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/CP3035MK
The Operator is: EDF Energy (Thermal Generation) Limited
The Installation is: West Burton CCGT Power Station
This Variation Notice number is: EPR/CP3035MK/V009

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.

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
4.1 Emissions to air and the emission limits applied to the plant
4.2 The energy efficiency levels associated with the Best Available Techniques Conclusions
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.)

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
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
SAC	Special Area of Conservation
SGN	Sector guidance note
TGN	Technical guidance note
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 29 October 2019.

We considered that, although the response contained sufficient information for us to commence the permit review, there was some information missing. We therefore issued a further information request to the Operator on 12/02/20. Suitable further information was provided by the Operator on 02/03/20 and 09/03/20.

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).

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:

LCP121 – 755MWth input combined cycle gas turbine fuelled on natural gas
LCP122 – 765MWth input combined cycle gas turbine fuelled on natural gas
LCP123 – 769MW input combined cycle gas turbine fuelled on natural gas

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 LCP121, LCP122 and LCP123, 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 if flue gases. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit.

NOx limits (mg/Nm^3)						
Averaging	**IED (Annex V Part 1 - existing**	**BREF (Table 25 BAT-c)**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**40**	**40**	BREF	When DLN is effective	Continuous
Monthly	**50**	**None**	**50**	IED	When DLN is effective	
Daily	**55**	**50**	**50** **50**	BREF and current permit	When DLN is effective MSUL/MSDL to baseload	
95th %ile of hr means	**100**	**None**	**100**	IED	When DLN is effective	

CO limits (mg/Nm^3)						
Averaging	**IED (Annex V Part 1) - existing**	**BREF (Table 25 BAT-c)**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**30**	**100**	Operator's proposal based on low load operation and existing limits	When DLN is effective	Continuous
Monthly	**100**	**None**	**100**	IED	When DLN is effective	
Daily	**110**	**None**	**100** **100**	Current permit	When DLN is effective MSUL/MSDL to baseload	
95th %ile of hr means	**200**	**None**	**200**	IED	When DLN is effective	

The operator provided information regarding when the DLN becomes effective with the Regulation 61 response. However, further information was provided on 11/06/2020 with revised information for DLN-E and with confirmation and further explanation on 30/06/2020 in response to our request dated 16/06/2020.

The operator proposed that DLN-E for each CCGT is the same as the minimum start up load, as follows:

1. The gas turbine is in the burner mode 6.3;
2. The gas turbine is running above 2900 rpm; and
3. The generator load is greater than 35 MW.

The operator provided the following explanation:

> The DLN abatement system status is primarily indicated by the GT fuel gas combustion mode which is the critical parameter. When the GTs are operating in Combustion Mode 6.3 the DLN abatement system is fully effective and ELVs are met. Other criteria are specified for MSUL so as to comply with the IED requirements. The other criteria indicate that for a GT rotational speed above 2900 rpm (approximately 48 Hz) the unit is close to the speed necessary for synchronisation with the National Grid and at a generator load of more than 35MW electrical indicates the generator is operating and producing electrical power.
>
> Whether ELVs may be met at any specific generator load is dependent on the fuel gas combustion mode. In this combustion mode (6.3) our experience is that the combustion exhaust emissions to air will comply with Best Available Techniques Associated Emission Levels (BAT-AELs) and Emission Limit Values (ELVs).

We have reviewed the information provided and agree with the proposal and have included the criteria in table S1.5 of the permit as the definition of DLN-E.

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

a summary of the testing carried out. 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**
LCP121: existing CCGT ≥600MWth					
50 - 60	**None**	**None**	**58.4**	**NA**	**NA**
LCP122: existing CCGT ≥600MWth					
50 - 60	**None**	**None**	**57.8**	**NA**	**NA**
LCP123: existing CCGT ≥600MWth					
50 - 60	**None**	**None**	**58.1**	**NA**	**NA**

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	S1.4, S1.5, S1.2, S3.1b
Energy efficiency	1.2 and 2.3	S3.3
Noise	3.4 and 2.3	S2.1
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	**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; ix. application of sectoral benchmarking on a regular basis. Etc - see BAT Conclusions	CC	In response to the Regulation 61 notice, the operator provided the following response: A certified EMS is in place for the operation and maintenance of the Installation. The management system is certified to the following standards: International Standards Organisation (ISO) 14001 (2015) Environmental Management Systems; • ISO 50001 Energy Management; • ISO 55001 Asset Management; • OHSAS 18001 Safety Management; • ISO 223001 Business Continuity; • ISO 9001 Quality Management • British Standards (BS) Publically Available Standard (PAS) 99 for Integrated Management systems. The site is also Registered under the requirements of the EU Eco-Management and Audit Scheme Regulation. The EMS applies to the operation of the three LCP units 1-3, the Auxiliary Boiler and the four stand-by emergency diesel generators. We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.

