

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/ZP3133LM
The Operator is: Centrica Brigg Limited
The Installation is: Glanford Brigg Generating Station
This Variation Notice number is: EPR/ZP3133LM/V010

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.

Throughout this document we will use a number of expressions. These are as referred to in the glossary and have the same meaning as described in “Schedule 6 Interpretation” of the Permit.

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 terms

- 1 Our decision
- 2 How we reached our decision
- 2.1 Requesting information to demonstrate compliance with BAT Conclusions for Large Combustion Plant
- 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
- 3 The legal framework
- 4 Key Issues
- 5 Decision checklist regarding relevant BAT Conclusions
- 6 Review and assessment of derogation requests made by the operator in relation to BAT Conclusions which include an associated emission level (AEL) value
- 7 Emissions to Water
- 8 Additional IED Chapter II requirements
- 9 Review and assessment of changes that are not part of the BAT Conclusions derived permit review.

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
OCGT	Open Cycle Gas Turbine
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 14th November 2018.

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.

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)
- The review and assessment of the availability of BAT for gas turbines operating <500 hours per year

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.

The installation is permitted to operate four Large Combustion Plants (LCPs) referenced LCP44, LCP45, LCP46 and LCP47 which are open cycle gas turbines running on natural gas. They are each 122MWth in size. The OCGTs are limited to 500 hrs operation per LCP.

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:

- <500 hours non-emergency plant

The following tables outline the limits that have been incorporated into the permit for LCP44, LCP45, LCP46 and LCP47. where these were derived from and the reference periods at which they apply. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit. As the only change to the plant is reporting against an indicative

nitrogen dioxide AEL, we have included the requirement from variation issue in table S3.1 rather than from the BAT Conclusions implementation date in 2021 following agreement with the operator and have not produced a separate air emissions table.

Under Chapter III gas turbines and gas engines operating for less than 500 hours per year were considered to be emergency plant and therefore were not covered by the emission limits set out in IED Annex V. However, for the purposes of the LCP BAT review, plants operated for emergency use may only be defined as plants which operate for the sole purpose of providing power at a site during an onsite emergency and/or during a black start and which do not provide balancing services or demand side response services. As this site runs commercially on an intermittent basis to support the Grid, it is not considered emergency plant and therefore indicative BAT applies.

We have set the indicative limit requiring validation through emission factors based on the principle that we will not require plant to fire up with the sole purpose of performing an emission measurement, as set out the UK Regulators Interpretation Document.

Emissions of nitrogen dioxide for comparison against the value included in the permit will be calculated every 2 years, based on fuel usage and emissions factors, according to the agreed protocol described in JEP Report JEP17EMG02/UTG/18/ERG/CT/773/R 'Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year', October 2018.

Plant type	Open Cycle Gas Turbine
Age	Permitted before publication of the LCP BREF AND existing plant in relation to the IED
Operating Hours	No more than 500 hours/year, not emergency
Fuel	Natural gas

NOx limits (mg/Nm ³) – indicative limits in italics				
Averaging	IED (Annex V Part 1) - Existing	BREF	Expected permit limits	Basis
Annual	None	None	None	NA
Monthly	None	None	None	NA
Daily	None	<i>140</i>	<i>304</i>	BAT Assessment
95 th %ile of hr means	None	None	None	NA

The operator has confirmed that the NOx limit of 304mg/m³ is more appropriate for their plant based on the JEP document described in more detail in section 4.3 of this document.

CO limits (mg/Nm ³)				
Averaging	IED (Annex V Part 1) - Existing	BREF	Expected permit limits	Basis
Annual	None	None	None	NA
Monthly	None	None	None	NA
Daily	None	None	None	NA
95 th %ile of hr means	None	None	None	NA

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 LCP BAT Conclusions specify that the BAT-AEELs for this type of plant are not applicable to plant operating less than 1500 hours per year. We have therefore not assessed this operational aspect of the plant. We have however included a process monitoring requirement in table S3.3 of the consolidated variation notice. This is required to demonstrate that efficiency levels are maintained following any significant overhauls of equipment in order to fulfil the requirement of BAT Conclusion 2. For <500 hour plant we have specified that the assessment of efficiency can be based on calculation. This is because we will not require plant to fire up with the sole purpose of carrying out an assessment of efficiency.

4.3 Any additional key issues e.g. the review and assessment of BAT for gas turbines operating < 500 hours per year

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.

