Environment Agency

Review of an Environmental Permit for an Installation subject to Chapter II of the Industrial Emissions Directive under the Environmental Permitting (England & Wales) Regulations 2016

Decision document recording our decision-making process following review of a permit

The Permit number is: EPR/HP3939LN
The Operator is: Medway Power Limited
The Installation is: Medway Power Station
This Variation Notice number is: EPR/HP3939LN/V004

What this document is about

Article 21(3) of the Industrial Emissions Directive (IED) requires the Environment Agency to review conditions in permits that it has issued and to ensure that the permit delivers compliance with relevant standards, within four years of the publication of updated decisions on best available techniques (BAT) conclusions.

We have reviewed the permit for this installation against the revised BAT Conclusions for large combustion plant published on 17th August 2017. This is our decision document, which explains the reasoning for the consolidated variation notice that we are issuing.

It explains how we have reviewed and considered the techniques used by the Operator in the operation and control of the plant and activities of the installation. This review has been undertaken with reference to the decision made by the European Commission establishing best available techniques (BAT) conclusions ('BAT Conclusions') for large combustion plant as detailed in document reference IEDC-7-1. It is our record of our decision-making process and shows how we have taken into account all relevant factors in reaching our position. It also provides a justification for the inclusion of any specific conditions in the permit that are in addition to those included in our generic permit template.

As well as considering the review of the operating techniques used by the Operator for the operation of the plant and activities of the installation, the consolidated variation notice takes into account and brings together in a single document all previous variations that relate to the original permit

issued. It also modernises the entire permit to reflect the conditions contained in our current generic permit template.

The introduction of new template conditions makes the Permit consistent with our current general approach and philosophy and with other permits issued to installations in this sector. Although the wording of some conditions has changed, while others have been removed because of the new regulatory approach, it does not reduce the level of environmental protection achieved by the Permit in any way. In this document we therefore address only our determination of substantive issues relating to the new BAT Conclusions.

This is our record of our decision-making process and shows how we have taken into account all relevant factors in reaching our position.

We try to explain our decision as accurately, comprehensively and plainly as possible. We would welcome any feedback as to how we might improve our decision documents in future. A lot of technical terms and acronyms are inevitable in a document of this nature: we provide a glossary of acronyms near the front of the document, for ease of reference.

How this document is structured

Glossary of acronyms used in this document

(Please note that this glossary is standard for our decision documents and therefore not all these acronyms are necessarily used in this document.)

APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEEL	BAT Associated Energy Efficiency Level
BAT-AEL	BAT Associated Emission Level
BATc	BAT conclusion
BREF	Best available techniques reference document
CCGT	Combined Cycle Gas Turbine
CEM	Continuous emissions monitor
CHP	Combined heat and power
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DLN	Dry Low NOx burners
DLN-E	Dry Low NOx effective
EIONET	European environment information and observation network is a partnership network of the European Environment Agency
ELV	Emission limit value derived under BAT or an emission limit value set out in IED
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No. 1154)
EWC	European waste catalogue
FSA	Food Standards Agency
IC	Improvement Condition
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
LCP	Large Combustion Plant subject to Chapter III of IED
MSUL/MSDL	Minimum start up load/minimum shut-down load
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
NPV	Net Present Value
PHE	Public Health England
SAC	Special Area of Conservation
SGN	Sector guidance note
TGN	Technical guidance note
TNP	Transitional National Plan
TOC	Total Organic Carbon
WFD	Water Framework Directive (2000/60/EC)

1 Our decision

We have decided to issue the consolidated variation notice to the Operator. This will allow it to continue to operate the Installation, subject to the conditions in the consolidated variation notice.

We consider that, in reaching that decision, we have taken into account all relevant considerations and legal requirements and that the varied permit will ensure that a high level of protection is provided for the environment and human health.

The consolidated variation notice contains many conditions taken from our standard Environmental Permit template including the relevant Annexes. We developed these conditions in consultation with industry, having regard to the legal requirements of the Environmental Permitting Regulations and other relevant legislation. This document does not therefore include an explanation for these standard conditions. Where they are included in the Notice, we have considered the techniques identified by the operator for the operation of their installation, and have accepted that the details are sufficient and satisfactory to make those standard conditions appropriate. This document does, however, provide an explanation of our use of "tailor-made" or installation-specific conditions, or where our Permit template provides two or more options.

2 How we reached our decision

2.1 Requesting information to demonstrate compliance with BAT Conclusions for Large Combustion Plant

We issued a Notice under Regulation 61(1) of the Environmental Permitting (England and Wales) Regulations 2016 (a Regulation 61 Notice) on 1st May 2018 requiring the Operator to provide information to demonstrate how the operation of their installation currently meets, or will subsequently meet, the revised standards described in the large combustion plant BAT Conclusions document. The Notice also required that where the revised standards are not currently met, the operator should provide information that:

- Describes the techniques that will be implemented before 17th August 2021, which will then ensure that operations meet the revised standard, or
- Justifies why standards will not be met by 17th August 2021, and confirmation of the date when the operation of those processes will cease within the installation or an explanation of why the revised BAT standard is not applicable to those processes, or
- Justifies why an alternative technique will achieve the same level of environmental protection equivalent to the revised standard described in the BAT Conclusions.

Where the Operator proposed that they were not intending to meet a BAT standard that also included a BAT Associated Emission Level (BAT AEL) described in the BAT Conclusions Document, the Regulation 61 Notice requested that the Operator make a formal request for derogation from compliance with that AEL (as provisioned by Article 15(4) of IED). In this circumstance, the Notice identified that any such request for derogation must be supported and justified by sufficient technical and commercial information that would enable us to determine acceptability of the derogation request.

The Regulation 61 Notice response from the Operator was received on 1st November 2018.

We considered that the response did not contain sufficient information for us to commence the permit review. We therefore issued a further information request to the Operator on 31/10/2019 and 25/02/20. Suitable further information was provided by the Operator on 29/11/19 and 03/03/20.

We have not received any information in relation to the Regulation 61 Notice response that appears to be confidential in relation to any party.

2.2 Review of our own information in respect to the capability of the installation to meet revised standards included in the BAT Conclusions document

Based on our records and previous regulatory activities with the facility we have no reason to consider that the operator will not be able to comply with the conditions that we include in the permit.

In relation to BAT Conclusion 4 we agree with the operator in respect to their current stated capability as recorded in their Regulation 61 Notice response that improvements are required so that the requirements of the BAT Conclusion are delivered by 17 August 2021. This is discussed in more detail in the key issues section and/or in the decision checklist regarding relevant BAT Conclusions.

3 The legal framework

The consolidated variation notice will be issued under Regulation 20 of the EPR. The Environmental Permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* as described by the IED;
- subject to aspects of other relevant legislation which also have to be addressed.

We consider that the consolidated variation notice will ensure that the operation of the Installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

4 The key issues

The key issues arising during this permit review are:

- Emissions to air and the emission limits applied to the plant.
- The energy efficiency levels associated with the Best Available Techniques (BAT-AEELs)
- Effective Dry Low NO_x point.
- Characterisation of fuel - gas turbines operating on gas oil

We therefore describe how we determined these issues in most detail in the relevant sections of this document.

4.1 Emissions to air and the emission limits applied to the plant

A number of general principles were applied during the permit review. These included:

- The upper value of the BAT AELs ranges specified were used unless use of the tighter limit was justified.
- The principle of no backsliding where if existing limits in the permit were already tighter than those specified in the BREF, the existing permit limits were retained.
- Where a limit was specified in both IED Annex V and the BAT Conclusions for a particular reference period, the tighter limit was applied and in the majority of cases this was from the BAT Conclusions.
- Where AELs are indicative in the BAT Conclusions, these were applied unless adequate justification was provided by the operator to demonstrate that an alternative limit was more appropriate.
- For gas turbines where the IED specified that limits applied over 70% load and the BAT Conclusions specified that AELs applied when dry low NOx is effective (DLN-E), we have used DLN-E as a default across all monitoring requirements for NOx and CO.

The LCPs on site consist of LCP 218 a 755MWth combined cycle gas turbine (CCGT) and LCP 219 a 755 MWth CCGT.

The plant was put into operation before IED came into force and therefore the existing limits in the permit are from Part 1 of IED Annex V applicable to existing plant.

The ELVs and AELs are based on the following operating regime:

- Unlimited hours operation
- >600MWth input; and
- <75% efficiency.

The following tables outline the limits that have been incorporated into the permit for LCP218 and LCP 219, where these were derived from and the reference periods at which they apply. The emission limits refer to concentrations, expressed as mass of emitted substance per volume of flue-gas under the following standard conditions: dry gas at a temperature of 273,15 K, pressure of 101,3 kPa and 15% volume reference oxygen concentration of flue gases. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit.

