Predictive Emissions Monitoring Systems (PEMS)

Technical Note

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- Christopher Smith Xodus Group
- Helen Drewery Bumi Armada
- James Shannon OPEX
- Michael Rae OPEX
- Matthew Chester Genesis
- Oliver Lever TechnipFMC

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London Office:

1st Floor, Paternoster House, 65 St Paul's Churchyard, London EC4M 8AB

Aberdeen Office:

4th Floor, Annan House, Palmerston Road, Aberdeen

info@oeuk.org.uk

www.oeuk.org.uk

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List of Abbreviations

Abbreviations	Definitions
AEL	Associated Emission Level
AST	Annual Service Test
BAT	Best Available Technique
BATc	Best Available Technique Conclusions
BRef	Best Available Techniques Reference Document
CEMS	Continuous Emissions Monitoring System
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DCS	Distributed Control System
EEMS	Environmental Emissions Monitoring System
ELV	Emission Limit Value
EN	European Standards
ESG	Environment, Social and Governance
E-PRTR	The European Pollutant Release and Transfer Register
ETS	Emissions Trading Scheme
EU	European Union
GHG	Greenhouse Gas
IED	Industrial Emissions Directive
ISO	International Organisation for Standardisation
JRC	Joint Research Centre
LCP	Large Combustion Plant
LCPD	Large Combustion Plant Directive
MCP	Medium Combustion Plant
MCPD	Medium Combustion Plant Directive
mg	Milligrams
Nm^3	Normal cubic metres
NO_x	Nitrogen Oxides
OEM	Original Equipment Manufacturer
OEUK	Offshore Energies UK
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
PEM	Predictive Emissions Monitoring

Abbreviations	Definitions
PEMS	Predictive Emissions Monitoring System
PPC	Offshore Combustion Installation (Pollution Prevention and Control) Regulations
ROM	Report on Monitoring
SRM	Standard Reference Method
UHC	Unburned hydrocarbons
UK	United Kingdom
WHRU	Waste Heat Recovery Unit

Introduction

The Predictive Emissions Monitoring (PEM) working group was conceived as a spin off from the OEUK Environmental Operators Group. The objective of the spin-off was to draw on the collective experience and knowledge of the industry stakeholders to understand the following:

- What are the drivers for PEMS?
- What is OPRED's position on PEMS?
- What would PEMS need to do?
- What are realistic timelines for implementation?

The group concluded that there are no mandatory regulatory drivers for PEMS and that compliance with the monitoring requirements for Large Combustion Plant (LCP) Chapter III of the Industrial Emissions Directive (IED) (2010/75/EU) could be achieved through routine stack sampling. A PEM system would however provide additional and complementary support for efforts to comply with the PPC permit LCP monitoring conditions and may in time reduce or replace the need for periodic sampling.

The group determined that the early adoption of PEMS had many advantages. Most notably it was unanimously agreed that the timely collation and analysis of emissions data enables action to be taken to reduce emissions in real time and maintain compliance with AEL and ELV thresholds. The adoption of a PEM system also increases the likelihood of the operator reporting any non-compliance within the stated 14-day period. Perhaps most important, the early identification of ELV breaches can limit the impact by allowing the operator to intervene and adjust operating modes and so restore compliant operations.

2 Regulatory Context

Qualifying combustion activities are regulated under the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013, as amended, collectively hereafter referred to as the PPC or the Regulations).

The Regulations implemented Council Directive 2010/75/EU concerning “industrial emissions (integrated pollution prevention and control)” (known as the Industrial Emissions Directive or IED) and Council Directive 2015/2193 concerning “the limitation of emissions of certain pollutants into the air from specific medium combustion plants” (known as the Medium Combustion Plant Directive or MCPD).

The Regulations provide separate provisions for the management of Large Combustion Plant (LCP) (including under IED Chapter 3 and the LCP BAT Reference (BREF) document), Medium Combustion Plant (MCP) and other qualifying combustion plant. Existing EU BRefs and Conclusions have been retained in UK law and thus remain valid.