The operator has concluded that as emissions performance of the OCGTs remain stable and based on the JEP documents, that BAT is equivalent to the currently permitted performance combined with an appropriate maintenance regime. A flow diagram was provided and annotated to indicate the assessment route taken. Whilst a water injection system or a Dry Low NOx (DLN) combustor could (subject to a detailed technical assessment) potentially be retrofitted to reduce the NOx emissions, the BAT assessment given in the JEP document "Maintaining the Emissions Performance of Open

Cycle Gas Turbines that operate for less than 500 hours per year" has shown that it is not appropriate to retrofit low NOx combustors for an OCGT that operates for <500 h/yr. The site operates GE Frame 6 gas turbines which are included in the data set for the study and hence, there is insufficient environmental benefit in reducing the already low annual mass emission, when considering the high conversion costs.

Emissions reporting will continue to be based on Emission Factors and a fixed emission concentration. A maintenance based approach will continue to be used to maintain the general emissions performance of the combustor. Maintenance includes periodic hot gas path inspections and maintenance based on factored fired starts.

In this instance the operator has proposed an AEL of 304mg/m³ based on the figure for a GE Frame 6 gas turbine as set out in the JEP document. We agree that this is an appropriate limit and have included it in table S3.1.

In all cases, the minimum BAT requirements for <500 hour non-emergency plant are considered to be: i) the continued compliance with any permit requirements already in place to protect air quality and ii) the demonstration of an appropriate maintenance regime to maintain plant emissions performance.

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	S3.1
Monitoring	2.3, 3.5 and 3.6	S1.2, S3.1
Energy efficiency	1.2 and 2.3	S3.3
Noise	3.4 and 2.3	S1.2
Other operating techniques	2.3	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	<p>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:</p> <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> (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: <ul style="list-style-type: none"> (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; ix. application of sectoral benchmarking on a regular basis. <p>Etc - see BAT Conclusions</p>	CC	<p>The station operates an EMS which is integrated and certified to ISO14001: 2015 Certificate No: 246955/2017/AE/GBR/UKAS</p> <p>The EMS incorporates all the features described in BAT1 (i to Xiii), and the site has site specific procedures and systems in place to address relevant topics listed in BAT1 x to xvi where practicable to do so.</p> <p>xi - see response to BAT 10/11.</p> <p>xiv – no dust management plan as the fuel used is natural gas and therefore it is not considered to be an environmental risk. However, there are procedures in place to review any complaints received which could be used if issues related to dust were to arise.</p> <p>xv - Noise nuisance is not expected at sensitive receptors. The site has specific procedures and systems in place to address noise.</p> <p>xvi - no odour management plan as the operation does not involve the combustion of malodorous substances, therefore this is not considered to be an environmental risk. However, there are procedures in place to review any complaints received</p>