<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>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>The operator provided the following response:

The net electrical efficiency of the three LCPs has been confirmed via performance testing. This testing was determined in accordance with the requirements of the purchase contract and included net power output and equipment net heat rate with reference to a number of international standards.

Tests are repeated after outages and upgrades as appropriate. Weekly efficiency monitoring is undertaken to determine gross electrical efficiency during full load, part load and low load operations.

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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>The operator has provided the following response:

Flue gases from the three LCP units are continuously monitored with MCERTS-certified Continuous Emissions Monitoring systems (CEMs). All appropriate parameters are monitored for on all three LCP units. Flow, oxygen content, temperature and pressure are measured. The flue-gas is dried before analysis so measurement of water vapour content is not applicable. Continuous monitoring is undertaken in line with the requirements of BS EN 14181. No wastewater arises from any treatment of the flue-gas. Emissions from MCPs are calculated based on fuel used and National factors.</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></td><td></td><td>We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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, 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>
<tr><td>N_2O</td><td>— Coal and/or lignite in circulating fluidised bed boilers</td><td>All sizes</td><td>EN 21258</td><td>Once every year ([10])</td><td>BAT 20
BAT 24</td></tr>
</table></td><td>CC</td><td>The operator provided the following response:

Emissions of oxides of nitrogen and carbon monoxide from the three LCPs are continuously monitored via the MCERTS-certified CEMs according to the requirements of BS EN 14181.

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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
		— Solid biomass and/or peat in circulating fluidised bed boilers						
	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		
	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	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		

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
		— Process fuels from the chemical industry in boilers — IGCC plants						
	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		
	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	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		

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
		— Gas-oil-fired gas turbines						
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69		
	Metals and metalloids except mercury (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V, Zn)	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers and engines	All sizes	EN 14385	Once every year (18)	BAT 22 BAT 26 BAT 30		
		— Waste co-incineration	< 300 MW_{th}	EN 14385	Once every six months (13)	BAT 68 BAT 69		
			≥ 300 MW_{th}	EN 14385	Once every three months (19) (13)			
		— IGCC plants	≥ 100 MW_{th}	EN 14385	Once every year (18)	BAT 75		
	Hg	— Coal and/or lignite including waste co-incineration	< 300 MW_{th}	EN 13211	Once every three months (13) (20)	BAT 23		
			≥ 300 MW_{th}	Generic EN standards and EN 14884	Continuous (16) (21)			
		— Solid biomass and/or peat	All sizes	EN 13211	Once every year (22)	BAT 27		
		— Waste co-incineration with solid biomass and/or peat	All sizes	EN 13211	Once every three months (13)	BAT 70		
		— IGCC plants	≥ 100 MW_{th}	EN 13211	Once every year (23)	BAT 75		
	TVOC	— HFO- and/or gas-oil-fired engines — Process fuels from chemical industry in boilers	All sizes	EN 12619	Once every six months (13)	BAT 33 BAT 59		
		— Waste co-incineration with coal, lignite, solid biomass and/or peat	All sizes	Generic EN standards	Continuous	BAT 71		

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>Formaldehyde</td><td>— Natural-gas in spark-ignited lean-burn gas and dual fuel engines</td><td>All sizes</td><td>No EN standard available</td><td>Once every year</td><td>BAT 45</td></tr><tr><td>CH_4</td><td>— Natural-gas-fired engines</td><td>All sizes</td><td>EN ISO 25139</td><td>Once every year (24)</td><td>BAT 45</td></tr><tr><td>PCDD/F</td><td>— Process fuels from chemical industry in boilers — Waste co-incineration</td><td>All sizes</td><td>EN 1948-1, EN 1948-2, EN 1948-3</td><td>Once every six months (13) (25)</td><td>BAT 59 BAT 71</td></tr></table>		
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 standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. <table><tr><th>Substance/Parameter</th><th></th><th>Standard(s)</th><th>Minimum monitoring frequency</th><th>Monitoring associated with</th></tr><tr><td colspan="2">Total organic carbon (TOC) (26)</td><td>EN 1484</td><td>Once every month</td><td>BAT 15</td></tr><tr><td colspan="2">Chemical oxygen demand (COD) (26)</td><td>No EN standard available</td><td></td><td></td></tr><tr><td colspan="2">Total suspended solids (TSS)</td><td>EN 872</td><td></td><td></td></tr><tr><td colspan="2">Fluoride (F^-)</td><td>EN ISO 10304-1</td><td></td><td></td></tr><tr><td colspan="2">Sulphate (SO_4^{2-})</td><td>EN ISO 10304-1</td><td></td><td></td></tr><tr><td colspan="2">Sulphide, easily released (S^{2-})</td><td>No EN standard available</td><td></td><td></td></tr><tr><td colspan="2">Sulphite (SO_3^{2-})</td><td>EN ISO 10304-3</td><td></td><td></td></tr><tr><td rowspan="6">Metals and metalloids</td><td>As</td><td rowspan="6">Various EN standards available (e.g. EN ISO 11885 or EN ISO 17294-2)</td><td rowspan="6"></td><td rowspan="6"></td></tr><tr><td>Cd</td></tr><tr><td>Cr</td></tr><tr><td>Cu</td></tr><tr><td>Ni</td></tr><tr><td>Pb</td></tr></table>	NA	The operator has confirmed that this is not applicable as there are no emissions to water from flue gas treatment.