2.1 Emissions Monitoring Compliance

Combustion equipment subject to the requirements of the PPC has monitoring conditions that depend on its size and use. These include:

- Schedule II IED (general applicability) Art 14(3) states that BAT conclusions shall be the reference point for setting permit conditions. Art 16(1), on monitoring requirements, specifies that monitoring requirements shall be based on BATc.[1].
- Schedule III and IV IED – special provision for LCP.
- Art 28 excludes gas turbines and gas engines for offshore platforms, which are thus regulated by the general application of BAT and BAT from Schedule II.

Equipment not captured within the relevant sections, such as MCP, requires special consideration.

[1] (Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (europa.eu))

2.2 LCP BREF BAT 4.

LCP BREF BAT 4[2] states:

> *BAT is to monitor emissions to air with at least the frequency given in Chapter 10, BAT 4 pages 740-7442 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."*

The relevant section of the table states that combustion plant should be tested for NO_x and CO to Standard Reference Methods (SRMs) once per year, hence the translation into the PPC permits conditions. A footnote to this section of the table states 'PEMS may be used instead.'

The PEMS referenced within the BRef has no stated standard associated with it. Thus far OPRED has chosen to specifically point to CEN and US-EPA standards, as referenced in Section 3.2.2 of the August 2022 monitoring guidance Rev4 issued by the OPRED.

The BATc recognises this and recommends that this is progressed as a topic. At an EU level this led to the development of a technical specification. At the time of publication this has not been adopted as a full standard.[3]

In summary, any PEMS that has been implemented for the purposes of complying with the Regulations must follow section 3.2.2 of the August 2022 monitoring guidance Rev 4.

2.3 PEMS – Wider Emissions Monitoring Benefits and BAT

IED schedule II operators are also required to demonstrate BAT as a general application.

> *BAT 1(v) - checking performance and taking corrective action, paying particular attention to:*
>
> *a) monitoring and measurement (see also the JRC Reference Report on Monitoring (ROM) of emissions to air and water from IED-installations)."*

This ROM talks to the purpose and objective of a monitoring program including:

[2] (JRC_107769_LCPBref_2017.pdf)

[3] PD CEN/TS 17198:2018 - Stationary source emissions and Predictive Emission Monitoring Systems (PEMS) - applicability, execution and quality assurance.

The objectives of monitoring are many and diverse. For example, monitoring can be applied to:

- *Assess compliance with permit requirements;*
- *Find the optimal balance between process yield, energy efficiency, resource input and emission levels;*
- *Analyse the causes of certain types of emission behavior (e.g., to detect reasons for variations in emissions under normal or other than normal operating conditions);*
- *Predict the emission behaviour of an installation, e.g., after operational conversions, operational breakdowns or an increase in capacity;*
- *Check the performance of abatement systems;*
- *Determine the relative contribution of different sources to the overall emissions;*
- *Provide measurements for safety checks;*
- *Report emissions for specific inventories (e.g. local, national and international, such as the E-PRTR);*
- *Provide data for assessing environmental impacts (e.g., for input to models, pollutant load maps, assessment of complaints); and*
- *Set or levy environmental charges and/or taxes.*

Operators and competent authorities should have a clear understanding of the objectives of monitoring before monitoring begins."

In conclusion, PEMS is an option for managing compliance with monitoring requirements. One potential benefit of PEMS is the removal of the need for annual stack monitoring. However, this depends on the OPRED accepting PEMS and the surveillance monitoring regime that is in place.

2.4 PEMS Drivers

According to the LCP BRef section 3.1.14.4.3

PEMS is used to determine the emissions concentration of a pollutant based on its relationship with a number of characteristic, continuously monitored process parameters (e.g. fuel gas consumption, air to fuel ratio) and fuel or feed quality data (e.g. the sulphur content) of an emission source […]These systems are computer-based and rely on the recording of a number of process variables, such as fuel flow, combustion temperature, ambient pressure/temperature, etc"

Monitoring many of these process variables can support compliance with PPC permit conditions and other combustion regulations, such as the UK Emissions Trading Scheme (ETS):

- Data collected from a PEMS can support the direct monitoring requirements of PPC permit conditions (Monitoring for LCP; Maintenance of Records) and may also allow for improved data quality included in the annual permit returns via EEMS (Permit Returns).