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													
	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.		which could be used if issues related to odour were to arise.													
2	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.	CC	The net baseload efficiency, corrected to ISO conditions is 30.15%. Performance tests will be carried out after any modification that could significantly affect the net electrical efficiency. Further details are in the BAT 40 response.													
3	<p>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.</p> <table border="1" data-bbox="322 778 1496 954"> <thead> <tr> <th data-bbox="322 778 689 810">Stream</th> <th data-bbox="689 778 1126 810">Parameter(s)</th> <th data-bbox="1126 778 1496 810">Monitoring</th> </tr> </thead> <tbody> <tr> <td data-bbox="322 810 689 922" rowspan="3">Flue-gas</td> <td data-bbox="689 810 1126 842">Flow</td> <td data-bbox="1126 810 1496 842">Periodic or continuous determination</td> </tr> <tr> <td data-bbox="689 842 1126 890">Oxygen content, temperature, and pressure</td> <td data-bbox="1126 842 1496 890">Periodic or continuous measurement</td> </tr> <tr> <td data-bbox="689 890 1126 922">Water vapour content⁽²⁾</td> <td data-bbox="1126 890 1496 922"></td> </tr> <tr> <td data-bbox="322 922 689 954">Waste water from flue-gas treatment</td> <td data-bbox="689 922 1126 954">Flow, pH, and temperature</td> <td data-bbox="1126 922 1496 954">Continuous measurement</td> </tr> </tbody> </table>	Stream	Parameter(s)	Monitoring	Flue-gas	Flow	Periodic or continuous determination	Oxygen content, temperature, and pressure	Periodic or continuous measurement	Water vapour content ⁽²⁾		Waste water from flue-gas treatment	Flow, pH, and temperature	Continuous measurement	NA	The site does not monitor the process parameters because there is no CEMS or periodic monitoring requirements.
Stream	Parameter(s)	Monitoring														
Flue-gas	Flow	Periodic or continuous determination														
	Oxygen content, temperature, and pressure	Periodic or continuous measurement														
	Water vapour content ⁽²⁾															
Waste water from flue-gas treatment	Flow, pH, and temperature	Continuous measurement														
4	<p>BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</p> <table border="1" data-bbox="322 1050 1496 1391"> <thead> <tr> <th data-bbox="322 1050 477 1169">Substance/Parameter</th> <th data-bbox="477 1050 790 1169">Fuel/Process/Type of combustion plant</th> <th data-bbox="790 1050 947 1169">Combustion plant total rated thermal input</th> <th data-bbox="947 1050 1126 1169">Standard(s)⁽⁴⁾</th> <th data-bbox="1126 1050 1350 1169">Minimum monitoring frequency⁽⁵⁾</th> <th data-bbox="1350 1050 1496 1169">Monitoring associated with</th> </tr> </thead> <tbody> <tr> <td data-bbox="322 1169 477 1391">NO_x</td> <td data-bbox="477 1169 790 1391"> <ul style="list-style-type: none"> — 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 </td> <td data-bbox="790 1169 947 1391">All sizes</td> <td data-bbox="947 1169 1126 1391">Generic EN standards</td> <td data-bbox="1126 1169 1350 1391">Continuous⁽⁶⁾⁽⁸⁾</td> <td data-bbox="1350 1169 1496 1391">BAT 20 BAT 24 BAT 28 BAT 32 BAT 37 BAT 41 BAT 42 BAT 43 BAT 47</td> </tr> </tbody> </table>	Substance/Parameter	Fuel/Process/Type of combustion plant	Combustion plant total rated thermal input	Standard(s) ⁽⁴⁾	Minimum monitoring frequency ⁽⁵⁾	Monitoring associated with	NO _x	<ul style="list-style-type: none"> — 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 	All sizes	Generic EN standards	Continuous ⁽⁶⁾ ⁽⁸⁾	BAT 20 BAT 24 BAT 28 BAT 32 BAT 37 BAT 41 BAT 42 BAT 43 BAT 47	CC	An indicative AEL for oxides of nitrogen is set in table S3.1 and will be reported against through concentration by calculation. Further details are in the BAT 42 response.	
Substance/Parameter	Fuel/Process/Type of combustion plant	Combustion plant total rated thermal input	Standard(s) ⁽⁴⁾	Minimum monitoring frequency ⁽⁵⁾	Monitoring associated with											
NO _x	<ul style="list-style-type: none"> — 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 	All sizes	Generic EN standards	Continuous ⁽⁶⁾ ⁽⁸⁾	BAT 20 BAT 24 BAT 28 BAT 32 BAT 37 BAT 41 BAT 42 BAT 43 BAT 47											

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
		<ul style="list-style-type: none"> — 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 				BAT 48 BAT 56 BAT 64 BAT 65 BAT 73		
		<ul style="list-style-type: none"> — Combustion plants on offshore platforms 	All sizes	EN 14792	Once every year ⁽⁹⁾	BAT 53		
CO		<ul style="list-style-type: none"> — 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		
		<ul style="list-style-type: none"> — Combustion plants on offshore platforms 	All sizes	EN 15058	Once every year ⁽⁹⁾	BAT 54		
5	BAT is to monitor emissions to water from flue-gas treatment with at least the frequency given in BAT 5 and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.						NA	No flue gas treatment on site.