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>Zn</td><td></td><td></td><td></td></tr><tr><td></td><td>Hg</td><td>Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)</td><td></td><td></td></tr><tr><td colspan="2">Chloride (Cl^-)</td><td>Various EN standards available (e.g. EN ISO 10304-1 or EN ISO 15682)</td><td></td><td>—</td></tr><tr><td colspan="2">Total nitrogen</td><td>EN 12260</td><td></td><td>—</td></tr></table>		
6	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>Generally applicable</td></tr><tr><td>b.</td><td>Maintenance of the combustion system</td><td>Regular planned maintenance according to suppliers' recommendations</td><td></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</td></tr></table>	CC	The operator has confirmed the following: All techniques are applied. Initiatives are implemented to optimise the performance of the combustion system of each of the three LCPs to reduce emissions to air of carbon monoxide and unburnt substances. Measures include: • fuel blending and mixing – The dry low NOx DLN2.6+ system is tuned to control fuel gas/air mixtures for optimum energy efficiency and minimum emissions of oxides of nitrogen and CO. The system relies on continuous on-line site analysis monitoring of fuel gas composition and energy content by a dedicated gas chromatograph. • appropriate maintenance of the combustion system – Outage maintenance is undertaken according to the gas turbine manufacturer's requirements based on operational hours, the number of start-up and other criteria and includes maintenance of the combustion system. • the use of an advanced control system – The DLN2.6+ system relies upon

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	<table><tr><td></td><td></td><td></td><td>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>		computer-based automatic control of combustion conditions according to the output of instrumentation continuously monitoring gas turbine parameters. • selection and installation of an appropriate design – God design of the combustion equipment and the DLN design of the gas turbine burners is recognised as BAT. • the selection of natural gas as the sole fuel – The sole fuel chosen for the operation of the LCPs is natural gas, thereby maximising the energy efficiency of the installation, minimising emissions of oxides of nitrogen and carbon dioxide and avoiding the potential emissions of particulates and sulphur dioxide. We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.
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 SCR or SNCR are required to be used.
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	The operator responded as follows: Measures are implemented in the design, operation and maintenance of the Installation to ensure that

<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></td><td></td><td>the GE DLN 2.6+ emissions abatement systems are used at optimal capacity and availability.

However, this is not applicable as there is no abatement equipment fitted.</td></tr>
<tr><td>9</td><td>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
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>Coal/lignite</td><td>— LHV
— Moisture
— Volatiles, ash, fixed carbon, C, H, N, O, S</td></tr>
</table></td><td>CC</td><td>The operator responded as follows:

The sole fuel used in the three LCPs is natural gas. Gas quality is continuously monitored according to appropriate standards by site chromatography equipment analysing for LHV, CH4, C2H6, C3, C4+, CO2, N2, Wobbe index. Data is used for auto control of the three LCP combustion settings.

The natural gas provided to the site via a buried pipeline is analysed by a gas Chromatograph according to ISO standard 6974. This determines percentage composition of eleven components. The analysis cycle takes four minutes to complete and runs continuously. The equipment is set to perform a calibration automatically (auto-cal) using a bottle of certified standard gas mixture each day.

National factors are used for the analysis of Diesel oil used in the operation of the four MCP emergency diesel engines.

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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>— Br, Cl, F</td></tr><tr><td></td><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><tr><td>Iron and steel process gases</td><td>— LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index</td></tr><tr><td>Waste ([28])</td><td>— 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)</td></tr></table>		
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,	CC	The operator responded as follows: A range of measures are implemented to monitor, manage and control emissions to air and water during other than normal operating conditions (OTNOC). • The Installation is appropriately design with consideration of potential environmental impact. Alarms are in place in the Central Control Room (CCR) for alerting operations staff regarding the occurrence of OTNOC conditions. Operations

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	— periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.		personnel receive training for responding to such occurrences. A 'Management of Change' process is in place for implementing improvements to plant design and operations that maybe required in responding to OTNOC event conditions. • Appropriate maintenance plans are in place for all plant and equipment. • Event reporting with cause analysis, mitigation and preventive actions is also implemented via a management system procedure. • Monitoring, assessment and reporting of overall emissions include releases during OTNOC e.g. start-up and shut-down. We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.
11	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.	CC	The operator has responded as follows: Continuous on-line monitoring of emissions to air from each of the three LCPs and discharges to water from site occurring during Other than Normal Operating Conditions (OTNOC) is carried out. Additional manual monitoring, sampling testing as appropriate to circumstances, is also completed, if required. We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.
12	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. **Technique** | **Description** | **Applicability**	CC	The operator has responded as follows: For all LCPs, combustion optimisation is practised. Energy consumption within the Installation as a whole is also minimised. CHP techniques (i), (j) and (k) are not applicable as there is no local demand.