An additional daily limit from start up/shut down to baseload has been added to the post BREF implementation table S3.1a. Although this is not a regulatory requirement, it was requested by the Emissions Methodology Working Group of the Joint Environmental Protocol to ensure consistency across the sites.

Annex V of IED states that the ELVs apply from 70% to baseload for gas turbines. As this site already complies with the limits from the end of start up to baseload we have not amended the references in table S3.1 as the limits are applicable at the end of start up which is equivalent to 35% load and therefore already compliant with IED.

The Operator is under the Transitional National Plan (TNP) route. By the end of the TNP on 30 June 2020, as a minimum plant must meet the limits set out in Annex V of the Industrial Emission Directive subject to BAT assessment and the principle of no backsliding. From the implementation date of the BAT Conclusion in 2021 the relevant AELs will also apply.

NOx limits (mg/Nm^3) when firing on gas							
Averaging	**Current under TNP**	**IED (Annex V Part 1)**	**BREF (Table 24 BAT-c)**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	None	40	40	BREF	E-DLN	Continuous
Monthly	50	50	None	50	IED	E-DLN	
Daily	50	50	50	50	BREF/Existing	E-DLN	
95th %ile of hr means	100	100	None	100	IED	E-DLN	

Annual NOx limit has been set as 40 mg/Nm^3. This has been set based upon an energy efficiency figure of 54.2%.

Daily NOx limit has been set as 50 mg/Nm3 for MSUL/MSDL to baseload and we accept that this is appropriate for this type of plant.

The monthly emission limit of 50 mg/m^3 was already set so that there is no backsliding in emission limits this has been retained in the permit.

CO limits (mg/Nm^3) when firing on Gas							
Averaging	**Current**	**IED (Annex V Part 1) - Existing**	**BREF (after Table 24 BAT-c)**	**Expec-ted permit limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	None	30	50	Aligned to Monthly	E-DLN	Continuous
Monthly	50	50	None	50	Current/ No backsliding rule	E-DLN	
Daily	50	55	None	50	Current/ No backsliding rule	E-DLN	
95th %ile of hr means	100	100	None	100	IED	E-DLN	

The operator has requested an annual emission limit for emissions of CO of 100 mg/m^3. This is higher than the indicative BAT-AEL of 30 mg/m^3. The operator has provided a justification based on the technical characteristics of the installed GE gas turbines. We consider the technical justification provided is adequate but on the basis of no backsliding we have set the annual emission limit for CO at 50 mg/m^3 in the revised and consolidated permit. See section 4.3 for more details.

LCP 218 and LCP219 – Firing on gas oil

The operator normally uses gas and has applied to retain the of use gas oil as an alternative fuel. Condition 2.3.6 allows gas oil to be used for periods of up to 10 days during times of interruption to the gas supply.

Joint Environmental Programme (JEP) produced a document 'BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year' dated October 2018. The content of this document has been agreed in principle by the Environment Agency and we have therefore taken the document into account during our determination of this variation.

There are no BAT AEL's for NO_2 or CO and the current limits have been retained. In line with table 22 of BAT Conclusion 36 for existing plants operated < 500 h/yr we have set indicative BAT AEL's in Table 22 for SO2 and dust.

The existing permit sets a dust limit of 20 mg/m^3 when operating on distillate fuel, we have reduced this to 10 mg/m^3 in the new permit. Continuous dust monitoring (for >100MWth plant) has been required when oil firing, and to be reported as a daily mean of validated hourly averages.

4.2 The energy efficiency levels associated with the Best Available Techniques Conclusions

An energy efficiency level associated with the best available techniques (BAT-AEEL) refers to the ratio between the combustion unit's net energy output(s) and the combustion unit's fuel/feedstock energy input at actual unit design. The net energy output(s) is determined at the combustion unit boundaries, including auxiliary systems (e.g. flue-gas treatment systems), and for the unit operated at full load.

The table below sets out the BAT-AEELs specified in the LCP BAT Conclusions for the large combustion plant on the site and the energy efficiency levels confirmed through the Regulation 61 notice response. The evidence provided to demonstrate that the AEELs are met was in the form of the guarantee of performance test reports for the 2 gas turbines undertaken in 2016, Report “Medway: Baseload Output and Efficiency Benchmark March 2016 Technical Note No: TN-GEN-AM-COMM-477-019 issued 12/04/2016”. We consider this plant is BAT in relation to the AEELs.

BAT AEELs (%)			Plant efficiency (%)		
Net electrical efficiency	**Net total fuel utilisation**	**Net mechanical efficiency**	**Net electrical efficiency**	**Net total fuel utilisation**	**Net mechanical efficiency**
LCP218: >=600 MWth CCGT – existing plant					
50-60	None	None	54.2%	NA	NA
LCP219: >=600 MWth CCGT- existing plant					
50-60	None	None	54.2%	NA	NA

BAT-associated energy efficiency levels (BAT-AEELs) for gas-oil-fired gas turbines

Table 21 of the LCP BAT Conclusions specifies that the BAT-AEELs for this type of plant are not applicable to plant operating less than 1500 hours per year.

4.3 Effective Dry Low NO_x point.

The operator provided Dry Low NO_x (DLN) curves for NO_x and CO. The eDLN point put forward by the operator was 90MW, 35%. We requested the operator justify retention of their current ELV's for CO for LCP 218 and 219 of 100 mg/m3 as the curves suggested a lower limit was possible. The operator provided the following response on 03/03/20 to our request.

At Medway the combustion gas is preheated prior to firing in the combustion turbines; this is a major factor in reducing NOx emissions. Ambient conditions also play a role in NOx formation with higher winter emissions due to lower temperatures. This requires that combustion turbines are tuned to optimise their performance to deal with ambient conditions and to protect downstream assets e.g. the heat recovery steam generator (HRSG). Due to the extreme variation in heating and cooling rates, the temperature of the exhaust gas entering the HRSG can lead to metal fatigue and asset failure resulting in downtime to complete necessary repairs. CO levels are highly susceptible to the tuning process with the potential for significant increases in the exhaust gas in contrast to NOx levels which are relatively stable. When tuning it is essential that Medway has the latitude to operate and protect its assets, whilst meeting its environmental obligations.

4.4 Fuel characterisation -BAT Conclusion 9

BAT 9 requires the operator to carry out fuel characterisation. We consider that for plants which burn natural gas from the National Grid as a fuel that it is not necessary for the operator to replicate the testing carried out by the National Grid. Where gas oil is used as a standby fuel then BAT 9 would apply.

We have therefore incorporated the Joint Environmental Programme (JEP) report – 'Characterisation of power plant fuels for compliance with LCP BREF Conclusion BAT 9' issued October 2019 into table S1.2 of the permit. This document sets out how this will be carried out prior to the implementation date for the BAT Conclusions.

The Operator confirmed in their response received 04/06/2020, that they will adhere to the requirements of this BAT Conclusion through application of the JEP report.

5 Decision checklist regarding relevant BAT Conclusions

BAT Conclusions for large combustion plant, were published by the European Commission on 17th August 2017. There are 75 BAT Conclusions. Only the BAT Conclusions relevant to the particular fuel type used on site have been replicated below.

This annex provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This annex should be read in conjunction with the Consolidated Variation Notice.

The conditions in the permit through which the relevant BAT Conclusions are implemented include but are not limited to the following:

BAT Conclusion requirement topic	Permit condition(s)	Permit table(s)
Environmental Management System	1.1.1	S1.2
BAT AELs	3.1.1 and 3.5.1	S3.1a
Monitoring	2.3, 3.5 and 3.6	S1.2, S1.4, S1.5 and S3.1a
Energy efficiency	1.2 and 2.3	S3.4
Noise	3.4 and 2.3	S2.1
Other operating techniques	1.2	S1.2

The overall status of compliance with the BAT conclusion is indicated in the table as:

NA Not Applicable
CC Currently Compliant
FC Compliant in the future (within 4 years of publication of BAT conclusions)
NC Not Compliant
PC Partially Compliant

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
General			
1	**In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:** i. commitment of the management, including senior management; ii. definition of an environmental policy that includes the continuous improvement of the installation by the management; iii. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; iv. implementation of procedures (a) Structure and responsibility (b) Training (c) Communication (d) Employee involvement (e) Documentation (f) Efficient process control (g) Maintenance programmes (h) Emergency preparedness and response (i) Safeguarding compliance with environmental legislation v. checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (see also the Reference Document on the General Principles of Monitoring) (b) corrective and preventive action (c) maintenance of records (d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; vi. review of the EMS and its continuing suitability, adequacy and effectiveness by senior management; vii. following the development of cleaner technologies; viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life; viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life;	CC	EMS in place registered to ISO 14001:2015, this standard meets the requirements of the BAT 1. Its scope and nature is appropriate to the Medway installation and its range of environmental impacts. Main certificate: GB 17/873624.00

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>ix. application of sectoral benchmarking on a regular basis.
Etc - see BAT Conclusions

Applicability. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.</td><td></td><td></td></tr>
<tr><td>2</td><td>BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification, IGCC and/or combustion units by carrying out a performance test at full load (1), according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. 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.</td><td>CC</td><td>Performance analysis from March 2016 determined station thermal efficiency at 54.2%. Tests are undertaken following works which are likely to impact efficiency or performance.