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																						
6	<p>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.</p> <table border="1" data-bbox="331 475 1489 1077"> <thead> <tr> <th data-bbox="331 475 367 507">Technique</th> <th data-bbox="367 475 994 507">Description</th> <th data-bbox="994 475 1489 507">Applicability</th> </tr> </thead> <tbody> <tr> <td data-bbox="331 507 367 592">a.</td> <td data-bbox="367 507 555 592">Fuel blending and mixing</td> <td data-bbox="555 507 994 592">Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type</td> <td data-bbox="994 507 1489 592" rowspan="2">Generally applicable</td> </tr> <tr> <td data-bbox="331 592 367 676">b.</td> <td data-bbox="367 592 555 676">Maintenance of the combustion system</td> <td data-bbox="555 592 994 676">Regular planned maintenance according to suppliers' recommendations</td> </tr> <tr> <td data-bbox="331 676 367 761">c.</td> <td data-bbox="367 676 555 761">Advanced control system</td> <td data-bbox="555 676 994 761">See description in Section 8.1</td> <td data-bbox="994 676 1489 761">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 data-bbox="331 761 367 845">d.</td> <td data-bbox="367 761 555 845">Good design of the combustion equipment</td> <td data-bbox="555 761 994 845">Good design of furnace, combustion chambers, burners and associated devices</td> <td data-bbox="994 761 1489 845">Generally applicable to new combustion plants</td> </tr> <tr> <td data-bbox="331 845 367 1077">e.</td> <td data-bbox="367 845 555 1077">Fuel choice</td> <td data-bbox="555 845 994 1077">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 data-bbox="994 845 1489 1077">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> </tbody> </table>	Technique	Description	Applicability	a.	Fuel blending and mixing	Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type	Generally applicable	b.	Maintenance of the combustion system	Regular planned maintenance according to suppliers' recommendations	c.	Advanced control system	See description in Section 8.1	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system	d.	Good design of the combustion equipment	Good design of furnace, combustion chambers, burners and associated devices	Generally applicable to new combustion plants	e.	Fuel choice	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	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	CC	<p>a) Stable combustion conditions are achieved as natural gas is used for the fuel and this is sourced from the national transmission system with composition and uniformity which is controlled in line with national standards.</p> <p>b) Regular planned maintenance is carried out according to manufacturer's recommendations. Hot gas path inspections and minor and major maintenance outages are based on factored fired starts. Periodic invasive inspections are completed to monitor condition of the combustion components.</p> <p>c) The site has an advanced control and monitoring system. This automated control system optimises combustion temperature and efficiency during running. There is also a PI system for high-performance monitoring.</p> <p>d) The plant was designed by the Original Equipment Manufacturer (OEM). The BREF document notes that this is generally only applicable to new plants.</p> <p>e) Natural gas is used for the site. Low sulphur fuel.</p>
Technique	Description	Applicability																							
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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	<p>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).</p> <p>BAT-associated emission levels</p> <p>The BAT-associated emission level (BAT-AEL) for emissions of NH₃ to air from the use of SCR and/or SNCR is < 3–10 mg/Nm³ 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/Nm³.</p>	NA	No abatement on site.						
8	<p>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.</p>	NA	No abatement on site.						
9	<p>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):</p> <ul style="list-style-type: none"> (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)). <p>Description</p> <p>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.</p> <table border="1" data-bbox="322 1254 1494 1372"> <thead> <tr> <th data-bbox="322 1254 712 1289">Fuel(s)</th> <th data-bbox="712 1254 1494 1289">Substances/Parameters subject to characterisation</th> </tr> </thead> <tbody> <tr> <td data-bbox="322 1289 712 1324">Natural gas</td> <td data-bbox="712 1289 1494 1324">— LHV</td> </tr> <tr> <td data-bbox="322 1324 712 1372"></td> <td data-bbox="712 1324 1494 1372">— CH₄, C₂H₆, C₃, C₄₊, CO₂, N₂, Wobbe index</td> </tr> </tbody> </table>	Fuel(s)	Substances/Parameters subject to characterisation	Natural gas	— LHV		— CH ₄ , C ₂ H ₆ , C ₃ , C ₄₊ , CO ₂ , N ₂ , Wobbe index	CC	<p>The site uses natural gas supplied via the national Transmission System and the fuel supplied is controlled in line with national standards.</p> <p>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.</p>
Fuel(s)	Substances/Parameters subject to characterisation								
Natural gas	— LHV								
	— CH ₄ , C ₂ H ₆ , C ₃ , C ₄₊ , CO ₂ , N ₂ , Wobbe index								

