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/EP3533RY
The Operator is: Uniper UK Limited
The Installation is: Grain Power Station
This Variation Notice number is: EPR/EP3533RY/V006

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 acronyms used in this document

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

APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEEL	BAT Associated Energy Efficiency Level
BAT-AEL	BAT Associated Emission Level
BATc	BAT conclusion
BREF	Best available techniques reference document
CCGT	Combined Cycle Gas Turbine
CEM	Continuous emissions monitor
CHP	Combined heat and power
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DLN	Dry Low NOx burners
DLN-E	Dry Low NOx effective
EIONET	European environment information and observation network is a partnership network of the European Environment Agency
ELV	Emission limit value derived under BAT or an emission limit value set out in IED
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016 (SI 2010 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 NO2 expressed as NO2)
NPV	Net Present Value
OCGT	Open Cycle Gas Turbine
PHE	Public Health England
SAC	Special Area of Conservation
SGN	Sector guidance note
TGN	Technical guidance note
TNP	Transitional National Plan
TOC	Total Organic Carbon
WFD	Water Framework Directive (2000/60/EC)

1 Our decision

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

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

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

2 How we reached our decision

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

We issued a Notice under Regulation 61(1) of the Environmental Permitting (England and Wales) Regulations 2016 (a Regulation 61 Notice) on 01/05/18 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 31/10/18.

We considered it was in the correct form and contained sufficient information for us to begin our determination of the permit review but not that it necessarily contained all the information we would need to complete that review. We therefore issued further information requests to the Operator on 11/03/19 and 26/03/19. Suitable further information was provided by the Operator on 26/04/19.

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

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

In relation to BAT Conclusion 9, we consider that improvements are required in respect to current capability stated by the operator as recorded in their Regulation 61 Notice response.

We have therefore included an improvement condition IC11 in the consolidated variation notice, which requires them to upgrade their operational techniques so that the requirements of the BAT Conclusion are delivered by 17 August 2021.

3 The legal framework

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

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

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

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

4 The key issues

The key issues arising during this permit review are:

- Emissions to air and the emission limits applied to the plant
- The energy efficiency levels associated with the Best Available Techniques (BAT-AEELs)
- The review and assessment of the availability of BAT for gas turbines operating <500 hours per year
- BATc 9 characterisation of fuel

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: 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.
- For gas turbines operating less than 500 hours per year, we have referred to the following publications that reflect the work carried out by Joint Environmental Programme (JEP) research group and agreed in principle by the Environment Agency:
    - JEP report JEP17EMG02 / UTG/18/ERG/CT/773/R ‘Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year’, October 2018;
    - JEP report JEP19AIB08 / UTG/18/PMP/774/R, ‘BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year', October 2018.

The site consists four LCPs, namely LCP 102, LCP 103, LCP 104 and LCP 105.

LCP 102 consists of two open cycle gas turbines (OCGTs) fired on gas oil for generation of electricity for balancing services as a non-emergency plant, for up to 500 hours per year. These are Rolls Royce Avon gas turbines installed in the 1970-ies.

LCP 103, LCP 104 and LCP105 consist each of a combined cycle gas turbine (CCGT) fired on natural gas.

All the LCPs within the installation were put into operation before IED came into force and therefore the existing limits in the permit are either from Part 1 of Annex V applicable to existing plant, or more stringent due to application of the no-backsliding principle at the time of implementation of the IED and associated permit review.

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

- <500 hours non-emergency plant for LCP 102
- Unlimited hours operation for LCP 103, LCP 104 and LCP 105.

The following table outlines the limits that have been incorporated into the permit for LCP 102, LCP 103, LCP 104 and LCP 105, where these were derived from, where the backsliding principle has been followed, and the reference periods at which they apply. The emission limits and monitoring tables have been incorporated into Schedule 3.