Testing is based on standards ISO 2314 and ASME PTC 46."</td></tr>
<tr><td>3</td><td>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.
<table>
<tr><th>Stream</th><th>Parameter(s)</th><th>Monitoring</th></tr>
<tr><td rowspan="3">Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr>
<tr><td>Oxygen content, temperature, and pressure</td><td rowspan="2">Periodic or continuous measurement</td></tr>
<tr><td>Water vapour content (3)</td></tr>
<tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
</table></td><td>CC</td><td><u>Process parameters for emissions to air:</u>

The applicant has confirmed that all the flue gas process parameters that are relevant to gas fired turbines as set out in BAT3 are undertaken and are set out in the current environmental permit Table S3.1.

Continuous monitoring of stack flow, oxygen, water vapour, stack gas temperature, and stack gas pressure for the CCGT gas turbines is specified in Table S3.1a

<u>In respect of process parameters for emissions to water</u>

The site does not have FG treatment fitted the parameters are not applicable.

No waste water from flue gas treatment"</td></tr>
<tr><td>4</td><td>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,</td><td>CC</td><td>The operator confirmed that continuous monitoring of NOx and CO plus Oxygen is undertaken to EN14181 for the gas turbine when firing on gas. Other parameters are not applicable to this plant.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><th>Substance/Parameter</th><th>Fuel/Process/Type of combustion plant</th><th>Combustion plant total rated thermal input</th><th>Standard(s) ([4])</th><th>Minimum monitoring frequency ([5])</th><th>Monitoring associated with</th></tr>
<tr><td>NH_3</td><td>— When SCR and/or SNCR is used</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous ([6]) ([7])</td><td>BAT 7</td></tr>
<tr><td>NO_X</td><td>— Coal and/or lignite including waste co-incineration
— Solid biomass and/or peat including waste co-incineration
— HFO- and/or gas-oil-fired boilers and engines
— Gas-oil-fired gas turbines
— Natural-gas-fired boilers, engines, and turbines
— Iron and steel process gases
— Process fuels from the chemical industry
— IGCC plants</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous ([6]) ([8])</td><td>BAT 20
BAT 24
BAT 28
BAT 32
BAT 37
BAT 41
BAT 42
BAT 43
BAT 47
BAT 48
BAT 56
BAT 64
BAT 65
BAT 73</td></tr>
<tr><td></td><td>— Combustion plants on offshore platforms</td><td>All sizes</td><td>EN 14792</td><td>Once every year ([9])</td><td>BAT 53</td></tr>
</table></td><td></td><td>We agree with the Operator’s stated compliance.

However, the GT are able to burn gas oil should the gas supply be interrupted. Where gas oil fuel is used then continuous monitoring of sulphur dioxide and dust would be required.

Continuous monitoring of dust is already specified in the permit is when gas turbines are fired on distillate fuel. SO_2 monitoring is currently required at least every 6 months by concentration by calculation, as agreed in writing with the Environment Agency and that this be retained in line with footnotes (8)

(8) As an alternative to the continuous measurement in the case of plants combusting oil with a known sulphur content and where there is no flue- gas desulphurisation system, periodic measurements at least once every three months and/or other procedures ensuring the provision of data of an equivalent scientific quality may be used to determine the SO2 emissions.

We agree and have retained the current SO2 monitoring regime See BAT 39.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement						Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	N_2O	— Coal and/or lignite in circulating fluidised bed boilers — Solid biomass and/or peat in circulating fluidised bed boilers	All sizes	EN 21258	Once every year ([10])	BAT 20 BAT 24		
	CO	— Coal and/or lignite including waste co-incineration — Solid biomass and/or peat including waste co-incineration — HFO- and/or gas-oil-fired boilers and engines — Gas-oil-fired gas turbines — Natural-gas-fired boilers, engines, and turbines — Iron and steel process gases — Process fuels from the chemical industry — IGCC plants	All sizes	Generic EN standards	Continuous ([6]) ([8])	BAT 20 BAT 24 BAT 28 BAT 33 BAT 38 BAT 44 BAT 49 BAT 56 BAT 64 BAT 65 BAT 73		
		— Combustion plants on offshore platforms	All sizes	EN 15058	Once every year ([9])	BAT 54		

BAT Concn. Number	Summary of BAT Conclusion requirement						Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	SO_2	— Coal and/or lignite incl waste co-incineration — Solid biomass and/or peat incl waste co-incineration — HFO- and/or gas-oil-fired boilers — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants	All sizes	Generic EN standards and EN 14791	Continuous ([6]) ([11]) ([12])	BAT 21 BAT 25 BAT 29 BAT 34 BAT 39 BAT 50 BAT 57 BAT 66 BAT 67 BAT 74		
	SO_3	— When SCR is used	All sizes	No EN standard available	Once every year	—		
	Gaseous chlorides, expressed as HCl	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	EN 1911	Once every three months ([6]) ([13]) ([14])	BAT 21 BAT 57		
		— Solid biomass and/or peat	All sizes	Generic EN standards	Continuous ([15]) ([16])	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous ([6]) ([16])	BAT 66 BAT 67		

BAT Concn. Number	Summary of BAT Conclusion requirement						Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	HF	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	No EN standard available	Once every three months [6] [13] [14]	BAT 21 BAT 57		
		— Solid biomass and/or peat	All sizes	No EN standard available	Once every year	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous [6] [16]	BAT 66 BAT 67		
	Dust	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines	All sizes	Generic EN standards and EN 13284-1 and EN 13284-2	Continuous [6] [17]	BAT 22 BAT 26 BAT 30 BAT 35 BAT 39 BAT 51 BAT 58 BAT 75		
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69		
5	BAT is to monitor emissions to water from flue-gas treatment with at least the frequency given below and in accordance with EN standards. If EN						NA	No flue-gas treatment plant installed

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	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.		

Substance/Parameter		Standard(s)	Minimum monitoring frequency	Monitoring associated with
Total organic carbon (TOC) (26)		EN 1484	Once every month	BAT 15
Chemical oxygen demand (COD) (26)		No EN standard available		
Total suspended solids (TSS)		EN 872		
Fluoride (F^-)		EN ISO 10304-1		
Sulphate (SO_4^{2-})		EN ISO 10304-1		
Sulphide, easily released (S^{2-})		No EN standard available		
Sulphite (SO_3^{2-})		EN ISO 10304-3		
Metals and metalloids	As	Various EN standards available (e.g. EN ISO 11885 or EN ISO 17294-2)		
	Cd			
	Cr			
	Cu			
	Ni			
	Pb			
	Zn			
	Hg	Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)		
Chloride (Cl^-)		Various EN standards available (e.g. EN ISO 10304-1 or EN ISO 15682)		—
Total nitrogen		EN 12260		—

<table>
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<tr>
<td>6</td>
<td>In order to improve the general environmental performance of combustion plants and to reduce emissions to air of CO and unburnt substances, BAT is to ensure optimised combustion and to use an appropriate combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel blending and mixing</td><td>Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>b.</td><td>Maintenance of the combustion system</td><td>Regular planned maintenance according to suppliers' recommendations</td></tr>
<tr><td>c.</td><td>Advanced control system</td><td>See description in Section 8.1</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>d.</td><td>Good design of the combustion equipment</td><td>Good design of furnace, combustion chambers, burners and associated devices</td><td>Generally applicable to new combustion plants</td></tr>
<tr><td>e.</td><td>Fuel choice</td><td>Select or switch totally or partially to another fuel(s) with a better environmental profile (e.g. with low sulphur and/or mercury content) amongst the available fuels, including in start-up situations or when back-up fuels are used</td><td>Applicable within the constraints associated with the availability of suitable types of fuel with a better environmental profile as a whole, which may be impacted by the energy policy of the Member State, or by the integrated site's fuel balance in the case of combustion of industrial process fuels.
For existing combustion plants, the type of fuel chosen may be limited by the configuration and the design of the plant</td></tr>
</table>
</td>
<td>CC</td>
<td>The operator has confirmed that the environmental performance of the combustion plant is optimised through the use of techniques (b),(c),(d) and (e)