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
10	<p>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:</p> <ul style="list-style-type: none"> — 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	<p>The EMS incorporates many of the key aspects of BAT 10 and 11. The site operates a risk based review with the EMS (Aspects and impacts) which includes a review of potential impacts of OTNOC. A) Gas turbine starts are optimised based on plant condition to minimise emissions during start-up. B) All plant components are included within the site specific preventative maintenance programmes, the frequency of maintenance is dependent on operation of the site.</p>
11	<p>BAT is to appropriately monitor emissions to air and/or to water during OTNOC.</p> <p>Description</p> <p>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.</p>	CC	<p>Emissions during start up and shut down operations are surrogate monitored by gas usage. This is reviewed to identify if corrective actions are required. Start up and shut down gas usage is assessed. In the event of an accident or environmental incident, we would review the emissions, cause etc. as part of the incident investigation process and ensure any relevant corrective and / or preventive action is implemented.</p>
12	<p>In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated $\geq 1\,500$ h/yr, BAT is to use an appropriate combination of the techniques given in BAT 12.</p>	NA	<p>LCPs on site are operated <500 hours per year.</p>
13	<p>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.</p>	CC	<p>Water usage is optimised and minimised where plant design</p>

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 border="1"> <thead> <tr> <th data-bbox="327 389 360 416">Technique</th> <th data-bbox="371 389 517 416">Description</th> <th data-bbox="528 389 1066 416">Applicability</th> </tr> </thead> <tbody> <tr> <td data-bbox="327 424 360 552">a. Water recycling</td> <td data-bbox="371 424 517 552">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 data-bbox="528 424 1066 552">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 data-bbox="327 560 360 684">b. Dry bottom ash handling</td> <td data-bbox="371 560 517 684">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 data-bbox="528 560 1066 684">Only applicable to plants combusting solid fuels. There may be technical restrictions that prevent retrofitting to existing combustion plants</td> </tr> </tbody> </table>			Technique	Description	Applicability	a. Water recycling	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	Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present	b. Dry bottom ash handling	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.	Only applicable to plants combusting solid fuels. There may be technical restrictions that prevent retrofitting to existing combustion plants		allows. The water used within the cooling water system is not of suitable quality to be re-used in other processes on site. Water usage within the cooling water system is optimised through management of cooling tower cycles of concentration.
Technique	Description	Applicability												
a. Water recycling	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	Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present												
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14	<p>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.</p> <p>Description Waste water streams that are typically segregated and treated include surface run-off water, cooling water, and waste water from flue-gas treatment.</p> <p>Applicability The applicability may be restricted in the case of existing plants due to the configuration of the drainage systems.</p>			CC	Process water passes through an oily water separator, which is regularly inspected and monitored. The cooling water is not deemed to be contaminated by the operator, and the site does not have waste water from flue gas treatment as a result surface water is not segregated from the discharge water. As this is already an established site, the applicability is restricted by the configuration of the existing drainage system.									
15	<p>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.</p>			NA	No flue gas treatment on site.									
16	<p>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:</p> <p>(a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;</p> <p>(b) waste preparation for reuse, e.g. according to the specific requested quality criteria;</p>			CC	The waste hierarchy is implemented on site, and steps for waste reduction continue to be taken where applicable. None of the four techniques in the BAT are relevant to the site. The site uses									

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	<p>(c) waste recycling;</p> <p>(d) other waste recovery (e.g. energy recovery),</p> <p>by implementing an appropriate combination of techniques such as:</p> <table border="1" data-bbox="322 491 1491 1088"> <thead> <tr> <th data-bbox="322 491 573 528">Technique</th> <th data-bbox="573 491 1079 528">Description</th> <th data-bbox="1079 491 1491 528">Applicability</th> </tr> </thead> <tbody> <tr> <td data-bbox="322 528 573 687">a. Generation of gypsum as a by-product</td> <td data-bbox="573 528 1079 687">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 data-bbox="1079 528 1491 687">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> <tr> <td data-bbox="322 687 573 820">b. Recycling or recovery of residues in the construction sector</td> <td data-bbox="573 687 1079 820">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 data-bbox="1079 687 1491 820">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 data-bbox="322 820 573 927">c. Energy recovery by using waste in the fuel mix</td> <td data-bbox="573 820 1079 927">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 data-bbox="1079 820 1491 927">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 data-bbox="322 927 573 1088">d. Preparation of spent catalyst for reuse</td> <td data-bbox="573 927 1079 1088">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 data-bbox="1079 927 1491 1088">The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_x and NH₃ emissions</td> </tr> </tbody> </table>	Technique	Description	Applicability	a. Generation of gypsum as a by-product	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	Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions	b. Recycling or recovery of residues in the construction sector	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)	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	c. Energy recovery by using waste in the fuel mix	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	Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber	d. Preparation of spent catalyst for reuse	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	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		a clean fuel source and no solid waste is generated from the natural gas.
Technique	Description	Applicability																
a. Generation of gypsum as a by-product	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	Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions																
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17	<p>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.</p> <table border="1" data-bbox="322 1129 1491 1359"> <thead> <tr> <th data-bbox="322 1129 573 1166">Technique</th> <th data-bbox="573 1129 1079 1166">Description</th> <th data-bbox="1079 1129 1491 1166">Applicability</th> </tr> </thead> <tbody> <tr> <td data-bbox="322 1166 573 1359">a. Operational measures</td> <td data-bbox="573 1166 1079 1359"> These include: <ul style="list-style-type: none"> — improved inspection and maintenance of equipment — closing of doors and windows of enclosed areas, if possible — equipment operated by experienced staff </td> <td data-bbox="1079 1166 1491 1359">Generally applicable</td> </tr> </tbody> </table>	Technique	Description	Applicability	a. Operational measures	These include: <ul style="list-style-type: none"> — improved inspection and maintenance of equipment — closing of doors and windows of enclosed areas, if possible — equipment operated by experienced staff 	Generally applicable	CC	Noise is reduced through operational measures including all those detailed in a). Where possible, low-noise equipment is utilised. High-noise equipment is contained within buildings and equipment insulation is used where applicable. The GTs are within an enclosure within the									
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		<ul style="list-style-type: none"> — avoidance of noisy activities at night, if possible — provisions for noise control during maintenance activities 			building designed for noise attenuation.						
	b. Low-noise equipment	This potentially includes compressors, pumps and disks	Generally applicable when the equipment is new or replaced								
	c. Noise attenuation	Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings	Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space								
	d. Noise-control equipment	This includes: <ul style="list-style-type: none"> — noise-reducers — equipment insulation — enclosure of noisy equipment — soundproofing of buildings 	The applicability may be restricted by lack of space								
	e. Appropriate location of equipment and buildings	Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens	Generally applicable to new plant								
Combustion of gaseous fuels											
40	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.			CC	BAT AEELs are not applicable as the LCPs are not operated ≥ 1500 h/yr. The site has a net electrical efficiency of 30.15%, determined by a performance test at full load to ISO conditions. The plant efficiency is greater than the efficiency threshold of 29.7% for existing OCGT and gas fuel plant shown in table 2 of the Environment Agency document "BAT guidance for >50MWth gas						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Technique</th> <th style="width: 25%;">Description</th> <th style="width: 60%;">Applicability</th> </tr> </thead> <tbody> <tr> <td data-bbox="327 1110 360 1318">a. Combined cycle</td> <td data-bbox="506 1110 719 1318">See description in Section 8.2</td> <td data-bbox="730 1110 1491 1318"> 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> </tbody> </table>	Technique	Description			Applicability	a. Combined cycle	See description in Section 8.2	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		
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	BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 50%;">BAT-AEELs ⁽¹³⁶⁾ ⁽¹³⁷⁾</th> </tr> </thead> <tbody> <tr> <td style="height: 20px;"></td> <td></td> </tr> </tbody> </table>				BAT-AEELs ⁽¹³⁶⁾ ⁽¹³⁷⁾						
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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	
	Type of combustion unit		Net electrical efficiency (%) New unit Existing unit		Net total fuel utilisation (%) ⁽¹³⁸⁾ ⁽¹³⁹⁾	Net mechanical energy efficiency (%) ⁽¹³⁹⁾ ⁽¹⁴⁰⁾ New unit Existing unit	and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hours per annum” (Working draft version 1.0 17/08/2018). See section 8 of the decision document for further details on energy efficiency and BAT.
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		
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 in BAT 41.				NA	No boilers on site.	
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.				CC	The site does not monitor CO and NO _x continuously, as only an indicative BAT AEL calculated through emission factors is applicable. Emissions performance of the OCGTs are reported as stable by the operator, and the power station runs to site specific BAT in reference to the following two JEP documents: “BAT Assessment for Existing Gas & Liquid Fuel Fired OCGTs, CCGTs & Dual-fuel GTs with a Thermal Input Rating of 50 MWth or Greater Operating <500 Hours Per Year” (JEP19AIB08 Issued October 2018) and “Maintaining the Emissions Performance of Open Cycle Gas Turbines that Operate for Less Than 500 Hours Per Year” (JEP17EMG02 Issued October 2018).	
Technique		Description		Applicability			
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 system and/or control command system			
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			

