditions. Subsequent to a baseline survey, periodic routine monitoring is required in-line with the scope and frequency specified within the permit conditions.

Baseline and periodic monitoring and reporting is required to provide verification or adjustment of the annual emission estimates in the permit application and demonstrate compliance with ELVs and for LCP BAT-AELs and relevant ELV's applied to MCP (see section 5 for summary of frequency). Equipment to be monitored must include all LCP and MCP (where MCP is subject to the compliance timings outlined in section 2.3.1) as a minimum as potentially significant sources, this is irrespective of any permit ELVs. Other sources to be monitored may be specified within the permit conditions, or may be in line with the guidance given in section 2.2.4 .

Equipment should be monitored across a representative load range, including at least operation at the normal process duties and normal equipment loads; i.e., at duties and loads that are typical of normal (routine) site operation in the relevant calendar year. Where such conditions change over time, or where it is recommended that monitoring should be undertaken under specific conditions, this should be taken into consideration in the monitoring plan and SSP.

Where units are dual-fired or dual-fuelled (typically gas oil/diesel and gas), emissions should be characterised for both fuels. If machines can operate on a wide range of fuel gas supplies, then it may also be necessary to undertake baseline measurements on more than one fuel gas supply. Units that operate on multi-fuel must be measured for each fuel type and across the load range as part of baseline reporting.

The data obtained from the initial baseline survey and further periodic sampling should be used to satisfy the objectives outlined in Section 3.1 and incorporated into annual reviews of the monitoring plan.

Emission concentrations should be standardised to appropriate reference conditions (oxygen, moisture, temperature and pressure). Guidance is given in the EA's techniques and standards for periodic monitoring [Ref 19] on how to convert measured concentrations to mass emission rates including correction for temperature, pressure and moisture and oxygen content, as well as being covered under the MCERTS personnel competency exams. The measured pollutants must also be reported (tabulated) in the format mg/Nm3 at the respective load for each combustion unit being measured.

Appendix F of the MCERTS Performance Standard for Monitoring Manual Stack Emissions (Ref 22) provides a format for reporting of stack monitoring results. The survey emissions report shall be a complete account of the measurements and the development of the measurements into EFs and annual emission estimates. Deviations from the requirements of MCERTS must also be documented in the report along with a justification as to why the MCERTS requirements were not achievable if this related to problems encountered during the monitoring that were not identified in the Site Specific Protocol (SSP).

All compliance reports should include the MCERTS certificate ID for named lead test personnel and should be signed by test laboratory QA Manager or Operator Asset HSE Manager (as appropriate depending on whether conducted by contractor or site personnel).

4.1.3 Equipment to be Monitored

Applicable LCP and MCP equipment should be monitored in accordance with Table 5-1, unless otherwise agreed by the Department.

It is expected that a risk-based approach can be adopted to identify any other emission sources, and these must be defined if these are of significance (%) relevance to annual emissions. Refer to section 2.2.4 for suggested significance considerations. For example, standby or emergency equipment with low use and low thermal input need not be monitored. This allows the operator to define a measurement programme that provides detailed coverage of the major combustion plant and an acceptable level of data for smaller combustion units. It is the responsibility of the operator to determine the significant environmental impact of all combustion plant on the PPC permit to identify which needs emissions testing. The monitoring plan is subject to the approval of the Department (via a permit variation for existing permits) once it has been reviewed.

To align with the application of base load interpretation within the IED, the Department interpret the meaning of the note to align with ISO base load rated output as defined in BS ISO 11086:1996 [Ref. 9]. It should be noted that if the plant has been officially de-rated this should be considered as the ISO base load rated output. For any plant that has been de-rated, evidence of this must be provided or where it is planned to be, those plans need to be accounted for in the permit and monitoring plan before the change is to be applied.

Monitoring reports should reference the emissions monitoring data obtained in relation to the operating conditions at the time of sampling, including the MW power output in the case of OCGT or engines; typically, from electrical generator or mechanical drive torquemeter, or if neither is available then by an alternative calculation / inference from surrogate parameters.

4.1.4 Pollutants to be Measured

Pollutants must be monitored in accordance with the objectives of baseline and periodic surveys. For initial baseline surveys the following pollutants must be characterised:

- Oxides of nitrogen (NOx);
- Carbon monoxide (CO);
- Unburnt Hydrocarbons including Methane and non-Methane volatile organic compounds (VOCs);

- Sulphur dioxide (SO2), where the fuel is known to have high Sulphur content; and
- Dust – where applicable to LCP and MCP within the regulations.

For the above monitoring methodologies – see Section 5.

Note that other parameters, for example percentage oxygen concentration and ambient conditions, are required to be monitored to enable correction and reporting of emission pollutants to reference conditions. Both raw measurements and corrections to reference conditions should be reported to the Department as an auditable dataset (see Section 6 below).

For periodic monitoring requirements - see Section 5.