(a) NA – only natural gas used.
(b) CC - Regular and planned maintenance is undertaken.
(c) An advanced control system is in place to automatically control and optimise combustion efficiency and manage prevention and reduction of emissions
(d) The combustion plant is a proven design.
(e) Only natural gas is used this includes for start-up and shut down.</td>
</tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
7	In order to reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/or selective non-catalytic reduction (SNCR) for the abatement of NO_X emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised reagent to NO_X ratio, homogeneous reagent distribution and optimum size of the reagent drops). **BAT-associated emission levels** The BAT-associated emission level (BAT-AEL) for emissions of NH_3 to air from the use of SCR and/or SNCR is < 3–10 mg/Nm^3 as a yearly average or average over the sampling period. The lower end of the range can be achieved when using SCR and the upper end of the range can be achieved when using SNCR without wet abatement techniques. In the case of plants combusting biomass and operating at variable loads as well as in the case of engines combusting HFO and/or gas oil, the higher end of the BAT-AEL range is 15 mg/Nm^3.	NA	No abatement for NOx emissions has been installed.
8	In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.	NA	No abatement equipment is installed to prevent or reduce plant emissions during normal operating conditions.
9	In order to improve the general environmental performance of combustion and/or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/quality control programmes for all the fuels used, as part of the environmental management system (see BAT 1): (i) Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. ISO, national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality; (ii) Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters chosen from the table below are based on the variability of the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed); (iii) Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system (see description in Section 8.1)). ***Description***	CC	The natural gas is supplied by the National Grid which already meets an appropriate standard. Natural gas supplied to site has been characterised to include the parameters listed. It is continuously tested using a Siemens MicroSAM gas chromatograph calibrated to ISO 10723:2012, providing the required parameters; data is recorded using the station logging system. Gas data is supplied to GE when the system is tuned. We agree that NO additional characterisation or testing is required. <u>Gas Turbines Firing on Gas Oil</u> The operator has confirmed that site gas oil consumption is low due to consistently firing on natural gas. They also state that there has been no recent deliveries of gas oil, as site has reduced stock to below COMAH reporting level. Analysis provided by supplier would be in line with Joint Environmental Programme (JEP) report – 'Characterisation of

<table>
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<tr><td></td><td>Initial characterisation and regular testing of the fuel can be performed by the operator and/or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee.
<table>
<tr><th>Fuel(s)</th><th>Substances/Parameters subject to characterisation</th></tr>
<tr><td rowspan="2">Biomass/peat</td><td>— LHV
— moisture</td></tr>
<tr><td>— Ash
— C, Cl, F, N, S, K, Na
— Metals and metalloids (As, Cd, Cr, Cu, Hg, Pb, Zn)</td></tr>
<tr><td rowspan="3">Coal/lignite</td><td>— LHV
— Moisture
— Volatiles, ash, fixed carbon, C, H, N, O, S</td></tr>
<tr><td>— Br, Cl, F</td></tr>
<tr><td>— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr>
<tr><td>HFO</td><td>— Ash
— C, S, N, Ni, V</td></tr>
<tr><td>Gas oil</td><td>— Ash
— N, C, S</td></tr>
<tr><td>Natural gas</td><td>— LHV
— CH_4, C_2H_6, C_3, C_4+, CO_2, N_2, Wobbe index</td></tr>
<tr><td>Process fuels from the chemical industry (27)</td><td>— Br, C, Cl, F, H, N, O, S
— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr>
</table></td><td></td><td>power plant fuels for compliance with LCP BREF Conclusion BAT 9’ issued October 2019.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	Iron and steel process gases: — LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index Waste ([28]): — LHV; — Moisture; — Volatiles, ash, Br, C, Cl, F, H, N, O, S; — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		
10	In order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC), BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: — appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines), — set-up and implementation of a specific preventive maintenance plan for these relevant systems, — review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary, — periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	CC	The operator has confirmed the following: The plant installed is highly sophisticated in terms of hardware and software. The fuel consumed is characterised continuously and is of a consistent high quality. If an " other than normal operating condition " event where to occur, it would most likely arise due to catastrophic equipment failure. This would necessitate plant shut-down to investigate and repair, for this reason it is not feasible to plan or conduct OTNOC events at Medway. The EMS incorporates consideration of "abnormal conditions, all OTNOC events are logged and subject to investigation. SSE operates a process to consider and review all proposed modifications to plant and processes (MPPC). The procedure seeks to identify all potential impacts of the intended change including health, safety and environment (SHE). For a modification to proceed it must be approved by the committee overseeing the MPPC's review and assessment. SSE operates a process to identify all possible SHE critical tasks on-site and put controls in-place to manage and maintain them; this process is referred as the process hazard review. It seeks to identify and rank potential "other than normal operating conditions" and put controls in place to reduce the risk.

<table>
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<tr><td></td><td></td><td></td><td>Medway follows the guidance contained in M20 for quality assurance of continuous emissions monitoring systems. During SU/SD the emissions for NOx and CO are at all times within the range of the CEMS which is possible by dual measurement range . Mass release of emissions can be reported either with or without the SU/SD contribution.

Procedures are in place to shutdown aqueous discharges should they deviate from permitted limits e.g. CW discharge. Site aqueous monitoring meets MCERTS requirements; site is certified for the self-monitoring of flow meeting the performance requirements of the installation and management system.

Station start-up is controlled by defined procedures which must be followed and met.</td></tr>
<tr><td>11</td><td>BAT is to appropriately monitor emissions to air and/or to water during OTNOC.
Description
The monitoring can be carried out by direct measurement of emissions or by monitoring of surrogate parameters if this proves to be of equal or better scientific quality than the direct measurement of emissions. Emissions during start-up and shutdown (SU/SD) may be assessed based on a detailed emission measurement carried out for a typical SU/SD procedure at least once every year, and using the results of this measurement to estimate the emissions for each and every SU/SD throughout the year.</td><td>CC</td><td>Air Emissions - CEMS are in place see response to BAT 4

Water emissions are monitored continuously for applicable parameters with relevant alarms to warn of approaching limits."</td></tr>
<tr><td>12</td><td>In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td>See description in Section 8.2. Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues</td><td>Generally applicable</td></tr>
</table></td><td>CC</td><td>The operator has confirmed that combustion optimisation (a) is undertaken by GE DLN 2.6+ combustion system achieve minimum emissions of NOx and CO whilst delivering optimum environmental and operational performance. This is achieved through staged combustion modes from diffusion through to premixed where the fuel is distributed differently in the combustors.

(b) Optimisation of the working medium conditions GE Mark VI control system. This control module is designed to run the DLN 2.6+ combustion system. Combined together they deliver optimal</td></tr>
</table>

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	b.	Optimisation of the working medium conditions	Operate at the highest possible pressure and temperature of the working medium gas or steam, within the constraints associated with, for example, the control of NO_X emissions or the characteristics of energy demanded			environmental performance, operability, availability and turbine performance. Have continuous monitoring at the SSE Engineering Centre via the Smart Signal connection to ensure system is operating at its optimum. Combustion turbines are re-tuned to account for seasonal temperature variation. (c) Optimisation of the working steam cycle Medway is continually monitored at the SSE Engineering Centre via the Smart Signal connection to ensure system is operating at its optimum. The condenser vacuum is operated to within the range 55 – 60 mBar. Condenser cooling water is supplied from on-site cooling tower, the temperature of which is effected by the rate of blowdown and number of cooling tower fans running. (f) Fuel preheating Incoming gas is preheated in heat exchangers supplied with water from the lower pressure economisers; this raises the gas temperature from approx. 5 °C to 140 °C. (g) Advanced Control System GE Mark VI control system is designed to run the DLN 2.6+ combustion system. Combined together they deliver optimal environmental performance, operability, availability and turbine performance. (h) Feed-water preheating using recovered heat Feedwater is deaerated by vacuum de-aeration using LP exhaust steam thereby leaving more steam for expansion in the turbine. This preheats the feedwater by approximately 10 °C. Site efficiency determined at 54.2 % and reported in SSE Engineering Centre Technical Report Medway: Baseload Output and Efficiency Benchmark March 2016. Preheating of combustion air: this technique is not appropriate to combustion turbines.
	c.	Optimisation of the steam cycle	Operate with lower turbine exhaust pressure by utilisation of the lowest possible temperature of the condenser cooling water, within the design conditions			
	d.	Minimisation of energy consumption	Minimising the internal energy consumption (e.g. greater efficiency of the feed-water pump)			
	e.	Preheating of combustion air	Reuse of part of the heat recovered from the combustion flue-gas to preheat the air used in combustion	Generally applicable within the constraints related to the need to control NO_X emissions		
	f.	Fuel preheating	Preheating of fuel using recovered heat	Generally applicable within the constraints associated with the boiler design and the need to control NO_Xemissions		
	g.	Advanced control system	See description in Section 8.2. Computerised control of the main combustion parameters enables the combustion efficiency to be improved	Generally applicable to new units. The applicability to old units may be constrained by the need to retrofit the combustion system and/or control command system		
	h.	Feed-water preheating using recovered heat	Preheat water coming out of the steam condenser with recovered heat, before reusing it in the boiler	Only applicable to steam circuits and not to hot boilers. Applicability to existing units may be limited due to constraints associated with the plant configuration and		