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	a.	Combustion optimisation	See description in Section 8.2. Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues	Generally applicable		The MCPs operate less than 1500 hours per year and are therefore excluded from this requirement. The Installation utilizes modern turbine technology to enable the efficient generation of electricity. The Installation achieves a thermal efficiency of approximately 58%. This is well in excess of that achieved by conventional coal- and oil-fired plant (38%). An action plan has been prepared for the development, implementation and periodic review of an energy efficiency plan, as is required under the requirements of the Environmental Permit for the Installation. This energy efficiency action plan is reviewed at least every four years, as required by the Environmental Permit. The key energy efficiency parameter monitored is the efficiency at which the Installation delivers energy to the local off-site electricity network of the National Grid. On-site electricity usage is minimized within the constraint of the safe overall optimization of power generation and the relevant benchmarks developed as experience is gained in plant performance. As part of the site Environmental Policy, an Energy Policy has been implemented. The policy includes a commitment to continuously improve energy conservation on site. An Energy Efficiency Plan is implemented as part of the Asset Management System (AMS), at the site to continually monitor and maintain energy efficiency and thereby limit the release of pollutants and carbon dioxide per unit of power generated. The AMS Energy Efficiency Plan actions set deliverable
	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			
	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 the amount of recoverable heat		

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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 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

objectives with targets and responsible owners. These include but are not limited to:

- Benchmarking plant performance (internally and externally);
- Developing KPIs for plant performance;
- Monitoring and validating plant performance;
- Maximizing plant operability;
- Maintenance initiatives;
- Creating an efficiency improvements group.

To demonstrate commitment to energy management, the Installation Energy Management System (EnMS) has achieved certification to ISO 50001 Energy Management System. Energy efficiency performance is a key focus for the Performance & Sustainability forum, with particular reference to:

- Reducing gas usage; and
- Reducing house load.

The expected Station load, as predicted by the Environmental Permit Application (2009), was 36MW. Actual Station load in 2014 was 31.8MW (representing a 12% reduction in predicted load) and 24.3MW (representing a 52% reduction in predicted load) in 2015.
The construction of an Outage Village and Learning and Development Centre was completed in 2015. Energy performance initiatives were implemented in the design and operation of both facilities, including rain water harvesting, solar panels and LED lighting. Both buildings achieved an Energy Performance Certificate rating of A.
During 2015 electric vehicle charging points were installed in the Installation car park and an electric vehicle is now being used for by staff and

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						contractors for travel around site and to the neighbouring West Burton A and Cottam Power Stations. During 2016 and 2017**, t**he following projects were undertaken to reduce gas usage and house load: • **2016 Reduction in Gas usage**. **Gas Turbine Ramp Down Rates –** For unit shut down times. A faster shutdown reduces the gas usage during this period and reduces associated mass emissions to air. • **2016 Reduction in Station load. Hybrid Cooling Tower (HCT) Lighting -** All lighting above ground level has been put on a switch system as well as a photo cell. A total of 398 36W fluorescent tubes no longer operate during night-time periods unless required to do so by the operator saving approximately £3,000 per annum for all three LCP units. Plant running regimes during off load periods greater than 24hours have been introduced to minimise house load of a non-running unit. This is now controlled by a HCT preservation procedure which controls tower chemical levels within specification and also reduces the use of house load by 22MW per day. HCT booster pump control has been brought under AUTO control thereby **r**educing the amount of time booster pumps are in service and associated energy consumption. HCT Cabinet Heating: modification of the control of panel heaters within the fire deluge cabinets on all x10 fire distribution valves. Before the change the 500w heater was on
			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 580 – 600 °C in the case of ultra-supercritical conditions	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. 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		

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			permanently. A thermostat was installed saving £3,307 per annum for all 3 LCP units. • **2017 Further Reduction in Station load. LED lighting replacement –** A project was implemented with purchase of 200 light fittings. Around site various locations have now been changed to LED lighting including the main control room permit office, the operations day shift office and the health and safety advisors new office. Control of boiler feed pumps when the units are off load. A study was completed for the FWP barrel differentials which allowed the limit on the barrel to be increased so a 2MW motor can be left off line unless the boiler circuits require filling. This change was implemented in June of 2017 with a rapid decline in the number of FWP starts while the unit is off load seen within the first few months of operation. The operator provided the following response with regard to the BAT12: a. An automated control system is installed and implemented to optimise natural gas combustion for electricity generation. This is demonstrated by the very low levels of carbon dioxide in flue gases. b. The automated control systems continuously monitor and optimise the mix of air and natural gas within the LCPs. The operation of the dry low NOx burners minimises emissions of oxides of nitrogen within the flue gas from all three units. The concentration of NOx in the flue gas is