5 Summary of Monitoring Frequency and Methodology

Table 5-1 provides a summary of the monitoring requirements noted in the IED, LCP BATc or MCPD. Only the primary SRM is noted. Refer to Table 3-3 for relevant AM and to Ref 26 for equivalence criteria.

Combustion Plant	**Qualifying Plant**	**Determinants**	**Monitoring Frequency**	**SRM / AM (3)**	**Emission Limit Values**
IED Chapter III, Annex V					
Gas and liquid fired boilers / heaters / diesel engines	≥50 but <100 MW(th)	NOx, SO2, CO and dust	Every 6 months	NOx - EN14792 CO - EN15058 SO2 - EN 14791:2017 Dust - EN 13284-1:2017	See Part 1/2 of Annex V of the IED Note: ELVs do not apply for offshore diesel engines (Article 30(8)(a))
Gas and liquid fired boilers / heaters / diesel engines	≥100 MW(th)	NOx, SO2, CO and dust	Continuous (4)	BS EN 14181:2014 BS EN 15267-1:2009 BS EN 15267-2:2009 BS EN 15267-3:2007	See Part 1 / 2, Annex V of the IED Note: ELVs do not apply for offshore diesel engines (Article 30(8)(a))

Combustion Plant	Qualifying Plant	Determinants	Monitoring Frequency	SRM / AM (3)	Emission Limit Values
LCP BATc					
All offshore combustion plant if not otherwise specified	All LCP plant	NOx and CO	Annual or using (certified) PEMS per conditions in 3.2.2	NOx - EN14792 CO - EN15058	Not applicable
Open cycle gas turbines (single and dual fuel)	≥50 MW(th) and normally operated at **<70%** baseload power	NOx and CO	Annual or using (certified) PEMS per conditions in 3.2.2	NOx - EN14792 CO - EN15058	Not applicable
Open cycle gas turbines (single and dual fuel)	≥50 MW(th) and normally operated at **>70%** baseload power	NOx and CO	Annual or using (certified) PEMS per conditions in 3.2.2	NOx - EN14792 CO - EN15058	Existing plant NOx <50 -350 mg/Nm3 New plant[1] NOx 15 - 50 mg/Nm3
MCPD (Required for new MCP after 20-Dec-2018 or Required from 1-Jan-2025 for existing MCP >5 MW(th) and 1-Jan-2030 for existing MCP ≤5 MW(th))					
Gas and liquid fired boilers / heaters / dual fuel engines	≥1 - ≤20 MW(th)	For natural gas and gas oil fuels: NOx and CO For liquid fuels other than gas oil: NOx, SO2, CO and dust	Every three (3) years (1)	To be agreed with the Department (SRM/AM not mandatory)	See Annex II of MCPD

Combustion Plant	Qualifying Plant	Determinants	Monitoring Frequency	SRM / AM (3)	Emission Limit Values
Gas and liquid fired boilers / heaters / dual fuel engines	>20 - <50 MW(th)	For natural gas and gas oil fuels: NOx and CO For liquid fuels other than gas oil: NOx, SO2, CO and dust	Annual (2)	To be agreed with the Department (SRM/AM required)	See Annex II of MCPD

Table 5-1 - Summary of LCP and MCP Monitoring Frequency and Methodologies.

Following notes correspond to (1-4) in the table above.

1. If plant is operated for ≤500 hours per annum, monitoring should be undertaken for CO every 1,500 operated hours or at least every five years.
2. If plant is operated for ≤500 hours per annum, monitoring should be undertaken for CO every 500 operated hours or at least every five years.
3. Only the primary SRM is noted. Refer to Section 3 and Table 3-3 for discussion and summary of SRM and AM techniques
4. Continuous monitoring can be reduced to periodic, but at least every 6 months, for certain circumstance s outlined in IED Annex V Part 3 (3).

6 Reporting

Results of emissions monitoring undertaken for compliance purposes, either baseline or ongoing compliance must be maintained for a period of at least 10 years.

In accordance with permit conditions and as per regulation 9(2)(d) of the Regulations the operator shall provide a copy of the required emissions monitoring to enable verification of compliance with the Permit. This shall be reported, in accordance with the permit conditions.

Non-compliance must be reported to the Department using the Integrated Reporting Service (IRS), when either:

- Periodic emissions testing undertaken for compliance monitoring purposes confirms that an ELV in a permit condition has been exceeded; or
- Monitoring of average daily power output (MW) indicates that LCP OCGT may have exceeded NOx ELV when operating above 70% of baseload power as stated in the permit condition, in relation to NOx vs load (MW) profiles of previous baseline or periodic tests or based on expected / predicted emissions at operating duty.

IRS is a service hosted within the United Kingdom Energy Portal. IRS is used generically to report a Non-compliance Notification (NCN) to the Department; IRS guidance is available on the Department's webpage under environmental alerts and incidence reporting on how to complete NCN for different environmental regulations including Offshore PPC.