- PEMS is a technique to consider in the determination of BAT to prevent and / or reduce NOx and CO emissions for offshore installations. PEMS will also support compliance with the application of BAT to minimise emissions from offshore installations (Prevention of Pollution).
- Data collected from a PEMS may also be a useful supporting data source for validating the attribution of CO_2 emissions to sub-installations as part of an operator's ETS monitoring activity under the UK GHG Order 2020, as amended.

3 OPRED Position

OPRED published an update to the PPC Monitoring Guidance in August 2022.[4] The guidance states that:

> *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."*

OPRED has confirmed during PEMS working group meetings that it encourages the use of PEMS and will work with operators who wish to launch compliant PEMS. It is the Group's interpretation that early adoption would be welcomed by OPRED and could potentially reduce the frequency of surveillance monitoring and strengthen an operator's ability to monitor compliance. The OPRED guidance states:

> *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."*

During their attendance at PEM work group meetings, representatives of OPRED have been transparent in stating that OPRED will support operators who choose the above approach. There are a number of well-structured and time-served validation procedures that have been used worldwide, including but not limited to those under US-EPA and CEN. In the absence of a UK-mandated standard for PEMS, OPRED expects a "high level description" to be presented by operators as a starting-point for dialogue in determining an appropriate specification to meet the uncertainties required in relation to the emission limit values (ELVs) in offshore PPC permits.

OPRED is willing to consider proposals from operators and their consultants on merit. Whatever proposal is put forward, OPRED will require the methodology used in the PEMS Tools (see Section 4) to be fully transparent and open to inspection in the field.

[4] Offshore Emissions Monitoring Guidance Revision 4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1099322/PPC_Offshore_Emissions_Monitoring_Guidance_v4_Aug_2022.pdf

OPRED would also point out that the Regulations require proof that energy is being used efficiently, and a PEM system can contribute to meeting this requirement.

4 PEMS Tools

4.1 Overview

EU Implementing Decision 2021/2326 defines PEMS 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 characteristics 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)"*[5]

At its most basic, a mass balance calculation could be considered to meet the definition of a PEMS. But the systems are typically applied to emissions impacted by multiple variables with complex and sometimes unknown relationships. A mass balance approach works for emissions like SO_2 and CO_2 based on simple combustion efficiency assumptions, but for other emissions such as NOx, CO, and UHC, there are other primary dependencies (e.g. combustion temperature and combustion residence times) that are more relevant and make a mass balance approach too simplistic or not representative.

The LCPD (and its integration into IED and offshore PPC) has made the measurement of NO_x and CO the most important of the reportable emissions. Simple, first-principle estimation methods are considered suitable for all other reportable emission gases; as such, NO_x, CH_4 and CO are of most interest for PEMS applications. Other emissions may also be predicted by PEMS using similar or more straight forward calculation methods as appropriate.

4.2 Development

PEMS were initially developed to back up or replace Continuous Monitoring Systems (CEMS) owing to the high costs and low availability of CEMS and they have been in operation for some time. Their use is acknowledged within regulatory frameworks around the world including the United States, the European Union and the UK. There is a 25-year precedent for PEMS being used as part of regulatory compliance around the world, in most cases with the need for periodic verification requirements. The 2017 LCP BRef Table 7.28 recognises PEMS as a technique to consider in the determination of BAT to prevent and / or reduce NOX and CO emissions for offshore installations.

Manufacturers and vendors of combustion equipment, control and automation systems, and other specialists have developed many tools for commercial use. Open-source and plant specific solutions have also been built to meet the needs of operators.

[5] COMMISSION IMPLEMENTING DECISION (EU) 2021/2326 of 30 November 2021 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants.
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021D2326

Within the UK, a Technical Specification (PD CEN/TS 17198:2018) has been published, and adherence to the requirements allows PEMS to be certified to this standard. Note certification is required for the PEMS software itself, as well as site-specific certification for the equipment and emission type. This complex and involved specification is not currently mandated under any UK regulatory regime.

4.3 Functionality

At its most basic, a PEMS should determine estimated emissions (both concentrations and mass release) based on process sensor inputs and a defined relationship between the input and the emissions. The relationship between inputs and emission is known as the emissions model. The emission model may use simple first principle (e.g. mass balances) or empirical models (e.g. operating performance curves) or more advanced statistical or machine learning techniques.

More advanced PEMS may also contain checking and validation systems to ensure the predicted emissions values remain suitable and within defined uncertainty requirements.

This could be taken further, so that the model estimates data during periods when the input sensors fail to maintain accurate emissions predictions.

In order for the predicted emissions to be utilised, the PEMS will require a means to output or display the data. An important aspect is the generation of robust hourly, daily, monthly and annual (calendar year) averages, maxima, and totals for monitoring and reporting (M&R) purposes. These need to distinguish when the combustion plant is online (fired) and offline based on plant signals, to be meaningful and resilient.

The data may be received, calculated, stored and visualised within the same single piece of hardware/software or it may be a composite of various systems. The PEMS may perform only the calculation of emissions and hand off the data for visualisation within an external system. The user interface may be local, networked or cloud based.

To meet the requirement of PD CEN/TS 17198:2018 a PEMS must include:

- An emissions model;
- A sensor validation system (this may be extended to provide substitute data for failing sensors); and
- A method for testing the integrity of the emission model.

The emissions model predicts the emission based on input process parameters. The sensor validation system monitors the performance of each input sensor. The system detects faulty sensors considering availability, operating range, operating limits and deviation from expected values. It also raises alarm if these readings exceed specified limits. The emission model integrity test verifies that, for a known input data set, the output matches expected values. This is performed at least every 24 hours and the PEMS will alarm if the test fails.

The detailed functionality of a PEMS in order to meet PD CEN/TS 17198:2018 is outlined below:

- Reading input sensors;
- Validating input sensors;

- Providing reconciled data (optional);
- Predicting emissions;
- Writing emission data;
- Writing sensor validation data;
- Testing model integrity;
- Displaying operating status;
- Displaying sensor validation information;
- Alarming for invalid operating status, failing sensors, using reconciled sensors (where applicable), operating outside operating envelope, failing emission model integrity test;
- Prevention of unauthorised access; and
- Production of log files on PEMS modification.

Where a PEMS is not required to meet the requirements of a specific standard for compliance monitoring, for example where it will be used for routine emissions monitoring or equipment optimisation, lesser functionality may be acceptable to the user.

4.4 Emission Prediction Methods

The methods used within the emission model of a PEMS can be grouped into two main categories:

1. **Relational models: emission concentration as a function of one or more process parameters: theoretical or empirical relations that are fitted to a plant-specific emission data set;**

2. **Nonlinear statistical models: e.g. neural network models, or other multiple regression technique**

Relational models may not require data to train the model if the relationships are well understood and not influenced by installation specific factors. Nonlinear statistical models will require training data.

Deciding which is the most suitable method for predicting a given emission will depend on the knowledge and complexity of the relationship between available operating parameters and the emission, and the degree to which the required inputs are available from the plant.

4.5 Layout and visualisation

The PEMS offerings now for sale have different output data and visualisation technology.

The business requirements for the PEMS will determine what is an appropriate level of visualisation e.g. emissions awareness; compliance; plant optimisation; and emissions reduction.

Careful consideration should be given to the choice of units of measurements. Reporting requirements and legislative or business targets should determine which.

The typical PEMS outputs for offshore combustion plant emissions would contain some or all of the following;

- Predicted emission rates – concentration (mg/Nm^3 at reference O_2 levels) and mass (tonnes).
- Emission limits (annual mass allowance (tonnes), peak limits (NOx – mg/Nm at reference O_2 levels), internal business targets.
- Alarm Status e.g. above limits, invalid operating status (normal, maintenance, failure codes), failing sensors, reconciled sensors (where applicable), operating outside the operating envelope, failing the emission model integrity test.
- Displaying operating status – e.g. online, offline, alarm status, air flow performance (air bleed and guide vane position), and combustion modes (especially for combustion plant fitted with DLN/DLE).
- Displaying sensor validation information – e.g. input value, operating envelope, alarm status.
- System Key Performance Indicator Status – e.g. availability.

The user interface should allow for prevention of unauthorised access to make changes to PEMS.

Where changes are made, the system may store log files of the modification. If this is the case, they should be accessible via an interface.

4.6 Data Input Requirements

The required input data will depend upon the specific relationships between the emission and the operating parameters and the available data.

Similar data will be required for the build, validation and operating periods. The fixed data and the stack samples are required for build and validation periods only.

The input sensors should be reliable, stable and well maintained. It may be possible to predict a given emission for a specific piece of equipment using a different combination of input sensors, with differing uncertainty. This is typical where various inputs relate to the same factor influencing the emission. Both the composition of the fuel and the ratio of air to fuel may influence flame temperature and this ultimately defines the emission rate. Different emission models with different combinations of input sensors may be applied to identify the best performing model both in terms of accuracy and availability accounting for the expected sensor reliability.

Data will be fixed format data (e.g. datasheets, specifications), periodic data (i.e. measurements taken intermittently or at a defined period, typically requiring manual intervention e.g. stack samples), and continuous data (e.g. plant sensor data). The continuous plant data may come from DCS, process historian, unit control panels or other sources.

Typical data requirements for the build of a PEMS include:

Fixed data:

- OEM data for combustion equipment; datasheet, performance curves, specifications, WHRU/exhaust dimensions.
- Typical local environmental data; temperature, humidity, atmospheric pressure.

Periodic data:

- Stack sample (training / validation data).
- Fuel composition.

Continuous plant data (equipment-dependant, and much is turbine-specific):

- Fuel supply rate.
- Fuel composition.
- Fuel to air ratio.
- Combustion temperature.
- Ambient or inlet air temperature.
- Variable geometry including bleed valve position and Inlet guide vane position.
- Exhaust pressure.
- Exhaust temperatures.
- Combustion equipment output e.g. electrical load, shaft power, absorbed power, steam flow rate.

Where there are no data, the PEMS supplier must prove there is sufficient data to meet any required uncertainty during model initial build and validation.

The frequency of each input should be high enough to capture all typical excursions for the parameter.

4.7 Sampling regimes and purpose of stack sampling

PEMS using statistical or machine-learning models need training. This requires process parameters and emissions data from stack sampling. If the historic process parameters are available from periods of historic stack sampling the model may be trained and validated with these. The wider the range of operating and external conditions captured by the training set, the wider the validity of the model.

Additional stack sampling once a PEMS system is in use ensures the model remains valid. The frequency and specifics of this testing will depend on the requirements for the PEMS. To meet the certification requirements of the UK technical specification PD CEN/TS 17198:2018, the following build and validation requirements are specified.

Initial training of the PEMS model requires stack sampling by an accredited company. The data must cover all relevant operational modes and plant-external conditions affecting the emissions to be predicted. Limitations of the PEMS building data will limit the PEMS validity. The PEMS building data can be assembled using data collected during multiple time distinctive campaigns. Data for building the PEMS may also be collected during the same initial validation stack testing campaign assuring independency of data by a minimum time delay of 12 hours between sample periods or collecting data at different plant operating conditions.

Initial validation of the PEMS is required by an accredited stack testing company. Testing should run for a minimum of 30 minutes/day for three days and cover the full operating envelope of input parameters that account for at least 80% of the PEMS variation. Initial validation shall also include broader functional tests of the PEMS (i.e. equipment, checks, records) to ensure that the PEMS is correctly installed and functions correctly.

During the first year of operation of the PEMS, an extra performance test is recommended about six months after the installation. An annual system service test (AST) is recommended for checking the validity and variability. An accredited stack testing company should carry out at least five separate measurements of 30 minutes each over the course of one day, and test at least three operating levels of the key parameter that most affects emissions.

Initial field-testing requirements for certifying newly developed PEMS software are over and above the quality assurance requirements listed here. They apply to the application of an existing certified software to a specific emission type and unit.

4.8 Uncertainty and availability requirements

PEMS must adhere to any specific legislative requirements for a specific plant. Where a PEMS is not required to meet specific legislative requirements, for example where it will be used for emissions monitoring or equipment optimisation only, greater uncertainty may be acceptable to the user.

If required to be calculated, PD CEN/TS 17198:2018 is one source of guidance on potential methods for calculating PEMS uncertainty based upon:

- The standard uncertainty of the emissions model - comparing predicted values to actual emission values measured in the field;
- the standard uncertainty owing to deviations in PEMS input sensors (the uncertainty of each input sensor, the uncertainty caused by the sensor validation procedure and the sensitivity of the emission model to the uncertainty of the sensor); and
- the standard uncertainty owing to parameters not included in the PEMS. These may be extra uncertainties required for parameters not included in the PEMS.

The user may also wish to define other requirements such as availability, completeness, and sensitivity. PD CEN/TS 17198:2018 defines a required availability of greater than or equal to 95%. Completeness and sensitivity are defined by the manufacturer's specification. The US-Environmental Protection Agency provides comparable guidance with nuanced differences but provides an equally suitable alternative calculation methodology.

4.9 Opportunities to operators of early adoption

There are several methodologies that operators can use for monitoring emissions in order to be compliant. So far these have not included PEMS offshore.

There is no evidence to suggest that the adoption of PEMs will become a mandatory regulatory requirement given the variety of methodologies operators have for monitoring emissions to be compliant. It is recognised that comprehensive guidance on PEMs calculations is required for a consistent approach to compliance monitoring.

It is possible that PPC compliance will become less dependent on the mass of emissions gases released and rely more heavily on the spot concentrations of emissions to demonstrate compliance. If this is the case, continual monitoring will become essential. PEMS would be an enabler to continual compliance monitoring.

- Pre-emptive and adaptive management is critical to managing emissions. The PEMS Working Group assessed that even without regulatory approval PEMS would enable an asset to achieve greater scrutiny of minute-to-minute emissions. PEMS would also enable operators to establish "what good looks like" during specific plant operation.
- PEMS would also allow operators to monitor emissions data in real time and be more responsive to emissions spikes.
- As the requirement to provide larger volumes of high-quality auditable emissions data grows, namely for ESG reporting purposes, the necessity to have this data at hand in an auditable format is growing. PEMS would enable this.
- The monetisation of industrial emissions has already taken place for CO_2 emissions and this mechanism is only likely to grow in its utility moving forward. The breadth of combustion sources that require monitoring and the expansion of the emissions trading schemes to cover alternative emissions gases will only increase. Utilising and advancing the adoption of PEMS early on irrespective of challenges and false starts can only increase industry understanding of emissions monitoring and speed up the development of accurate and timely emissions monitoring technologies for both combusted and un-combusted emissions.
- Ultimately PEMS may, in the fullness of time, reduce the routine requirement for offshore stack sampling. This could be its most attractive feature for operators. Stack emissions monitoring would become a verification of the operators' PEMS as opposed to a basis from which compliance is sought. If combined with the use of handheld Testo 350 monitoring devices by operator personnel, the routine mobilisation of stack sampling equipment and personnel offshore could become a thing of the past. A reduction in the frequency of physical monitoring would save operators time and money while also mitigating the minor environmental impacts of additional offshore deployments. It would also go some way to alleviate commonly encountered issues operators have when mobilising stack sampling campaigns.
- The external optics of adopting a PEMS or a comparative system also demonstrates the company has laid the foundation for tightly monitoring and controlling emissions using timely and accurate data.

5 Conclusions

The group concluded that although there are clear drivers for PEMS in the LCP BRef there are no mandated regulatory requirements. Compliance with the monitoring requirements under PPC could be achieved through routine stack sampling.

The group did determine that there were multiple advantages to the early adoption of PEMs such as:

- Operators would have large volumes of high-quality, auditable emissions data to hand to use for ESG and other reporting purposes.
- Less need for routine offshore stack sampling exercises once the system build and validation is complete.
- More granular data for an operator who is at, or about to exceed limits or may be working on derogation justifications;
- and adopting a PEMS or a comparative system also shows that operators have laid the foundation for tightly monitoring and controlling emissions using timely and accurate data.

Most notably it was unanimously agreed that the timely collation and analysis of emissions data enables dynamic action to be taken to reduce emissions in real time and maintain compliance with AEL thresholds.

OPRED encourages the use of PEMs and will work with operators who wish to develop compliant PEMS and incorporate these within PPC permits as part of demonstrating compliance with permit conditions. The approach required by OPRED is outlined in the PPC monitoring guidance Rev 4 of August 2022.

OEUK.org.uk/guidelines

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OEUK.org.uk

info@OEUK.org.uk

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