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
			subject to continuous monitoring via the MCERTS-certified CEMS. c. The Heat Recovery Steam Generator (HRSG) water-steam cycle is optimised while maintaining the long-term integrity of the plant and equipment. d. The key aims of the energy policy implemented on site are to optimise the efficiency of gas usage and to minimise house load. Measures to facilitate these aims were implemented in the design of the Installation. Additional measures are implemented on an annual basis as part of the commitment to continuous environmental improvement. e. This technique is not applicable to the Installation. f. The natural gas fuel is heated in the gas reception facility (GRF) area and in each unit by the use of recovered heat in Intermediate Pressure (IP) feed water. g. An automated control system is installed and implemented to optimise energy generation in each LCP. h. The Heat Recovery Steam Generator (HRSG) includes feed water pre-heating by use of Low Pressure (LP) Economiser design for all three LCPs. i. This technique is not applicable to the Installation as there is limited or no potential for the future use of heat in the vicinity of the installation due to the rural nature of the site and the lack of suitable adjacent industrial activity and sufficient residential customers. j. to s. These techniques are not applicable.

<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></td><td></td><td>We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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>The operator has responded as follows:
No water arises from the treatment of releases to air. In addition, there is no dry bottom ash arising from the operation of the LCPs. This technique is not applicable to waste water from site cooling systems as water treatment chemicals are present.

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</td></tr>
<tr><td>14</td><td>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.</td><td>CC</td><td>The operator stated:
Waste water streams are segregated, where appropriate, by the installed separate drainage systems to prevent contamination of uncontaminated wastewater streams. Water Treatment effluent neutralisation system discharge is controlled independently of the cooling water discharges.

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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 below, and to use secondary techniques as close as possible to the source in order to avoid dilution.
<table>
<tr><th>Technique</th><th>Typical pollutants prevented/abated</th><th>Applicability</th></tr>
<tr><td colspan="3">Primary techniques</td></tr>
</table></td><td>NA</td><td>Not applicable. There are no emissions to water from flue gas treatment.</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

a.	Optimised combustion (see BAT 6) and flue-gas treatment systems (e.g. SCR/SNCR, see BAT 7)	Organic compounds, ammonia (NH_3)	Generally applicable

Secondary techniques ([29])

b.	Adsorption on activated carbon	Organic compounds, mercury (Hg)	Generally applicable
c.	Aerobic biological treatment	Biodegradable organic compounds, ammonium (NH_4^+)	Generally applicable for the treatment of organic compounds. Aerobic biological treatment of ammonium (NH_4^+) may not be applicable in the case of high chloride concentrations (i.e. around 10 g/l)
d.	Anoxic/anaerobic biological treatment	Mercury (Hg), nitrate (NO_3^-), nitrite (NO_2^-)	Generally applicable
e.	Coagulation and flocculation	Suspended solids	Generally applicable
f.	Crystallisation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
g.	Filtration (e.g. sand filtration, microfiltration, ultrafiltration)	Suspended solids, metals	Generally applicable
h.	Flotation	Suspended solids, free oil	Generally applicable
i.	Ion exchange	Metals	Generally applicable
j.	Neutralisation	Acids, alkalis	Generally applicable
k.	Oxidation	Sulphide (S^{2-}), sulphite (SO_3^{2-})	Generally applicable
l.	Precipitation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
m.	Sedimentation	Suspended solids	Generally applicable
n.	Stripping	Ammonia (NH_3)	Generally applicable

The BAT-AELs refer to direct discharges to a receiving water body at the point where the emission leaves the installation.

BAT-AELs for direct discharges to a receiving water body from flue-gas treatment

Substance/Parameter	BAT-AELs

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

		Daily average
Total organic carbon (TOC)		20–50 mg/l [30] [31] [32]
Chemical oxygen demand (COD)		60–150 mg/l [30] [31] [32]
Total suspended solids (TSS)		10–30 mg/l
Fluoride (F^-)		10–25 mg/l [32]
Sulphate (SO_4^{2-})		1,3–2,0 g/l [32] [33] [34] [35]
Sulphide (S^{2-}), easily released		0,1–0,2 mg/l [32]
Sulphite (SO_3^{2-})		1–20 mg/l [32]
Metals and metalloids	As	10–50 µg/l
	Cd	2–5 µg/l
	Cr	10–50 µg/l
	Cu	10–50 µg/l
	Hg	0,2–3 µg/l
	Ni	10–50 µg/l
	Pb	10–20 µg/l
	Zn	50–200 µg/l

16

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:

	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	Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions

NA

The operator responded as follows:
A range of measures is adopted at the Installation to minimise the quantity of waste sent for disposal. All techniques are adopted. Measures are adopted in the following categories: avoidance/minimisation; segregation and disposal to re-use; and recycling. In addition, the use of energy recovery disposal options are prioritised as a matter of policy. Projects to optimise the water treatment process and minimise principle process waste continue to be pursued.

However, this is not applicable as there is no treatment of flue gases or ash generated.

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>influences the purity of the gypsum produced</td><td></td></tr><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>		
17	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 — provisions for noise control during maintenance activities</td><td>Generally applicable</td></tr></table>	CC	The operator has responded as follows: A combination of all techniques are adopted: operational measures, low noise equipment, noise attenuation, noise control equipment and appropriate location of equipment and buildings has been implemented in the design and operation of the Installation. The Installation has been designed to meet off-site limits set to minimise the potential for impacts to sensitive receptors (notably nearby rural residents). A range of initiatives has been adopted to minimise potential noise impacts including operational measures, the use of low-noise equipment, noise attenuation, the use of noise control equipment and the appropriate location of equipment 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

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: — 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

buildings. Key initiatives are summarised as follows.

- The three LCP gas turbines are located within individual acoustic enclosures and tests confirm they achieve 80 dB (A) at 1m. These, in turn, are housed within the turbine building, an acoustic-panelled building with 100% sound absorbent internal wall and ceiling treatments. All ventilation apertures in the walls of the turbine building are fitted with high-performance sound attenuators.
- The gas turbine inlet filter faces away from the neighbouring settlement of Bole, the nearest residential community to the Installation. The inlets are fitted with high performance inlet silencers and duct insulation.
- High performance sound absorptive silencers are fitted within each of the three main stacks. Measurements at the stack outlet demonstrate that levels of noise are insignificant in the far-field.
- The transformers are surrounded on three sides with concrete blast walls which direct the low levels of noise away from Bole.
- All potential items of tonal noise were identified at the detailed design stage and over-silenced in order to minimise the potential for tones being audible in the community.
- The HRSG feed water pumps are installed in high performance acoustic enclosures.
- Silencers are fitted on the discharges to atmosphere from vacuum pumps.
- Air compressors are installed within high performance acoustic enclosures.

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
			Noise monitoring has been undertaken to confirm compliance with operational noise limits specified in the Section 36 Consent issued under the requirements of the Electricity Act 1989. The monitoring has been performed in liaison with Bassetlaw District Council. Improvement Programme requirement IC4 (refer to Table S1.3 of the Permit v004) required a noise monitoring survey at the Installation to quantify the noise impact of the installation against information provided in the Permit Application. Measurement methodology and receptor monitoring locations were agreed in writing with the Agency in January 2014. The improvement was completed by presentation of results in a report, together with any consequent proposals to meet BAT standards, as submitted to the Environment Agency, in June 2014. The recording and monitoring of complaints (refer to IBMS procedure PRC-SIT-006 Action on Receipt of a Complaint) facilitates the identification of noise and vibration at levels that cause annoyance outside the site. Noise emissions are managed via the adoption of a combination of techniques in line with the requirements of BAT 17 in the BAT conclusions. We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.
Combustion of solid fuels only			
18- 27	BAT conclusions for the combustion of solid fuels	NA	The LCP combusts natural gas.
Combustion of liquid fuels			

<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>Table 13, 28-39</td><td>BAT Conclusions for the combustion of liquid fuels</td><td>NA</td><td>The LCP combusts natural gas.</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="4">BAT-AEELs ([136]) ([137])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th>Net total fuel utilisation (%) ([138]) ([139])</th><th colspan="2">Net mechanical energy efficiency (%) ([139]) ([140])</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th></th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas engine</td><td>39,5–44 ([141])</td><td>35–44 ([141])</td><td>56–85 ([141])</td><td colspan="2">No BAT-AEEL.</td></tr>
<tr><td>Gas-fired boiler</td><td>39–42,5</td><td>38–40</td><td>78–95</td><td colspan="2">No BAT-AEEL.</td></tr>
<tr><td>Open cycle gas turbine, ≥ 50 MWth</td><td>36–41,5</td><td>33–41,5</td><td>No BAT-AEEL</td><td>36,5–41</td><td>33,5–41</td></tr>
<tr><td colspan="6">Combined cycle gas turbine (CCGT)</td></tr>
<tr><td>CCGT, 50–600 MW_{th}</td><td>53–58,5</td><td>46–54</td><td>No BAT-AEEL</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CCGT, ≥ 600 MW_{th}</td><td>57–60,5</td><td>50–60</td><td>No BAT-AEEL</td><td colspan="2">No BAT-AEEL</td></tr>
</table></td><td>CC</td><td>The operator has provided the following response:

Combined cycle gas turbine (CCGT) technology is implemented in the design and operation of the three LCPs present at the Installation. The Installation achieves an efficiency of approximately 54% which is well within the applicable BAT range of 50-60 % net electrical efficiency for existing CCGTs greater than 600 MWth. Energy management implemented according to ISO 50001 includes performance review and improvement planning. Optimum efficiency is included in the annual business plan.

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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>
<table>
<tr><td>CHP CCGT, 50–600 MW_{th}</td><td>53–58,5</td><td>46–54</td><td>65–95</td><td>No BAT-AEEL</td></tr>
<tr><td>CHP CCGT, ≥ 600 MW_{th}</td><td>57–60,5</td><td>50–60</td><td>65–95</td><td>No BAT-AEEL</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>41</td><td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Air and/or fuel staging</td><td>See descriptions in Section 8.3. Air staging is often associated with low-NO_X burners</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Flue-gas recirculation</td><td rowspan="2">See description in Section 8.3</td><td rowspan="2"></td></tr>
<tr><td>c.</td><td>Low-NO_X burners (LNB)</td></tr>
<tr><td>d.</td><td>Advanced control system</td><td>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</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>e.</td><td>Reduction of the combustion air temperature</td><td rowspan="3">See description in Section 8.3</td><td>Generally applicable within the constraints associated with the process needs</td></tr>
<tr><td>f.</td><td>Selective non–catalytic reduction (SNCR)</td><td>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</td></tr>
<tr><td>g.</td><td>Selective catalytic reduction (SCR)</td><td>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</td></tr>
</table>
</td><td>NA</td><td>The LCPs are gas turbines and not boilers.</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>42</td><td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Advanced control system</td><td>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</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>b.</td><td>Water/steam addition</td><td rowspan="2">See description in Section 8.3</td><td>The applicability may be limited due to water availability</td></tr>
<tr><td>c.</td><td>Dry low-NO_X burners (DLN)</td><td>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</td></tr>
<tr><td>d.</td><td>Low-load design concept</td><td>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</td><td>The applicability may be limited by the gas turbine design</td></tr>
<tr><td>e.</td><td>Low-NO_X burners (LNB)</td><td rowspan="2">See description in Section 8.3</td><td>Generally applicable to supplementary firing for heat recovery steam generators (HRSGs) in the case of combined-cycle gas turbine (CCGT) combustion plants</td></tr>
<tr><td>f.</td><td>Selective catalytic reduction (SCR)</td><td>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</td></tr>
</table></td><td>CC</td><td>The operator has responded as follows:

Advanced control system and dry low-NOx (DLN) burners are used in design and operation of the three LCPs to reduce emissions to air of oxides of nitrogen (NOx). Typical yearly average hourly and daily NOx concentration are 20 - 30 mg/Nm3.

The operation of the LCP includes a combination of techniques to reduce NOx and CO emissions to air from the combustion of natural gas in gas turbines including:
• The use of an advanced control system;
• Incorporation of dry low-NOx burners (DLN);
• Low load design concept (i.e. adaptation of the process control and related equipment to maintain combustion efficiency and low emission concentrations during low loads).

We are satisfied that these measures will mean that the operations will be compliant with the BAT Conclusions.</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>
<table>
<tr><td></td><td></td><td></td><td>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 below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Advanced control system</td><td>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</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>b.</td><td>Lean-burn concept</td><td>See description in Section 8.3. Generally used in combination with SCR</td><td>Only applicable to new gas-fired engines</td></tr>
<tr><td>c.</td><td>Advanced lean-burn concept</td><td rowspan="2">See descriptions in Section 8.3</td><td>Only applicable to new spark plug ignited engines</td></tr>
<tr><td>d.</td><td>Selective catalytic reduction (SCR)</td><td>Retrofitting existing combustion plants may be constrained by the availability of sufficient space.
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</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>NA</td><td>The LCPs are gas turbines and not gas engines.</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 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/Nm^3) ([142]) ([143])</th></tr>
<tr><th>Yearly average ([144]) ([145])</th><th>Daily average or average over the sampling period</th></tr>
</table>
</td><td>CC</td><td>The operator has proposed the following BAT-AELs for NOx:

The applicable top-of-range NOx BAT-AELs for this Natural Gas fired, Dry Low NOx (DLN), combustion system are given in the table below for plants of the applicable size and thermal efficiency.
These BAT-AELs are the proposed Emission Limit Values (ELVs), applicable only when the DLN system is fully effective.</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

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
Existing CCGT with a net total fuel utilisation of ≥ 75 %	≥ 600	10–50	18–55 (150)
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 ≥ 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.

The DLN system premixes the fuel with a large excess of combustion air, upstream of the combustor. The lean premix combustion system is much more complex, and more dependent on precision engineered components, than conventional diffusion flame systems and the NOx can increase over time, across outage cycles, due to degradation of the fuel injection system, air leakage into the combustor and/or instrumentation issues. The NOx emissions are also more sensitive to fluctuations in fuel quality and ambient conditions. For all of these reasons, the top-of-range BAT-AEL values are appropriate.

Plant	Thermal input MWth	Plant efficiency %	Annual NOx mg/m^3	Daily NOx Mg/m^3
Existing CCGT >1500 hrs	≥600	<75	40	50

The operator did not provide proposed indicative BAT-AELs for CO so we requested these on 12/02/20. The operator provided the following in response to our request on 09/03/20:
As gas turbines are regarded as a type of internal combustion engine and as these engines are not otherwise separately identified in the BAT 44 conclusion's indication of yearly average Carbon Monoxide emission levels it would seem that the range of up to 100 mg/Nm^3 would be an acceptable technique for existing plant operating for more than 1500 hours per year, that is for continuously generating Plant. As the daily and monthly Emission Limit Values are also set at this value the introduction of a lower annual limitation potentially imposes an additional restriction to the continued

<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>
— 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.
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>
operations at what would otherwise be an acceptable daily or monthly performance. It would therefore be appropriate not to impose an annual limit that is lower than the daily or monthly limit and thereby limit potential for generation. Further the current acceptable annual limitation is not an average but set at 95% of validated hourly averages within a calendar year and is to be less than twice this average value i.e. at 200 mg/Nm^3, which statistically could arise from an annual mean above an average of 100 mg/Nm^3. An annual limit of 100 mg/Nm^3 would therefore represent a tightening of the existing conditions.

In addition the BAT conclusion also provides a further indication that existing large CCGTs of more than 50 MWth, such as at West Burton B, may generally operate at up to 50 mg/Nm^3 when at low load. The West Burton B Power Station has developed and operates as a flexible generator and operating as such does not always generate at maximum design capacity. The plant supports the National Grid in sustaining the UK electricity network by intermittent operation at various loads within the operating range, including periods of low loads so as to compensate when the network demand reduces or when other resources such as renewable sources of electrical power are either unavailable or subject to a variable output. While producing electricity other supporting services such as frequency response are also provided and this too may require operation at loads other than at maximum i.e. at low load. Thus operation at up to 50 mg/Nm^3 as also defined by the best available technique is also applicable.

We have set the indicative BAT-AEL for annual average CO as 100 mg/Nm^3.
</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></td><td></td><td>DLN-E is defined in accordance with the information provided in section 4.1 of this document.</td></tr>
<tr><td>45</td><td>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.
Description
See descriptions in Section 8.3. Oxidation catalysts are not effective at reducing the emissions of saturated hydrocarbons containing less than four carbon atoms.
BAT-associated emission levels (BAT-AELs) for formaldehyde and CH_4 emissions to air from the combustion of natural gas in a spark-ignited lean-burn gas engine
<table>
<tr><th rowspan="4">Combustion plant total rated thermal input (MW_{th})</th><th colspan="3">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th>Formaldehyde</th><th colspan="2">CH_4</th></tr>
<tr><th colspan="3">Average over the sampling period</th></tr>
<tr><th>New or existing plant</th><th>New plant</th><th>Existing plant</th></tr>
<tr><td>≥ 50</td><td>5–15 (162)</td><td>215–500 (163)</td><td>215–560 (162) (163)</td></tr>
</table></td><td>NA</td><td>The LCPs are gas turbines and not engines.</td></tr>
<tr><td>46 - 51</td><td>BAT conclusions for the combustion of iron and steel process gases</td><td>NA</td><td>The LCP does not combust iron and steel process gases.</td></tr>
<tr><td>52 - 54</td><td>BAT conclusions for the combustion of gaseous and/or liquid fuels on offshore platforms</td><td>NA</td><td>The LCP is not on an offshore platform.</td></tr>
<tr><td>55 - 59</td><td>BAT conclusions for the combustion of process fuels from the chemical industry</td><td>NA</td><td>The LCP does not combust process fuels form the chemical industry.</td></tr>
<tr><td>60 - 71</td><td>BAT conclusions for the co-incineration of waste</td><td>NA</td><td>The LCP is not an incinerator.</td></tr>
<tr><td>72 – 75</td><td>BAT conclusions for gasification</td><td>NA</td><td>The LCP is not a gasifier.</td></tr>
</table>

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 Note response, the operator has not requested a derogation from compliance with any AEL values.

7. Emissions to Water

The consolidated permit incorporates the two current discharges to controlled waters identified as W5 and W6.

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.

8 Additional IED Chapter II requirements:

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 2.3.7. 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.

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	The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat. 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. We have not consulted Natural England on the application. The decision was taken in accordance with our guidance.
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	We have varied the permit as stated in the variation notice.

Aspect considered	Decision
Environment Agency initiated variation	
Improvement programme	We have imposed an improvement programme (IC1) 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.
Emission limits	We have decided that emission limits should be set for the parameters listed in the permit. These are described in the relevant BAT Conclusions in Section 5 and in section 4.1 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 S3.3 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 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	

Aspect considered	Decision
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 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.