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																														
	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 for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr		See section 4.3 of the decision document for further information.																														
43	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.			NA	No LCP gas engines on site – see section 8 for further information on Medium Combustion Plant gas engines on site.																														
44	<p>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.</p> <p>Description - See descriptions in Section 8.3.</p> <p>BAT-associated emission levels (BAT-AELs) for NO_x emissions to air from the combustion of natural gas in gas turbines</p> <table border="1" data-bbox="322 951 1491 1369"> <thead> <tr> <th rowspan="2">Type of combustion plant</th> <th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th> <th colspan="2">BAT-AELs (mg/Nm³) ⁽¹⁴²⁾ ⁽¹⁴³⁾</th> </tr> <tr> <th>Yearly average ⁽¹⁴⁴⁾ ⁽¹⁴⁵⁾</th> <th>Daily average or average over the sampling period</th> </tr> </thead> <tbody> <tr> <td colspan="4" style="text-align: center;">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" style="text-align: center;">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> </tbody> </table>			Type of combustion plant	Combustion plant total rated thermal input (MW _{th})	BAT-AELs (mg/Nm ³) ⁽¹⁴²⁾ ⁽¹⁴³⁾		Yearly average ⁽¹⁴⁴⁾ ⁽¹⁴⁵⁾	Daily average or average over the sampling period	Open-cycle gas turbines (OCGTs) ⁽¹⁴⁶⁾ ⁽¹⁴⁷⁾				New OCGT	≥ 50	15–35	25–50	Existing OCGT (excluding turbines for mechanical drive applications) — All but plants operated < 500 h/yr	≥ 50	15–50	25–55 ⁽¹⁴⁸⁾	Combined-cycle gas turbines (CCGTs) ⁽¹⁴⁶⁾ ⁽¹⁴⁹⁾				New CCGT	≥ 50	10–30	15–40	Existing CCGT with a net total fuel utilisation of < 75 %	≥ 600	10–40	18–50	CC	<p>The plant can comply with the indicative AEL for NO₂ of 140mg/m³. This is specified in the permit to be calculated through emission factors.</p> <p>There is no AEL for carbon monoxide for this plant as it operates less than 500 hours, however the operator has confirmed that the plant has an emission level of approximately 100mg/m³.</p> <p>See sections on air emissions and BAT for <500 hours for more information.</p> <p>AELs for gas engines applicable only to LCP engines, not medium</p>
Type of combustion plant	Combustion plant total rated thermal input (MW _{th})	BAT-AELs (mg/Nm ³) ⁽¹⁴²⁾ ⁽¹⁴³⁾																																	
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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 $\geq 75\%$	≥ 600	10–50	18–55 ⁽¹⁵⁰⁾		combustion plant (MCP) engines as can be found on this site.	
Existing CCGT with a net total fuel utilisation of $< 75\%$	50–600	10–45	35–55				
Existing CCGT with a net total fuel utilisation of $\geq 75\%$	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⁾				
<p>As an indication, the yearly average CO emission levels for each type of existing combustion plant operated $\geq 1\,500$ h/yr and for each type of new combustion plant will generally be as follows:</p> <ul style="list-style-type: none"> — New OCGT of ≥ 50 MW_{th}: $< 5\text{--}40$ mg/Nm³. 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] \times 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): $< 5\text{--}40$ mg/Nm³. The higher end of this range will generally be 80 mg/Nm³ in the case of existing plants that cannot be fitted with dry techniques for NO_x reduction, or 50 mg/Nm³ for plants that operate at low load. — New CCGT of ≥ 50 MW_{th}: $< 5\text{--}30$ mg/Nm³. 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] \times EE/55, where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions. — Existing CCGT of ≥ 50 MW_{th}: $< 5\text{--}30$ mg/Nm³. The higher end of this range will generally be 50 mg/Nm³ for plants that operate at low load. — Existing gas turbines of ≥ 50 MW_{th} for mechanical drive applications: $< 5\text{--}40$ mg/Nm³. The higher end of the range will generally be 50 mg/Nm³ when plants operate at low load. <p>In the case of a gas turbine equipped with DLN burners, these indicative levels correspond to when the DLN operation is effective.</p>							
BAT-associated emission levels (BAT-AELs) for NO_x emissions to air from the combustion of natural gas in boilers and engines							
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%; text-align: center;">BAT-AELs (mg/Nm³)</td> </tr> </table>							BAT-AELs (mg/Nm³)
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Boiler	10–60	50–100	30–85	85–110																		
Engine ⁽¹⁶⁰⁾	20–75	20–100	55–85	55–110 ⁽¹⁶¹⁾																		
45	In order to reduce non-methane volatile organic compounds (NMVOC) and methane (CH ₄) emissions to air from the combustion of natural gas in spark-ignited lean-burn gas engines, BAT is to ensure optimised combustion and/or to use oxidation catalysts.	NA	No LCP gas engines on site. See section 8 for information on MCP gas engines.																			

6. Review and assessment of derogation requests made by the operator in relation to BAT Conclusions which include an associated emission level (AEL) value

The IED enables a competent authority to allow derogations from BAT AELs stated in BAT Conclusions under specific circumstances as detailed under Article 15(4):

By way of derogation from paragraph 3, and without prejudice to Article 18, the competent authority may, in specific cases, set less strict emission limit values. Such a derogation may apply only where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:

(a) the geographical location or the local environmental conditions of the installation concerned; or

(b) the technical characteristics of the installation concerned.

As part of their Regulation 61 Notice response, the operator not has requested a derogation from compliance with the AEL value.

7. Emissions to Water

The consolidated permit incorporates the one current discharge to controlled waters identified as W1.

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.

In addition the LCPs operate <500 hours per year and are unlikely to produce significant volumes of process water. We therefore consider the likely risk from the discharge to be low.

8 Additional IED Chapter II requirements:

BAT for balancing plant

The BAT for balancing plant guidance (Draft V9, 2017) sets out additional restrictions on hours for <1500 hour non-emergency plant which are low efficiency. Table 1 of the guidance sets out categories for LCP peaking plant. The LCPs at Glandford Brigg fall into category B because it's NO_x emissions are below 500mg/m³ and its efficiency at 30.15% is above that set out in table 2 of the guidance. Table 1 therefore confirms that there are no additional restrictions applied to the hours of operation.

Black start

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 2.3.8. 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.

Medium Combustion Plant Directive

The spark ignition engines operating as peaking plant on site are MCPs and therefore have been assessed against the MCP Directive. The ELVs, monitoring and reporting requirements in the permit comply with the Directive and therefore no changes have been made to these.

Removal of plant

References to the fuel offloading area, fuel oil storage compound and fuel forwarding pump house have been removed from the permit as these are no longer in use.

9 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.
The site	
Biodiversity, heritage, landscape and nature conservation	<p>The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat.</p> <p>A full assessment of the application and its potential to affect the site(s)/species/habitat has not been carried out as part of the permit review process. We consider that the review will not affect the features of the site(s)/species/habitat as 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.</p> <p>We have not consulted Natural England on the application. The decision was taken in accordance with our guidance.</p>
Operating techniques	
General operating techniques	<p>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.</p> <p>The permit conditions ensure compliance with the relevant BREF, BAT Conclusions.</p>
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	We have varied the permit as stated in the variation notice.

Aspect considered	Decision
Environment Agency initiated variation	
Emission limits	<p>We have decided that emission limits should be set for the parameters listed in the permit.</p> <p>These are described in the relevant BAT Conclusions in Section 5 of this document.</p> <p>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.</p>
Monitoring	<p>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.</p> <p>These are described in the relevant BAT Conclusions in Section 5 of this document.</p> <p>Table S3.3 Process monitoring requirements was amended to include the requirement to monitor energy efficiency after overhauls on site in line with BAT2.</p>
Reporting	<p>We have specified reporting in the permit for the following parameters:</p> <ul style="list-style-type: none"> • Nitrogen dioxide • Carbon monoxide • Sulphur dioxide <p>These are described in the relevant BAT Conclusions in Section 5 of this document.</p>
Operator competence	
Management system	<p>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.</p>
Growth Duty	
Section 108 Deregulation Act 2015 – Growth duty	<p>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.</p> <p>Paragraph 1.3 of the guidance says:</p> <p>“The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are 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</p>

Aspect considered	Decision
	<p>factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation.”</p> <p>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.</p> <p>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.</p>