Further to the discussion in Section 4.1.2. Baseline and periodic emissions testing should be reported by email submission to the Department within 3 months of the required monitoring being conducted. No permit variation is required to report stack monitoring results. However, stack monitoring reports should always be uploaded to the portal by the permit holder /operator at the next permit variation.

The emissions monitoring annual compliance report shall be submitted with a suitable summary which allows a comparison with the ELVs authorised under the permit and associated with the Best Available Techniques. Annual mass emissions data returns must be reported into the Environmental and Emissions Monitoring System (EEMS) in accordance with the permit condition and the associated EEMS Guidance [Ref 23].

Note that the requirement to monitor and report LCP each calendar year to meet annual compliance allows results from the calendar year to be used to determine / sense check annual EEMS returns submitted in Q1 of the following calendar year.

7 Asset Specific Emission Factors

The development of a specific emissions factor (EF) for a pollutant requires knowledge of the pollutant emission concentration, oxygen concentration of the emission and analysis of the fuel gas composition and fuel input flow rate or alternatively exhaust flow rate. It is therefore recommended that fuel samples are collected and analysed, and fuel flow to individual combustion plant is measured or attributed, to allow robust calculation of EFs from measured point source concentrations. Using such specific factors for compliance must be presented within a permit with supporting evidence that these are correct prior to using them for any compliance reporting.

Appropriate attention should be given at the planning stages in relation to the measurement and reporting of fuel flow, gas turbine load parameters, gas composition data, and stack velocity (the latter only where relevant to the monitoring method), in parallel with the primary measurements of stack emissions concentrations. These parameters are important for characterisation of the emissions and will generate additional element of uncertainty, which should be minimised to ensure good overall quality of data.

References

Reference	Title / Description
Ref 1	The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013/971.
Ref 2	The Offshore Combustion Installations (Pollution Prevention and Control) (Amendment) Regulations 2018. 2018/798.
Ref 3	European Commission. Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention and Control). 2010.
Ref 4	Directive (EU) 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plants. 2015.
Ref 5	European Commission. Commission Implementing Decision (EU) 2017/1442 establishing BAT conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants. 2017.
Ref 6	European Commission. JRC Science for Policy Report. Best Available Techniques (BAT) Reference Document for Large Combustion Plants. 2017.
Ref 7	European Commission. JRC Reference Report on Monitoring of Emissions to Air and Water from IED Installations. 2018.
Ref 8	European Commission. 2012/249/EU Commission Implementing Decision concerning the determination of start-up and shut-down periods for the purposes of Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions. 2012.
Ref 9	International Organisation for Standardisation. ISO 11086:1996 (en) Gas Turbines - Vocabulary. 1996.
Ref 10	Environment Agency. Technical Guidance Note M5, Monitoring of Stack Gas Emissions from Medium Combustion Plants and Specified Generators. 2018.
Ref 11	BEIS. OFFSHORE COMBUSTION INSTALLATIONS (PPC) LCP BREF – BATc and IED Article 15(4) Derogation Guidance notes for the offshore oil and gas Industry. 2020

Ref 12	Environment Agency. Technical Guidance Note M1, Sampling requirements for stack emission monitoring. 2017.
Ref 13	Environment Agency. Performance Standard for Organisations Carrying Out Manual Stack Emission Monitoring. 2019.
Ref 14	Environment Agency. Method Implementation Document for EN 15259:2007: stationary source emissions- Requirements for the measurement sections and sites and for the measurement objective, plan and report. 2019.
Ref 15	Environment Agency. Monitoring stack emissions: techniques and standards for periodic monitoring. 2019 (web based).
Ref 16	Environment Agency. Performance Standards and Test Procedures for Continuous Emission Monitoring Systems (CEMs) and Transportable-CEMs (T-CEMs). 2018.
Ref 17	Environment Agency. Performance Standard for Handheld Emission Monitoring Systems (HEMs). 2018.
Ref 18	Draft PD CEN/TS 17198:2018 – Stationary source emissions – Predictive Emission Monitoring Systems (PEMS) – applicability, execution, and quality assurance
Ref 19	Environment Agency. Guidance Monitoring stack emissions: techniques and standards for periodic monitoring. Published 18 December 2019 (web based)
Ref 20	Environment Agency Personnel Competency Standard for Manual Stack-Emission Monitoring. 2018
Ref 21	Environment Agency. Examination syllabuses for Manual stack emissions monitoring. 2018
Ref 22	Environment Agency. Performance standard for organisations carrying out manual stack emission monitoring. 2019
Ref 23	BEIS. EEMS Atmospheric Guidance Notes. 2013
Ref 24	ISO 11771:2010. Air quality — Determination of time-averaged mass emissions and emission factors — General approach. 2010
Ref 25	EN ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories

Ref 26	EN 14793:2017 Stationary Source Emissions – Demonstration of Equivalence of an Alternative Method with a Reference Method.

This publication is available from: https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation