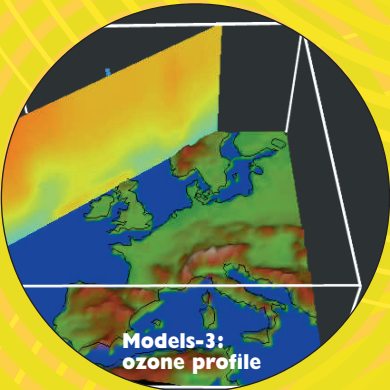




*Interim Guidance on Returning
the Large Combustion Plant
Reporting Forms
(Emissions to Air)*



by
D P Graham



JOINT ENVIRONMENTAL PROGRAMME

This report has been produced by the Joint Environmental Programme (“the JEP”) that is funded by eight of the leading electricity generators in the UK. The objective of the JEP work programme is to understand and increase knowledge of the environmental science and impacts associated with the production of electricity from coal, gas, gasoil and biomass fired power plant.

The main drivers for the programme come from the national and international legislative and regulatory initiatives which now address the full range of emissions-related impacts. The JEP takes a forward look at trends in legislative and regulatory thinking, identifies any gaps and major uncertainties in the scientific knowledge raised by such new proposals together with the modelling, data and other research requirements that arise. This ensures that the representative companies are well placed to make a constructive contribution to national and European debate from initial concepts right through to the practicalities of implementation. Close liaison is maintained, through regular meetings, with UK Regulatory bodies to ensure the correct focus for the programme and JEP members are representatives on a number of European advisory bodies.

The major areas of current activity cover:

Air Quality – the impact of power plant emissions on air quality both locally and more widely across the UK in relation to other sources.

- Pollution and Health – the relationships between atmospheric emissions from power plant and human health effects
- Pollution and the Natural Environment – effects of pollutant deposition on ecosystems
- Understanding Emissions – quantifying emission levels and assessing their significance

Compliance Monitoring – development of protocols to support application of consistent best practice in the monitoring and reporting of emissions across JEP power plants.

Aquatic Environment – impact of water usage by power plants and effects on groundwater, of chemical releases from waste material disposal, and the associated methods of assessment.

The work is undertaken either by in-house experts within the member companies or when appropriate through contracts with leading environmental consultancies and universities. To facilitate informed debate on key environmental issues related to electricity production, the results from the JEP research studies are shared externally with relevant stakeholders through external publications. There have also been more detailed monograph reviews (listed overleaf) which summarise many years of work on a specific topic.

Some Recent Reports and Publications from the JEP

External Reports

Pollution Inventory 2017 Electricity Supply Industry Methodology

Predicted and measured SO₂ concentrations presented in air quality management plan annual reviews 2001-2012

Water Use at Thermal Power Plants

Evaluation of ADMS5 for Air Quality Management Plan dispersion modelling

ESI-IED compliance protocol for utility boilers and gas turbines

Monograph Reviews

Ashes to Assets? Studies of the usefulness and environmental management of ash from coal fired power stations.

The Acid Tests? Studies of the ecological effects of atmospheric pollutants

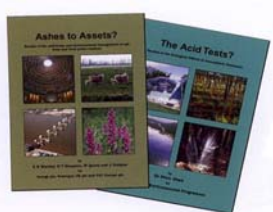
Crumbling Heritage? Studies of the effect of 'acid rain' on historic buildings

Flying Chemistry Studies of the long range atmospheric transport of pollutants

Generating Emissions? Studies of the local impact of gaseous power station emissions

Using Water Well? Studies of Power Stations and the aquatic environment

Borne on the Wind? Understanding the dispersion of power station emissions



Copies of these monographs and more details on the current JEP programme can be obtained from the JEP secretary by sending your request in an Email to jepsec@jep.website

**JEP20EMB01: INTERIM GUIDANCE ON RETURNING
THE LARGE COMBUSTION PLANT REPORTING
FORMS (EMISSIONS TO AIR)**

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Executive Summary

Reporting Forms for emissions to air from Large Combustion Plant (LCP) are hosted on the Energy UK web-site. The Reporting Forms apply from 1 January 2021 and take account of the requirements of the LCP BREF which has introduced newly monitored species for solid fuel fired plant and for plant fitted with specific NO_x abatement systems.

This interim guidance on the use of the Forms is provided in advance of the revision of the IED Compliance Protocol of the Electricity Supply Industry which provides further detail. This guidance, agreed with the UK Competent Authorities, applies to boilers and Combined or Open Cycle Gas Turbines operating within the Electricity Supply Industry and other plant as required by the UK Competent Authorities.

LCP always report annual operating hours, annual energy consumption and annual mass emissions of key pollutants.

LCP that monitor continuously with CEMS are required to report concentration averages for all of the relevant pollutants for the purpose of compliance assessment against Emission Limit Values (ELVs) that are specified for a number of different averaging periods, depending on the annual operating hours. The ELVs apply during normal operation only, excluding start-up and shut-down. There are also specific provisions for data exclusion covering abatement equipment malfunction/breakdown and black start operation.

Those pollutants that are not measured continuously at these sites are subject to periodic monitoring at a frequency that depends upon the: plant size and annual operating hours; the type of abatement process and whether or not the emissions are deemed to be sufficiently stable such that their monitoring frequency can be reduced.

LCP without CEMS are required to report concentration averages for the key pollutants based on either periodic monitoring or alternative estimation techniques.

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1 INTRODUCTION

Reporting Forms for emissions to air from Large Combustion Plant (LCP) are hosted on the Energy UK web-site: <https://www.energy-uk.org.uk/publication/272-governmentdocuments.html>.

The Reporting Forms apply from 1 January 2021, taking account of the requirements of the Large Combustion Plant Best Available Techniques Reference document (LCP BREF). This guidance is provided in advance of the revision of the IED Compliance Protocol of the Electricity Supply Industry which provides further detail. This guidance applies to LCP that are boilers or combined cycle or open cycle gas turbines (CCGT or OCGT) operating within the Electricity Supply Industry and other plant as required by the UK Competent Authorities. An LCP comprises combustion Unit(s) aggregating to $\geq 50 \text{ MW}_{\text{th}}$, not counting Unit(s) $< 15 \text{ MW}_{\text{th}}$ (net thermal input).

The Reporting Forms shall be returned in accordance with the individual permit requirements, noting the general provisions in Section 2 for compliance with Emission limit Values (ELVs). A typical reporting schedule is given in Section 3, by plant type, and this is most dependent on whether or not the plant is fitted with Continuous Emissions Monitoring Systems (CEMS). CEMS are subject to the quality assurance requirements of EN 14181, supplemented by EN 13284-2 for Dust, EN 14884 for mercury (Hg), and EN ISO 16911-2 for stack gas flow rate, as applicable. EN 14181 defines three Quality Assurance Levels: QAL1 (certification); QAL2 (calibration) and QAL3 (control). Periodic monitoring, based on stack testing, may be required instead of continuous monitoring for specified pollutants. Both CEMS calibration and periodic testing must be conducted by a test laboratory accredited to ISO 17025 for the relevant quality assurance or test method standards which are defined in the LCP BREF BAT Conclusion 4¹.

Software used for reporting purposes shall comply with the requirements of the UK Competent Authorities and any applicable CEN standards and MCERTS requirements on Data Acquisition, Handling and Storage (DAHS) systems. Thus recognising the need for a robust on-site implementation with defined procedures in the Environmental Management System for controlling the handling and reporting of emissions data. However, for the first reporting year only (2021), manual preparation and submission of reporting forms that are normally generated by the DAHS is permitted provided that they are checked for transcription errors according to site procedures.

2 GENERAL PROVISIONS

2.1 Operating Hours (Forms HR1, AR1, BD1)

Operating hours are calculated to the nearest minute from the moment the plant completes start-up to the moment the plant commences shut-down. The operating hours are first rounded to the nearest minute, e.g., 4,534 hours 33 minutes. The operating hours are then reported to two decimal places, e.g., 4,534.55 for the same example (Forms HR1 and AR1). Operating hours associated with commercial bypass operation at CCGT plant are included in the LCP annual total and are also reported separately (Form HR1).

When there are multiple combustion Units comprising a single LCP, the operating hours are counted from the moment the first unit to operate completes start-up until the moment that the

¹ In the absence of a recommended EN or ISO standard in BAT 4, a test method recommended by the Environment Agency shall be adopted: <https://www.gov.uk/government/publications/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring>

last unit to operate commences shut-down. However, Unit(s) with an ELV derogation, based on a five-year rolling average of operating hours being less than 1500 h/yr, are reported as a separate LCP. Plant with a five-year rolling average derogation must report the operating hours within the given calendar year (Forms HR1 and AR1), and also the five-year rolling average, from the derogation start date (Form HR1).

Plant that have been previously granted a formal derogation from continuous monitoring, based on 10,000 h remaining life-time, additionally report cumulative operating hours from 1 January 2016 (Form HR1).

Operating hours associated with black start operation within a calendar year are reported separately (Form HR1). Similarly, hours associated with abatement malfunction or breakdown are reported separately but as a rolling annual total (Form BD1). For each abated pollutant, an annual cap of 120h applies to abatement malfunction and an annual cap of 120h applies to abatement breakdown. These reportable hours relate only to those periods when emissions data, the inclusion of which would otherwise cause a breach of the Daily ELV, are excluded for the purposes of compliance assessment.

The Competent Authority must be notified of a period of abatement malfunction/breakdown within 48 hours, counting from mid-night on the first affected day. Similarly, the Competent Authority must be notified of a period of black start operation within 7 calendar days, counting from mid-night on the last affected day.

2.2 Plant with CEMS (Forms CON1, CON2, AR1, MF1, BD1, AQRA1, AQRA2)

The IED and the LCP BREF combined requirements generally result in the specification of ELVs for the following averaging periods: Annual, Monthly, Daily and Hourly (as an Annual 95th Percentile of hourly averages). These ELVs apply during normal operation only, excluding start-up and shut-down periods.

For gas turbines, the IED specified the normal load range to be operation > 70% of ISO base load. Under the LCP BREF, this is replaced by an 'effective dry low NO_x' (E-DLN) load point which may be lower than 70% of ISO base load. All of the required averaging periods, including the daily average, are then calculated and reported for all operation above E-DLN. Only an additional 'part load' Daily ELV then applies to all operation above the Minimum Start Up Load (MSUL), i.e., an additional daily average is calculated and reported for all operation above MSUL which includes any operation above E-DLN in that day.

Compliance with Annual ELVs begins in 2022. The Annual ELV does not apply for any year when the plant is operating < 1500 h/yr, or for any plant which has opted to operate < 1500 h/yr over a 5 year rolling average, so the Annual ELV is not then entered on the Reporting Form. However, the annual mean is always reported from 2021 onwards. These arrangements also apply to the Hourly Annual 95th Percentile ELV when there is an in-year change of the Percentile ELV (Form CON1 for boilers or Form CON2 for gas turbines).

For an in-year change of the Monthly and/or Daily ELVs, both sets of ELVs are recorded on the Reporting Form for the two periods, e.g., Period 1 from January to July and Period 2 from August to December. This facilitates compliance assessment but the reporting of the monthly mean and the maximum daily mean are unaffected (Form CON1 or CON2).

All reporting of concentration data is based on validated hourly mean concentrations excluding periods of: start-up and shut-down, malfunction or breakdown of abatement equipment and black start operation. In order for a mean concentration to be reported, a minimum qualifying

period is required as shown in Table 1. For example, in the case of hourly data, the CEMS data must be available when the plant is in normal operation for at least 40 minutes in the hour.

The valid hourly data is first obtained by applying the QAL2 calibration factors to the raw concentration data² for each pollutant and also the peripheral measurements of oxygen and water vapour (if applicable). This is followed by correction to the applicable reporting conditions (dry gas at 273.15K, 101.3 kPa at the relevant dry oxygen concentration³). The validated hourly data is obtained by subtracting the applicable Confidence Interval (Table 2), from the valid hourly data.

The reportable mean concentrations, for all averaging periods, are calculated from the validated hourly data (Form CON1 or CON2).

Table 1: DAHS Qualifying Periods

Averaging period	Qualifying period ≥	Alternative period ≥	Condition/Comment
Hour	40 m	20 m	Operational CEMS time coincident with the plant operating normally for ≥ 40 m in the hour. Shorter qualifying period for OCGT in the UK.
Day	6 h	-	For gas turbines, ≥ 6 h within the relevant load range is required for each daily average (> E-DLN and > MSUL) in the UK.
Month	72 h	3 d	An alternative, equivalent period of 3 qualifying days is allowed in the UK, i.e., 3 reportable daily averages within the month.
Year	500 h	-	Originally specified as 876h (10%) in the standard but reduced in the UK to 500 h/yr to align with LCP BREF plant categories.

During periods of malfunction or breakdown of abatement equipment, or black start operation, hourly emissions data that would cause a breach of the Daily ELV are excluded from the daily average reporting only, for the purposes of compliance assessment, and the excluded concentrations are reported separately (Form MF1 or BS1) along with an air quality risk assessment (Form AQRA1 for boilers or Form AQRA2 for gas turbines).

Validated hourly average concentrations that are excluded from compliance with the Daily ELV, due to abatement malfunction/breakdown, are reported on Form MF1 for each affected day. Similarly, those excluded hourly average concentrations associated with black start operation are reported on Form BS1. DAHS that cannot distinguish between abatement issues and black start operation may use Form MF1 to report either type of emission exclusion provided that the total black start hours are estimated and reported on Form HR1.

² QAL2 factors are applied within six weeks of receipt of the draft test report and no later than six months from the test date.

³ Boilers: Solid fuel 6% O₂; Liquid fuel and Natural Gas 3% O₂. Gas turbines (any fuel): 15% O₂.

Table 2: Confidence Intervals

Species	Confidence Interval
-	%
NO _x	20%
SO ₂	20%
Dust	30%
CO	10%
HCl	40%
HF	40%
NH ₃	40%
Hg	40%

For an abatement malfunction or breakdown, the excluded emissions data (Form MF1) and a pro-forma air quality risk assessment (Form AQRA1 or AQRA2) must be submitted to the Competent Authority within 10 calendar days counting from mid-night on the first affected day. Similarly, for black start operation, the excluded emissions data (Form BS1) and the pro-forma air quality risk assessment, must be submitted to the Competent Authority within 14 calendar days, counting from mid-night on the last affected day.

When required, annual mass emissions are determined by summing, across the year, the product of the valid hourly mean concentration (mg/m³) multiplied by the hourly mean stack gas flow rate expressed at the same reporting conditions (m³/h). The total is divided by 10⁹ in order to obtain tonnes (Form AR1). When the stack gas flow rate is measured directly, QAL2 factors must first be applied to the raw flow data. When the stack gas flow rate is calculated from the plant thermal input, QAL2 factors are not applied but the calculated flow rate must be verified by passing the QAL2 Variability test and the AST Validity test (both tests are performed using the corrected QAL2 flow data at the reporting conditions). These tests are defined in EN 14181 and EN ISO 16911-2.

2.3 Plant without CEMS (Forms PM1, PM2, PM3, PM4, AR1)

Periodic monitoring requires consecutive triplicate tests to be performed by a test laboratory accredited to ISO 17025 for the relevant test method. The individual results and their average are recorded on the relevant Form. However, if the individual test duration needs to be extended in order to improve the quality of the measurements at very low concentration levels, fewer tests of longer duration may be agreed with the Competent Authority. The Confidence Interval is not subtracted from the average of the test results which is compared directly with the applicable ELV. However, when assessing compliance, the Competent Authority takes into account the measurement uncertainty reported by the test laboratory, also recorded on the Reporting Form, up to a maximum value that is acceptable to the Competent Authority⁴ (Forms PM1 to PM4).

Alternative monitoring arrangements⁵ are based on agreed concentration values or emission factors and the calculated results are recorded on the same periodic monitoring Reporting Forms.

When the emission factor, E, is mass specific, the equivalent emission concentration, C, can be calculated as follows: $C \text{ (mg/m}^3\text{)} = E \text{ (kg/t)} * 10^6 \text{ (mg/kg)} / F \text{ (m}^3\text{/t)}$. The flue gas volume

⁴ <https://www.gov.uk/guidance/monitoring-stack-emissions-maximum-uncertainty-values-for-periodic-monitoring#uncertainties-table>.

⁵ Typically agreed for emergency plant and non-emergency plant, put into operation no later than 27 November 2003, operating < 500 h/yr. Also for plant with an IED 10,000 h remaining life derogation.

conversion factor, F, is given in Table 3 and, for solid fuels, this assumes that E is given in kg of pollutant per tonne (as received basis).

When the Emission Factor is energy specific, the equivalent emission concentration, C, can be calculated as follows: $C \text{ (mg/m}^3\text{)} = E \text{ (mg/MJ)} / F \text{ (m}^3\text{/MJ)}$. The flue gas volume conversion factor, F, is given in Table 4. The biomass factor, at 6% O₂, can be interpolated from the values given in Table 4 using the annual average biomass moisture content, noting that biomass at 20% and 10% fuel moisture content (by mass, as received) has fuel factors of 0.364 and 0.357 m³/MJ, respectively.

Table 3: Flue Gas Conversion Factors

Fuel	6 %O ₂ m ³ /t	3 %O ₂ m ³ /t	15 %O ₂ m ³ /t
Coal	9000	-	-
Biomass	6500	-	-
Oil	14400	12000	36000
Natural Gas	15600	13000	38500

When required, annual mass emissions are usually determined by multiplying the average annual periodic test result (mg/m³) by the annual stack gas emitted volume (m³). This is divided by 10⁹ in order to obtain tonnes⁶ (Form AR1). The total stack gas volume is normally calculated from the applicable fuel factor (Table 4) multiplied by the total annual thermal input (MJ). In turn, the annual thermal input is given by the total annual fuel consumption (kg) multiplied by the average Net Calorific Value (MJ/kg)⁷.

When an alternative approach is used instead of periodic monitoring, the same approach can be applied to the estimation of mass emissions. That is, the reported concentration is multiplied by the annual stack gas emitted volume. Alternatively, the emission factor may be multiplied by the annual energy consumption in order to obtain the same result, for example:

$$\text{annual mass emission (tonnes)} = \text{emission factor (mg/MJ)} * \text{annual energy consumed (MJ)} / 10^9$$

Emission Factors are given in the UK Pollution Inventory methodology. However, for convenience, the agreed emission concentrations of SO₂ and Dust are also shown in Table 5 for natural gas and gas oil combustion for both boilers (3% O₂) and gas turbines (15% O₂). SO₂ emissions are based on the sulphur content of the fuel and are given for both odorised and un-odorised natural gas in Table 5. The maximum sulphur content of gas oil (0.1% by mass) is used to estimate the SO₂ concentration from gas oil fired plant. However, the measured sulphur content of the fuel may instead be used for reporting purposes.

Table 4: Flue Gas Fuel Factors

m ³ /MJ at 273.15K, 101.3 kPa at:	0% O ₂	3% O ₂	6% O ₂	15% O ₂
Coal	0.256	-	0.359	-
Heavy Fuel Oil	0.248	0.289	0.348	-
Gas Oil	0.244	0.285	0.342	0.859
Natural Gas	0.240	0.280	0.336	0.845
m ³ /MJ at 6% O ₂ dry at fuel moisture:	30% M	40% M	50% M	60% M
Biomass	0.374	0.387	0.406	0.440

⁶ For mercury concentration in µg/m³, divide by 10¹² instead of 10⁹.

⁷ Or m³ natural gas multiplied by the Net Calorific Value in MJ/m³ provided that the volume reference conditions are the same for both the fuel consumption and calorific value, i.e., both at 15°C or both at 0°C (at 101.3 kPa).

Filterable Dust emissions from non-sooting natural gas fired combustion systems can be assumed to be zero whilst those from non-sooting gas oil fired combustion can be based on the maximum ash content of the fuel, as shown in Table 5. Older gas oil fired black start gas turbines at power stations (Olympus and Avon variants) cannot be assumed to be non-sooting and higher factors are required to estimate their total Dust emissions.

Table 5: Natural Gas and Gas Oil Emissions

Fuel	SO ₂		Dust	
	3% O ₂	15% O ₂	3% O ₂	15% O ₂
Natural Gas (unodorised)	0.27	0.09	-	-
Natural Gas (odorised)	0.73	0.24	-	-
Gas Oil	165	55	7.2	2.4

3 TYPICAL REPORTING SCHEDULE

A summary of the Reporting Forms is given in Table 6. Typical requirements are listed below noting that the permit shall be referred to for the individual LCP reporting requirements and the required return dates.

Every LCP is required to return the following forms:

- HR1 Annual operating hours, including CCGT commercial bypass and black start operation
- AR1 Annual energy input and total annual mass emissions of NO_x, SO₂ and Dust
- REM1 Annual Resource Efficiency Metrics (energy consumption and production; water consumption and discharge; waste disposal and recovery)

Every LCP without CEMS⁵ is required to return the following forms:

- PM1 Six-monthly⁸ periodic or alternative monitoring results for NO_x, SO₂, Dust, CO (as required)⁹

Every LCP with CEMS is required to return the following forms:

- CON1 Quarterly emission concentrations: Boilers report NO_x, SO₂¹⁰, Dust, CO¹¹, HCl¹², NH₃¹³
- CON2 Quarterly emission concentrations: Gas Turbines report NO_x and CO
- CEM1 CEMS invalidity log (by exception if the CEMS invalidity is > 10 days/yr)¹⁴

⁸ May be specified as six months of operating hours (4380 h), or two years, whichever is shorter.

⁹ Generally, NO_x and CO for gas-fired plant, additionally SO₂ and Dust for oil and solid fuel fired plant.

¹⁰ Oil fired plant without SO₂ abatement may instead report SO₂ based on three-monthly periodic monitoring results or, for fuel with a known sulphur content, an alternative approach based on fuel sulphur, by agreement with the Competent Authority.

¹¹ When an ELV is specified.

¹² Continuous HCl monitoring is required for biomass fired plant. Six monthly periodic monitoring is instead required when the Competent Authority regards the emissions as being 'sufficiently stable'. Six monthly periodic monitoring is instead required for plant < 100 MW_{th}, operating < 1500 h/yr. Annual periodic monitoring is instead required for plant < 100 MW_{th}, operating < 500 h/yr.

¹³ Continuous NH₃ monitoring is required for SCR and SNCR NO_x abatement processes only. Six monthly periodic monitoring is instead required for plant < 100 MW_{th}, operating < 1500 h/yr. For SCR only, annual periodic monitoring instead applies when the Competent Authority regards the emissions as being 'sufficiently stable'.

¹⁴ An 'invalid' day occurs when the CEMS are not able to report > 3h within the day during plant operation. However, all of the valid data from within that day are used when determining the reportable daily average and for all other averaging periods.

Every LCP with emissions abatement systems additionally returns:

- BD1 Quarterly return of cumulative annual rolling Malfunction and Breakdown (M&B) hours
- MF1 Return of M&B excluded emissions concentrations (by exception)
- AQRA1/2 Return of M&B Air Quality Risk Assessment (by exception)
- PM2 Six Monthly¹³ or Annual¹³ periodic monitoring results for NH₃ (SCR or SNCR NO_x abatement)
- PM2 Annual periodic monitoring results for SO₃ (SCR NO_x abatement only)

Every LCP with a Black Start capability and CEMS additionally returns:

- BS1 Black Start excluded emissions concentrations (by exception)
- AQRA1/2 Black Start Air Quality Risk Assessment (by exception)

Every biomass fired LCP additionally returns:

- PM2 Annual periodic monitoring results for HF
- PM2 Six Monthly¹² or Annual¹² periodic monitoring results for HCl (if not measured continuously)
- PM3 Annual periodic monitoring results for Hg and trace metals

Every LCP with coal firing (utility boiler) additionally returns:

- PM2 Quarterly or Annual¹⁵ periodic monitoring results for HF (when operating ≥ 500 h/yr)
- PM2 Quarterly or Annual¹⁵ periodic monitoring results for HCl (when operating ≥ 500 h/yr)
- PM3 Annual periodic monitoring results for trace metals
- PM4 Annual¹⁵ periodic monitoring results for Hg (when operating ≥ 500 h/yr)
- FUEL1 Quarterly return of monthly mean coal Hg, Cl and F contents (when operating ≥ 500 h/yr)
- OR
- FUEL2 Annual return of coal Hg, Cl and F contents (when operating < 500 h/yr)

¹⁵ Annual periodic monitoring when the Competent Authority regards the emissions as being 'sufficiently stable'.

Table 6: IED/LCP BREF Reporting Forms

Permit Reference	Title
IED/LCPBREF HR1	ANNUAL OPERATING HOURS RETURN
	For each LCP: Annual operating hours. For each LCP with a Limited Lifetime Derogation or a 10,000h monitoring derogation: cumulative operating hours from 1 Jan 2016. For each Unit or LCP with an IED Annex V or LCP BREF 1,500 h/yr provision: annual operating hours (from entry month in first year and 1 January in subsequent years) and five year running average from entry month. For a combined cycle gas turbine that operates with a bypass stack in normal operation, the bypass hours during normal operation are included in the plant hours but are also reported separately. Total hours of excluded emissions data, relating to forced operation in support of Black Start Events, is also recorded on this form. This is the sum of excluded hours relating to all submissions of Form LCPBREF BS1 within the reporting year or, when these emissions are aggregated within Form IED/LCPBREF MF1, a manual estimate of Black Start hours within the calendar year.
IED/LCPBREF AR1	ANNUAL RETURN OF ENERGY INPUT AND TOTAL EMISSIONS
	IED Article 72 Inventory: annual energy and annual mass emissions return. Annual declaration of rated thermal input. (For information only since this form is owned and updated by the Environment Agency)
IED/LCPBREF CON1/2	QUARTERLY RETURN: MONTHLY MEAN, MAXIMUM DAILY MEAN, ANNUAL MEAN AND ANNUAL PERCENTILE CONCENTRATIONS
	Continuous monitoring results. Quarterly return for each LCP (noting that Unit(s) with a 1,500h provision under either the IED or the LCP BREF are regarded as a separate LCP). Validated concentration data: Monthly mean; Maximum Daily mean within month; Annual mean, for plants with an Annual ELV, and Annual 95th percentile of hourly means. Version 1 (IED/LCPBREF CON1) Utility Boilers; Version 2 (IED/LCPBREF CON2) Gas turbines.
IED/LCPBREF PM1	PERIODIC MONITORING RESULTS (AS REQUIRED)
	Periodic monitoring return (e.g., six monthly NO _x , SO ₂ , Dust or CO test results) or Alternative monitoring return (as agreed by the Competent Authority). Required when these species are not monitored continuously and at the frequency specified by the Permit.
IED/LCPBREF PM2	PERIODIC MONITORING RESULTS (AS REQUIRED)
	Periodic monitoring return for HCl and HF for solid fuel fired boilers, operating ≥ 500 h/y, for compliance assessment, typically quarterly or annual monitoring. Periodic monitoring return for NH ₃ and SO ₃ for plants fitted with Non-Selective or Selective Catalytic Reduction (SNCR/SCR), typically annual monitoring.
IED/LCPBREF PM3	PERIODIC MONITORING RESULTS (AS REQUIRED)
	Periodic monitoring return for trace metals, and mercury, for solid fuel fired boilers operating ≥ 500 h/y. Typically annual monitoring. For coal fired boilers subject to 'sufficiently stable' monitoring provisions, periodic mercury monitoring is reported on Form PM4.
IED/LCPBREF PM4	ANNUAL RETURN OF MERCURY RETENTION FACTOR RESULTS
	Annual return for coal fired plants subject to sufficiently stable emissions criteria, operating ≥ 500h/y. Periodic flue gas monitoring results are combined with the fuel mercury contents to give calculated Retention Factors. These R values are adjusted, to give a maximum possible Retention Factor, R _{max} , using the uncertainties of the flue gas and fuel Hg measurements. If the average R _{max} is greater than the Declared Retention Factor then a re-test is required or the Declared Retention Factor and the fuel Hg limit are updated to the measured R value.
IED/LCPBREF FUEL1	QUARTERLY RETURN: MONTHLY MEAN HALOGEN AND MERCURY 'AS RECEIVED' FUEL CONCENTRATION
	Quarterly return for each coal fired LCP, subject to sufficiently stable emissions criteria, for the demonstration of sufficiently stable emissions and, for mercury, compliance assessment. Contains Monthly average mercury, chlorine and fluorine contents of the fired fuel.
IED/LCPBREF FUEL2	ANNUAL RETURN OF FUEL BASED MONITORING APPROACH (< 500h/y only)
	Annual return for each coal fired LCP operating < 500 h/y. Contains Annual average mercury, chlorine and fluorine contents of fired fuel and the associated calculated flue gas concentrations.
IED/LCPBREF BD1	QUARTERLY RETURN OF CUMULATIVE ANNUAL ROLLING MALFUNCTION AND BREAKDOWN HOURS
	For each LCP fitted with abatement, return the cumulative Malfunction and Breakdown hours as a rolling average (12 monthly period) that is updated on a monthly basis.
IED/LCPBREF MF1	RETURN OF MALFUNCTION AND BREAKDOWN DATA (AS REQUIRED)
	Validated concentration data for each day affected by Malfunction or Breakdown.
IED/LCPBREF BS1	RETURN OF BLACK START DATA (AS REQUIRED)
	Validated concentration data for each day affected by Black Start running.
IED/LCPBREF AQRA1	AIR QUALITY RISK ASSESSMENT FOR OTNOC - UTILITY BOILERS (AS REQUIRED)
	Basic air quality risk assessment for valid concentration excursions related to Other Than Normal Operating Conditions (Malfunction/Breakdown or Black Start running). Select pollutants from: SO ₂ ; NO ₂ ; Dust.
IED/LCPBREF AQRA2	AIR QUALITY RISK ASSESSMENT FOR OTNOC - GAS TURBINES (AS REQUIRED)
	Basic air quality risk assessment for valid concentration excursions related to Other Than Normal Operating Conditions (Malfunction/Breakdown or Black Start running). Select pollutants from: NO ₂ ; CO.
IED/LCPBREF REM1	ANNUAL RETURN OF RESOURCE EFFICIENCY METRICS
	Energy consumption and production; water consumption and discharge; waste disposal and recovery.
IED/LCPBREF CEM1	CONTINUOUS EMISSIONS MEASUREMENT SYSTEMS (CEMS) INVALIDITY LOG
	This form is submitted in the event that the CEMS unavailability exceeds 10 days in a given calendar year.

4 SUMMARY

All Large Combustion Plant (LCP) are required to report annual operating hours, annual energy consumption and annual mass emissions of key pollutants (NO_x, SO₂ and Dust), in addition to various other metrics associated with energy and water consumption and waste disposal. The LCP BREF has introduced newly monitored species for solid fuel fired plant (HCl, HF, Hg and trace metals) and for plant fitted with SCR or SNCR NO_x abatement systems (NH₃ and SO₃).

LCP that monitor continuously with CEMS are required to report concentration averages for all of the relevant pollutants for the purpose of compliance assessment against Emission Limit Values (ELVs) that are specified for a number of different averaging periods, depending on the annual operating hours. The ELVs apply during normal operation only, excluding start-up and shut-down. There are also specific provisions for data exclusion covering abatement equipment malfunction/breakdown and black start operation.

Those pollutants that are not measured continuously at these sites are subject to periodic monitoring at a frequency that depends upon the: plant size and annual operating hours; the type of abatement process and whether or not the emissions are deemed to be sufficiently stable such that their monitoring frequency can be reduced. Coal fired LCP also regularly report the coal mercury, chlorine and fluorine contents in order to demonstrate that the emissions are sufficiently stable.

LCP without CEMS are required to report concentration averages for the key pollutants based on either periodic monitoring or alternative estimation techniques.