BAT Concn. Number	Summary of BAT Conclusion requirement				Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
						CHP/CHP readiness: no local heat and power demand, station not designed/construction for CHP. Flue-gas condenser: no CHP demand. Wet stack: station does not have FGD installed. Cooling water discharge: station does not have FGD installed. Fuel pre-drying: not applicable to natural gas or gas oil. Minimisation of heat losses: not applicable to natural gas or gas oil. Advanced materials: plant commissioned in 1995. Steam turbine upgrades: limited plant lifetime. Supercritical and ultra-supercritical steam conditions: plant commissioned in 1995.
				the amount of recoverable heat		
	i.	Heat recovery by cogeneration (CHP)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial processes/activities or in a public network for district heating. Additional heat recovery is possible from: — flue-gas — grate cooling — circulating fluidised bed	Applicable within the constraints associated with the local heat and power demand. The applicability may be limited in the case of gas compressors with an unpredictable operational heat profile		
	j.	CHP readiness	See description in Section 8.2.	Only applicable to new units where there is a realistic potential for the future use of heat in the vicinity of the unit		
	k.	Flue-gas condenser	See description in Section 8.2.	Generally applicable to CHP units provided there is enough demand for low-temperature heat		
	l.	Heat accumulation	Heat accumulation storage in CHP mode	Only applicable to CHP plants. The applicability may be limited in the case of low heat load demand		
	m.	Wet stack	See description in Section 8.2.	Generally applicable to new and existing units fitted with wet FGD		
	n.	Cooling tower discharge	The release of emissions to air through a cooling tower and not via a dedicated stack	Only applicable to units fitted with wet FGD where reheating of the flue-gas is necessary before release, and where the unit cooling system is a cooling tower		
	o.	Fuel pre-drying	The reduction of fuel moisture content before combustion to improve combustion conditions	Applicable to the combustion of biomass and/or peat within the constraints		

BAT Concn. Number	Summary of BAT Conclusion requirement				Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
				associated with spontaneous combustion risks (e.g. the moisture content of peat is kept above 40 % throughout the delivery chain). The retrofit of existing plants may be restricted by the extra calorific value that can be obtained from the drying operation and by the limited retrofit possibilities offered by some boiler designs or plant configurations		
	p.	Minimisation of heat losses	Minimising residual heat losses, e.g. those that occur via the slag or those that can be reduced by insulating radiating sources	Only applicable to solid-fuel-fired combustion units and to gasification/IGCC units		
	q.	Advanced materials	Use of advanced materials proven to be capable of withstanding high operating temperatures and pressures and thus to achieve increased steam/combustion process efficiencies	Only applicable to new plants		
	r.	Steam turbine upgrades	This includes techniques such as increasing the temperature and pressure of medium-pressure steam, addition of a low-pressure turbine, and modifications to the geometry of the turbine rotor blades	The applicability may be restricted by demand, steam conditions and/or limited plant lifetime		
	s.	Supercritical and ultra-supercritical steam conditions	Use of a steam circuit, including steam reheating systems, in which steam can reach pressures above 220,6 bar and temperatures above 374 °C in the case of supercritical conditions, and above 250 – 300 bar and temperatures above	Only applicable to new units of ≥ 600 MW_{th} operated > 4 000 h/yr. Not applicable when the purpose of the unit is to produce low steam temperatures and/or pressures in process industries.		

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<tr><td></td><td>
<table>
<tr><td></td><td></td><td>580 – 600 °C in the case of ultra-supercritical conditions</td><td>Not applicable to gas turbines and engines generating steam in CHP mode.
For units combusting biomass, the applicability may be constrained by high-temperature corrosion in the case of certain biomasses</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>13</td><td>In order to reduce water usage and the volume of contaminated waste water discharged, BAT is to use one or both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water recycling</td><td>Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant</td><td>Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present</td></tr>
<tr><td>b.</td><td>Dry bottom ash handling</td><td>Dry, hot bottom ash falls from the furnace onto a mechanical conveyor system and is cooled down by ambient air. No water is used in the process.</td><td>Only applicable to plants combusting solid fuels. There may be technical restrictions that prevent retrofitting to existing combustion plants</td></tr>
</table>
</td><td>CC</td><td>Operator has confirmed that water usage is optimised and minimised where plant design allows; limiting recycling opportunities.

Blowdown from the HRSGs is diverted to the cooling tower where it dilutes the seawater concentration.

Water Treatment Plant effluent
High purity water for boiler use is produced in the water treatment plant using a series of ion exchange beds. Effluents are mixed in a holding tank and the pH adjusted until within the permit discharge pH limits when it is then pumped to the site trade effluent tank.

Site trade effluent
All internal building drains and external areas where there is potential for oil contamination are discharged through a site oil interceptor and pumped to the site trade effluent tank. In this tank, site drainage and effluent from the WTP are combined. Prior to discharge a sample is tested to ensure the discharge is within the permit limits.
There is no opportunity to recycle this stream due to quality.

Cooling water
The cooling water system is not of suitable quality to be re-used in other processes on-site. Water usage within the cooling system is optimised through management of cooling tower cycles of concentration.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
14	In order to prevent the contamination of uncontaminated waste water and to reduce emissions to water, BAT is to segregate waste water streams and to treat them separately, depending on the pollutant content. ***Description*** Waste water streams that are typically segregated and treated include surface run-off water, cooling water, and waste water from flue-gas treatment. ***Applicability*** The applicability may be restricted in the case of existing plants due to the configuration of the drainage systems.	CC	Site effluent streams are segregated with no cross contamination before treatment. Cooling Water Site extracts water from the Medway estuary which is then used in the cooling tower. During operation the water is cycled up in concentration to typically 1.3. Water is pumped to the cooling tower and then returned directly to the estuary. Boiler blowdown Blowdown from the HRSGs is diverted to the cooling tower where it dilutes the seawater concentration. Water Treatment Plant effluent All waste water flows from the water treatment plant are collected in a sump from where they are pumped to the neutralisation tank. Here the effluent is mixed in a holding tank and the pH adjusted through chemical addition. The contents are circulated through the tank to ensure they are well mixed and the site permit discharge pH limits are achieved. It is then that the contents are pumped to the site trade effluent tank and discharged to the estuary. Internal & external drains The flow from all internal building drains and those external areas where there is potential for oil contamination (e.g. car park, tank bunds and black start sump) is discharged through a site oil interceptor and pumped to the site trade effluent tank. Sewage effluent Site sewage is treated on-site in an aerobic treatment plant, the effluent from this plant is diverted to trade effluent tank. This comprises the waste water from kitchen and wash areas. Site trade effluent This tank collects the flows from the various effluent streams detailed above. All flows have been treated before entering this tank where they are mixed and tested to ensure the discharge complies with the site permit limits. Effluent is monitored and tested to ensure discharge

<table>
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<tr><td></td><td></td><td></td><td>quality.

External drains
Site storm water is collected via the surface water drains, a number of interceptors have been installed to protect against potential oil contaminated run-off from car parks.</td></tr>
<tr><td>15</td><td>In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of the techniques given in BAT 15, and to use secondary techniques as close as possible to the source in order to avoid dilution.</td><td>NA</td><td>No flue gas treatment installed</td></tr>
<tr><td>16</td><td>In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking:
(a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;
(b) waste preparation for reuse, e.g. according to the specific requested quality criteria;
(c) waste recycling;
(d) other waste recovery (e.g. energy recovery),
by implementing an appropriate combination of techniques such as:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Generation of gypsum as a by-product</td><td>Quality optimisation of the calcium-based reaction residues generated by the wet FGD so that they can be used as a substitute for mined gypsum (e.g. as raw material in the plasterboard industry). The quality of limestone used in the wet FGD influences the purity of the gypsum produced</td><td>Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions</td></tr>
</table></td><td>NA</td><td>No flue gas treatment undertaken so no waste streams for treatment</td></tr>
</table>

<table>
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<tr><td></td><td>
<table>
<tr><td>b.</td><td>Recycling or recovery of residues in the construction sector</td><td>Recycling or recovery of residues (e.g. from semi-dry desulphurisation processes, fly ash, bottom ash) as a construction material (e.g. in road building, to replace sand in concrete production, or in the cement industry)</td><td>Generally applicable within the constraints associated with the required material quality (e.g. physical properties, content of harmful substances) associated to each specific use, and by the market conditions</td></tr>
<tr><td>c.</td><td>Energy recovery by using waste in the fuel mix</td><td>The residual energy content of carbon-rich ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat or biomass can be recovered for example by mixing with the fuel</td><td>Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber</td></tr>
<tr><td>d.</td><td>Preparation of spent catalyst for reuse</td><td>Preparation of catalyst for reuse (e.g. up to four times for SCR catalysts) restores some or all of the original performance, extending the service life of the catalyst to several decades. Preparation of spent catalyst for reuse is integrated in a catalyst management scheme</td><td>The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_X and NH_3 emissions</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>17</td><td>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Operational measures</td><td>These include:
— improved inspection and maintenance of equipment
— closing of doors and windows of enclosed areas, if possible
— equipment operated by experienced staff
— avoidance of noisy activities at night, if possible</td><td>Generally applicable</td></tr>
</table>
</td><td>CC</td><td>The operator has confirmed that the following operational measures are undertaken start-ups
Coil steam generator used to initiate warming of system and provide steam to turbine glands. This reduces start-up time by enabling the plant to establish vacuum earlier.
Start-up vents: minimise use, installation of silencers, avoidance of long periods of use at night.
Building Doors: doors to generation buildings are kept closed.

Noise: attenuation & control equipment
All noisy equipment is housed within enclosures and buildings.
Silencers are installed on steam release points.
Buildings include soundproofing material on the inside.
Noise sources are shielded from receptors using buildings.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	<table><tr><td></td><td></td><td>— provisions for noise control during maintenance activities</td><td></td></tr><tr><td>b.</td><td>Low-noise equipment</td><td>This potentially includes compressors, pumps and disks</td><td>Generally applicable when the equipment is new or replaced</td></tr><tr><td>c.</td><td>Noise attenuation</td><td>Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings</td><td>Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space</td></tr><tr><td>d.</td><td>Noise-control equipment</td><td>This includes: — noise-reducers — equipment insulation — enclosure of noisy equipment — soundproofing of buildings</td><td>The applicability may be restricted by lack of space</td></tr><tr><td>e.</td><td>Appropriate location of equipment and buildings</td><td>Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens</td><td>Generally applicable to new plant</td></tr></table>		Location Medway power station is situated at a location removed from potential receptors; all neighbouring sites are industrial, nearest village is approximately 2 miles. Medway has a regular programme of noise measurements.
BAT Conclusions 18 to 23 for the combustion of coal and/or lignite (solid fuels only) BAT Conclusions 24 to 27 for the combustion of solid biomass and/or peat (solid fuels only)			
Combustion of liquid fuels -			
28	In order to prevent or reduce NO_X emissions to air while limiting CO emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given in BAT 28.	NA	Not undertaken on site
29	In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given in BAT 29.	NA	Not undertaken on site

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td>30</td><td>In order to reduce dust and particulate-bound metal emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given in BAT 30.</td><td>NA</td><td>Not undertaken on site</td></tr>
<tr><td>31</td><td>In order to increase the energy efficiency of HFO and/or gas oil combustion in reciprocating engines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="2">BAT-AEELs ([119])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) ([120])</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — single cycle</td><td>41,5–44,5 ([121])</td><td>38,3–44,5 ([121])</td></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — combined cycle</td><td>> 48 ([122])</td><td>No BAT-AEEL</td></tr>
</table></td><td>NA</td><td>The station has installed 6 Wartsila Series 200 V18 engines each connected to an electrical generator producing 3 MW electrical power and currently operate less than 1,500 hours/yr in single cycle.</td></tr>
<tr><td>32</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Low-NO_X combustion concept in diesel engines</td><td>See descriptions in Section 8.3</td><td>Generally applicable</td></tr>
</table></td><td>NA</td><td>The operator has confirmed that there are no LCP reciprocating gas engines on site.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	b. Exhaust-gas recirculation (EGR) — Not applicable to four-stroke engines c. Water/steam addition — Applicable within the constraints of water availability. The applicability may be limited where no retrofit package is available d. Selective catalytic reduction (SCR) — Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space		
33	In order to prevent or reduce emissions of CO and volatile organic compounds to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or both of the techniques given in BAT 33.	NA	None applicable.
34	In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below. a. Fuel choice — See descriptions in Section 8.4 — Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State b. Duct sorbent injection (DSI) — There may be technical restrictions in the case of existing combustion plants. Not applicable to combustion plants operated < 500 h/yr c. Wet flue-gas desulphurisation (wet FGD) — There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}.	NA	Engines fired using gas oil with sulphur content less than 0.1% w/w.

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

			Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in reciprocating engines

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for SO_2 (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (127)	New plant	Existing plant (128)
All sizes	45–100	100–200 (129)	60–110	105–235 (129)

35	In order to prevent or reduce dust and particulate-bound metal emissions from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.	NA	Engines fired using gas oil with sulphur content less than 0.1% w/w.

Technique		Description	Applicability
a.	Fuel choice	See descriptions in Section 8.5	Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State
b.	Electrostatic precipitator (ESP)		Not applicable to combustion plants operated < 500 h/yr
c.	Bag filter		

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in reciprocating engines

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs for dust (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant ([130])</th><th>New plant</th><th>Existing plant ([131])</th></tr>
<tr><td>≥ 50</td><td>5–10</td><td>5–35</td><td>10–20</td><td>10–45</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>36</td><td>In order to increase the energy efficiency of gas oil combustion in gas turbines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for gas-oil-fired gas turbines
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="2">BAT-AEELs ([132])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) ([133])</th></tr>
<tr><th></th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas-oil-fired open-cycle gas turbine</td><td>> 33</td><td>25–35,7</td></tr>
<tr><td>Gas-oil-fired combined cycle gas turbine</td><td>> 40</td><td>33–44</td></tr>
</table>
</td><td>CC</td><td>BAT AEL for efficiency is 33 – 44% in line with BAT36</td></tr>
<tr><td>37</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water/steam addition</td><td></td><td>The applicability may be limited due to water availability</td></tr>
</table>
</td><td>CC</td><td>No BAT AEL exists for NOx. Permit ELVs are 125 mg/m^3 monthly mean, 125 mg/m^3 95% daily means, 250 mg/m^3 95% hourly means. These have been carried forward and are specified in table S3.1(a)</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	b. Low-NO_X burners (LNB) — See description in Section 8.3 — Only applicable to turbine models for which low-NO_X burners are available on the market c. Selective catalytic reduction (SCR) — See description in Section 8.3 — Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space		
38	In order to prevent or reduce CO emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below. a. Combustion optimisation — See description in Section 8.3 — Generally applicable b. Oxidation catalysts — See description in Section 8.3 — Not applicable to combustion plants operated < 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space As an indication, the emission level for NO_X emissions to air from the combustion of gas oil in dual fuel gas turbines for emergency use operated < 500 h/yr will generally be 145–250 mg/Nm^3 as a daily average or average over the sampling period.	CC	Gas Turbines Firing on Gas Oil BAT sets an indicative ELV of 145 – 250 mg/m3 CO but only for emergency units operating <500hrs/year. The current permit restricts use of standby fuel distillate oil to no more than 2400 hours per year, we have reduced this down to 500 hours as the gas oil is a standby fuel. We have reduced this to 10 days. It is accepted in line with jep protocol that any gas fired plant, when firing standby fuel for individual periods of ≤ 10 days, due to a sudden interruption of the gas supply, shall be exempt from ELV compliance. Refer to Section 4.1 above.
39	In order to prevent or reduce SO_X and dust emissions to air from the combustion of gas oil in gas turbines, BAT is to use the technique given below. a. Fuel choice — See description in Section 8.4 — Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State	CC	The operator has confirmed that they are able to meet both the SOx (Yearly Average 60 mg/m^3, Daily Average 66 mg/m^3) BAT AEL's And Dust (Yearly Average 5 mg/m^3, Daily Average 10 mg/m^3 when undertaking the combustion of gas oil in the GT's. Monitoring is to be undertaken in accordance with BAT4. The relevant BAT AELs and monitoring are specified in table S3.1(a)

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>BAT-associated emission levels for SO_2 and dust emissions to air from the combustion of gas oil in gas turbines, including dual fuel gas turbines
<table>
<tr><th rowspan="3">Type of combustion plant</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">SO_2</th><th colspan="2">Dust</th></tr>
<tr><th>Yearly average (134)</th><th>Daily average or average over the sampling period (135)</th><th>Yearly average (134)</th><th>Daily average or average over the sampling period (135)</th></tr>
<tr><td>New and existing plants</td><td>35–60</td><td>50–66</td><td>2–5</td><td>2–10</td></tr>
</table></td><td></td><td></td></tr>
<tr><td colspan="4">Combustion of gaseous fuels</td></tr>
<tr><td>40</td><td>In order to increase the energy efficiency of natural gas combustion, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new gas turbines and engines except when operated < 1 500 h/yr.
Applicable to existing gas turbines and engines within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing gas turbines and engines operated < 1 500 h/yr.
Not applicable to mechanical drive gas turbines operated in discontinuous mode with extended load variations and frequent start-ups and shutdowns.
Not applicable to boilers</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="3">BAT-AEELs (136) (137)</th></tr>
<tr><th>Net electrical efficiency (%)</th><th>Net total fuel utilisation (%) (138) (139)</th><th>Net mechanical energy efficiency (%) (139) (140)</th></tr>
</table></td><td>CC</td><td>The installations uses a combination of techniques a, b, c, d, f, g and h.

Optimisation of the working medium conditions GE Mark VI control system
This control module is designed to run the DLN 2.6+ combustion system. Combined together they deliver optimal environmental performance, operability, availability and turbine performance. Medway is continually monitored at the SSE Engineering Centre via the Smart Signal connection to ensure system is operating at its optimum. Combustion turbines are re-tuned to account for seasonal temperature variation.

Optimisation of the working steam cycle
Medway is continually monitored at the SSE Engineering Centre via the Smart Signal connection to ensure system is operating at its optimum. The condenser vacuum is operated to within the range 55 – 60 mBar. Condenser cooling water is supplied from on-site cooling tower, the temperature of which is effected by the rate of blowdown and number of cooling tower fans running. Combustion turbines are tuned to account for seasonal temperature variation.

Advanced Control System</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

	New unit	Existing unit		New unit	Existing unit
Gas engine	39,5–44 (141)	35–44 (141)	56–85 (141)	No BAT-AEEL.	
Gas-fired boiler	39–42,5	38–40	78–95	No BAT-AEEL.	
Open cycle gas turbine, ≥ 50 MWth	36–41,5	33–41,5	No BAT-AEEL	36,5–41	33,5–41
Combined cycle gas turbine (CCGT)					
CCGT, 50–600 MW_{th}	53–58,5	46–54	No BAT-AEEL	No BAT-AEEL	
CCGT, ≥ 600 MW_{th}	57–60,5	50–60	No BAT-AEEL	No BAT-AEEL	
CHP CCGT, 50–600 MW_{th}	53–58,5	46–54	65–95	No BAT-AEEL	
CHP CCGT, ≥ 600 MW_{th}	57–60,5	50–60	65–95	No BAT-AEEL	

GE Mark VI control system is designed to run the DLN 2.6+ combustion system. Combined together they deliver optimal environmental and turbine performance, operability and availability.

Fuel preheating
Incoming gas is preheated in heat exchangers supplied with water from the lower pressure economisers; this raises the gas temperature from approx. 5 °C to 140 °C.

Combined cycle
Medway power station is a combined cycle plant comprising (1) Brayton cycle: two GE 9FA combustion turbines (CT) and generators, and (2) Rankine cycle: a triple-pressure reheat steam cycle comprising two heat recovery steam generator (HRSG) feeding a single steam turbine and generator.

Site efficiency determined at 54.2 % and reported in SSE Engineering Centre Technical Report Medway: Baseload Output and Efficiency Benchmark March 2016.

The BAT AEEL for each of the gas turbines are within the specified range of 50-60% as require for an existing CCGT greater than or equal to 600MWe. See section 4.2 of this document.

41

In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in boilers, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Air and/or fuel staging	See descriptions in Section 8.3. Air staging is often associated with low-NO_X burners	Generally applicable
b.	Flue-gas recirculation	See description in Section 8.3	
c.	Low-NO_X burners (LNB)		

CC

The operator has confirmed that they have an auxiliary boiler for the supply of superheated steam during station start-up to supply gland steam at 6,000 kg/hr, 7 Bar and 260 °C. The plant is designed for quick response and intermittent operation.

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	d. Advanced control system — See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr — The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system e. Reduction of the combustion air temperature — See description in Section 8.3 — Generally applicable within the constraints associated with the process needs f. Selective non–catalytic reduction (SNCR) — Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads. The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads g. Selective catalytic reduction (SCR) — Not applicable to combustion plants operated < 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr		
42	In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in gas turbines, BAT is to use one or a combination of the techniques given below. a. Advanced control system — See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr — The applicability to old combustion plants may be constrained by the need to retrofit the combustion	CC	The operator confirmed that the following techniques are used a. Advanced control system GE Mark VI control system is in place This control module is designed to run the DLN 2.6+ combustion system. Combined together they deliver optimal environmental and turbine performance, operability and availability. c. Combustion optimisation, Dry low-NOx burners (DLN) GE DLN 2.6+ combustion system

BAT Concn. Number	Summary of BAT Conclusion requirement				Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
				system and/or control command system		Emissions of NOx and CO are minimised to deliver optimum operational and environmental performance. This is achieved through staged combustion modes from diffusion through to premixed where the fuel is distributed differently in the combustors and the fuel flow is modulated as a function of the combustion temperature. Combustion hardware and control system is current state of the art supplied by GE for combustion turbines installed at Medway. DLN is effective at (i) 90 MW output load, and (ii) 57% rated thermal output based on DLN curves provided with the Reg61 response and email of 03/03/20 as evidence. See section 4.3
	b.	Water/steam addition	See description in Section 8.3	The applicability may be limited due to water availability		
	c.	Dry low-NO_X burners (DLN)		The applicability may be limited in the case of turbines where a retrofit package is not available or when water/steam addition systems are installed		
	d.	Low-load design concept	Adaptation of the process control and related equipment to maintain good combustion efficiency when the demand in energy varies, e.g. by improving the inlet airflow control capability or by splitting the combustion process into decoupled combustion stages	The applicability may be limited by the gas turbine design		
	e.	Low-NO_X burners (LNB)	See description in Section 8.3	Generally applicable to supplementary firing for heat recovery steam generators (HRSGs) in the case of combined-cycle gas turbine (CCGT) combustion plants		
	f.	Selective catalytic reduction (SCR)		Not applicable in the case of combustion plants operated < 500 h/yr. Not generally applicable to existing combustion plants of < 100 MW_{th}. Retrofitting existing combustion plants may be constrained by the availability of sufficient space. There may be technical and economic restrictions		

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>43</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in engines, BAT is to use one or a combination of the techniques given in BAT 43.</td><td>N/A</td><td>There are no natural gas engines on site.</td></tr>
<tr><td>44</td><td>In order to prevent or reduce CO emissions to air from the combustion of natural gas, BAT is to ensure optimised combustion and/or to use oxidation catalysts.
Description - See descriptions in Section 8.3.
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in gas turbines
<table>
<tr><th>Type of combustion plant</th><th>Combustion plant total rated thermal input (MW_{th})</th><th colspan="2">BAT-AELs (mg/Nm^3) (142) (143)</th></tr>
<tr><th></th><th></th><th>Yearly average (144) (145)</th><th>Daily average or average over the sampling period</th></tr>
<tr><td colspan="4">Open-cycle gas turbines (OCGTs) (146) (147)</td></tr>
<tr><td>New OCGT</td><td>≥ 50</td><td>15–35</td><td>25–50</td></tr>
<tr><td>Existing OCGT (excluding turbines for mechanical drive applications) — All but plants operated < 500 h/yr</td><td>≥ 50</td><td>15–50</td><td>25–55 (148)</td></tr>
<tr><td colspan="4">Combined-cycle gas turbines (CCGTs) (146) (149)</td></tr>
<tr><td>New CCGT</td><td>≥ 50</td><td>10–30</td><td>15–40</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of < 75 %</td><td>≥ 600</td><td>10–40</td><td>18–50</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of ≥ 75 %</td><td>≥ 600</td><td>10–50</td><td>18–55 (150)</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of < 75 %</td><td>50–600</td><td>10–45</td><td>35–55</td></tr>
</table>
</td><td>CC</td><td>As per the response to BAT 42 above:

An Advanced control system GE Mark VI control system is in place Combustion optimisation, Dry low-NOx burners (DLN) GE DLN 2.6+ combustion system to minimise emissions of NOx and CO are minimised to deliver optimum operational and environmental performance. However, the operator has pointed out that unlike NOx, CO increases exponentially as the gas turbine approaches the emission compliance boundary defined by the combustion system. For this reason, hourly CO emissions are often close to the current 100mg/m3 ELV when the plant is operating at its stable operating limit (SEL) and gas turbine load is at its minimum. The operator has therefore requested a BAT-AEL to 100 mg/m3, higher than indicative CO Annual BAT-AEL of 30 mg/m3 to allow for the combustion characteristics of this gas turbine and potential combustor degradation relating to combustor air in-leakage. See section 4.3 for details of the limit as specified in table S3.1a of the permit</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

Existing CCGT with a net total fuel utilisation of ≥ 75 %	50–600	25–50 (151)	35–55 (152)

Open- and combined-cycle gas turbines

Gas turbine put into operation no later than 27 November 2003, or existing gas turbine for emergency use and operated < 500 h/yr	≥ 50	No BAT-AEL	60–140 (153) (154)
Existing gas turbine for mechanical drive applications — All but plants operated < 500 h/yr	≥ 50	15–50 (155)	25–55 (156)

As an indication, the yearly average CO emission levels for each type of existing combustion plant operated ≥ 1 500 h/yr and for each type of new combustion plant will generally be as follows:

- New OCGT of ≥ 50 MW_{th}: < 5–40 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 39 %, a correction factor may be applied to the higher end of this range, corresponding to [higher end] × EE/39, where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions.
- Existing OCGT of ≥ 50 MW_{th} (excluding turbines for mechanical drive applications): < 5–40 mg/Nm^3. The higher end of this range will generally be 80 mg/Nm^3 in the case of existing plants that cannot be fitted with dry techniques for NO_X reduction, or 50 mg/Nm^3 for plants that operate at low load.
- New CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the range, corresponding to [higher end] × EE/55, where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions.
- Existing CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. The higher end of this range will generally be 50 mg/Nm^3 for plants that operate at low load.
- Existing gas turbines of ≥ 50 MW_{th} for mechanical drive applications: < 5–40 mg/Nm^3. The higher end of the range will generally be 50 mg/Nm^3 when plants operate at low load.

In the case of a gas turbine equipped with DLN burners, these indicative levels correspond to when the DLN operation is effective.

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in boilers and engines
<table>
<tr><th rowspan="3">Type of combustion plant</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average (157)</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (158)</th><th>New plant</th><th>Existing plant (159)</th></tr>
<tr><td>Boiler</td><td>10–60</td><td>50–100</td><td>30–85</td><td>85–110</td></tr>
<tr><td>Engine (160)</td><td>20–75</td><td>20–100</td><td>55–85</td><td>55–110 (161)</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— < 5–40 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,
— < 5–15 mg/Nm^3 for new boilers,
— 30–100 mg/Nm^3 for existing engines operated ≥ 1 500 h/yr and for new engines.
</td><td></td><td></td></tr>
<tr><td colspan="4">BAT Conclusions 46 to 51 for iron and steel process gases.
BAT Conclusions 52 to 54 for offshore platforms.
BAT Conclusions 55 to 59 for chemical process gases.
BAT Conclusions 60 to 71 for co-incineration.
BAT Conclusions 72 to 75 for gasification.
These BAT Conclusions are not applicable to the activities carried out at the installation.</td></tr>
</table>

6. Emissions to Water

The consolidated permit incorporates the 3 current discharges to controlled waters identified as W1 to W3. W1 (cooling water including boiler blow down from HRSG and auxiliary boiler) and W2 (effluent tank consisting of water treatment plant effluent, treated site sewage effluent, condensate from the deodorising compound and site drainage) discharge to the River Medway at NGR TQ 868739 and NGR TQ 867739 respectively. W3 (surface water run-off and storm water from roofs and roadways) discharges via an interceptor to the River Medway at NGR TQ 873347.

There are no BAT AELs specified in the BAT Conclusions for this type of plant. There are also no additional treatment options identified as BAT for the installation. We have therefore not carried out any additional assessment of the emissions to water as part of this review.

The Operator also requested that the limits for mercury and cadmium are removed from the surface water discharge monitoring requirements, emission point W1 (Table S3.2). Currently the permit specifies weekly spot sample. The Operator states that the monitoring results have always been below the limit of detection.

Mercury and cadmium were originally included in the permit as they were identified as being potentially minor constituents in two products used in regenerating the water treatment plant (hydrochloric acid and sodium hydroxide). However, the Operator has confirmed that the water treatment plant now uses caustic soda. The supplier of the caustic soda confirmed that they use purified brine to produce the caustic soda solution. They also carry out biannual analysis of the caustic soda produced, both mercury and cadmium are included in the analysis suite. They are routinely shown to be at very low levels or none is detected.

We agree with the Operators justification and have removed mercury and cadmium from Table S3.2 in the consolidated permit.

7. Additional IED Chapter II requirements:

Black start operations

In the event of a black out National Grid would call on combustion plant to operate and may require them to do so outside their permitted conditions. We have dedicated black start plant and they are permitted to run as such but this scenario is relevant to the rest of the large combustion plant which could be called depending on the circumstances.

A risk assessment will be carried out by Energy UK/Joint Environmental Programme on behalf of Large Combustion Plant connected to the National Transmission System. Air emissions modelling will be based on generic black start scenarios to establish whether they have the potential to have local impact on the environment or not (on a national basis). If the modelling demonstrates that no significant impacts are likely, the plant can operate under condition 2.3.9. This conditions allows the hourly ELVs for plants operating under a black start instruction to be discounted for the purpose of reporting. We would also require there to be a procedure in place for minimisation of emissions in the case of a black start event and for reporting in the event of a black start. This modelling and the procedures have not been agreed in advance of the issue of the permit review and therefore a condition linking back to an improvement condition have been included in the permit.

8. Review and assessment of changes that are not part of the BAT Conclusions derived permit review.

This document should be read in conjunction with the application, supporting information and notice.

Aspect considered	Decision
Receipt of application	
Confidential information	A claim for commercial or industrial confidentiality has not been made.
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential.
Operating techniques	
General operating techniques	We have reviewed the techniques used by the operator where they are relevant to the BAT Conclusions and compared these with the relevant guidance notes. The permit conditions ensure compliance with the relevant BREF, BAT Conclusions. The ELVs deliver compliance with the BAT-AELs.
Permit conditions	
Updating permit conditions during consolidation	We have updated permit conditions to those in the current generic permit template as part of permit consolidation. The conditions will provide at least the same level of protection as those in the previous permit and in some cases will provide a higher level of protection to those in the previous permit.
Changes to the permit conditions due to an Environment Agency initiated variation	We have varied the permit as stated in the variation notice.
Improvement programme	We have imposed an improvement programme (IC14) to ensure that the operator provides a report that assesses the impact of emissions during operation under Black Start and provides a methodology for minimising impact during Black Start operation and for reporting instances of Black Start operation. We have also removed the completed improvement conditions from the permit.
Emission limits	We have decided that emission limits should be set for the parameters listed in the permit. • Nitrogen Dioxide • Carbon Monoxide

Aspect considered	Decision
	And when using standby fuel gas oil • Sulphur dioxide • Dust These are described in the relevant BAT Conclusions in Sections 4.1 and 5 of this document. It is considered that the ELVs/equivalent parameters or technical measures described above will ensure that significant pollution of the environment is prevented and a high level of protection for the environment is secured.
Monitoring	We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified. These are described in the relevant BAT Conclusions in Section 5 of this document. Table S3.4 Process monitoring requirements was amended to include the requirement to monitor energy efficiency after overhauls on site in line with BAT2. Based on the information in the application we are satisfied that the operator's techniques, personnel and equipment have either MCERTS certification or MCERTS accreditation as appropriate.
Reporting	We have specified reporting in the permit for the following parameters: • Nitrogen dioxide • Carbon monoxide • Sulphur dioxide • Dust These are described in the relevant BAT Conclusions in Section 5 of this document.
Operator competence	
Management system	There is no known reason to consider that the operator will not have the management system to enable it to comply with the permit conditions.
Growth Duty	
Section 108 Deregulation Act 2015 – Growth duty	We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit. Paragraph 1.3 of the guidance says: "The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are

Aspect considered	Decision
	responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation." We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections. We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.