LCP 102

Plant type	Open Cycle Gas Turbine
Age	Permitted **before** publication of the LCP BREF and **before** IED
Operating Hours	Less than 500 hours/year non-emergency
Fuel	Gas oil

Under Chapter III gas turbines and gas engines operating for less than 500 hours per year are considered to be emergency plant and therefore are not covered by the emission limits set out in IED Annex V. However, for the purposes of the LCP BAT review, plants operated for emergency use may only be defined as plants which operate for the sole purpose of providing power at a site during an onsite emergency and/or during a black start and which do not provide balancing services or demand side response services. As LCP 102 within this site runs commercially on an intermittent basis to support the Grid (fast start contract), it is not considered emergency plant for the purposes of the LCP BAT review and therefore indicative BAT apply.

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

NOx limits (mg/Nm³) – indicative in *italics*								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Annual	**None**	**None**	**None**	NA	NA	Continuous Note 2	**None**	**None**
Monthly	**None**	**None**	**None**	NA	NA		**None**	**None**

NOx limits (mg/Nm^3) – indicative in *italics*								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Daily average or average over the sampling period	**None**	**None** Note 1	**None**	BREF	70% to baseload		**None**	***300***
95th %ile of hr means	**None**	**None**	**None**	NA	NA		**None**	**None**
Note 1: BATc 38 provides an indicative emission level of 250 mg/Nm^3 for combustion of gas oil in dual fuel gas turbines operating less than 500 hours per year. However this indicative figure is not applicable to LCP 102, because gas turbines within LCP 102 are not dual fuel. **Note 2:** Footnote 2 to BAT conclusion 4 specifies that the monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement.								

The indicative emission level for combustion of gas oil in dual fuel gas turbines operating less than 500 hours per year is reported in Note 1 of table above for reference. This indicative emission level is not applicable to LCP 102, because gas turbines within LCP 102 are not dual fuel. We have therefore set a benchmark emission level in the revised and consolidated permit notice at 300 mg/Nm^3 based on the emissions reported by the operator for the type of machines installed within LCP 102.
The figure reported by the operator is based on industry benchmark emission level from reported industry performance, documented in JEP report JEP17EMG02 / UTG/18/ERG/CT/773/R 'Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year', October 2018, for the specific gas turbines installed at Grain Power Station.

CO limits (mg/Nm^3)								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Annual	**None**	**None**	**None**	NA	NA	NA	**None**	**None**
Monthly	**None**	**None**	**None**	NA	NA		**None**	**None**
Daily	**None**	**None**	**None**	NA	NA		**None**	**None**
95th %ile of hr means	**None**	**None**	**None**	NA	NA		**None**	**None**

SO_2 limits (mg/Nm^3) – indicative in *italics*								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Annual	**None**	**None**	**None** Note 1	NA	NA	Continuous or Periodic Notes 2, 3	**None**	**None**
Monthly	**None**	**None**	**None**	NA	NA		**None**	**None**
Daily or average over the sampling period	**None**	***66***	***66***	BREF	70% to baseload		**None**	***66***
95th %ile of hr means	**None**	**None**	**None**	NA	NA		**None**	**None**

Note 1: Footnote 1 to Table 22 of BATc specifies that the annual AELs are not applicable to plants operating <1500 hours.

Note 2: Footnote 2 to BAT conclusion 4 specifies that the monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement.

Note 3: Footnote 8 to BAT conclusion 4 specifies that, as an alternative to the continuous measurement, in the case of plants combusting oil with a known sulphur content and where there is no flue- gas desulphurisation system, periodic measurements at least once every three months and/or other procedures ensuring the provision of data of an equivalent scientific quality may be used to determine the SO_2 emissions.

Dust limits (mg/Nm^3) – indicative in *italics*								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Annual	**None**	**None**	**None**	NA	NA	Continuous or Periodic Note 1	**None**	**None**
Monthly	**None**	**None**	**None**	NA	NA		**None**	**None**
Daily or average over the sampling period	**None**	***10***	***10***	BREF	70% to baseload		**None**	***10***
95th %ile of hr means	**None**	**None**	**None**	NA	NA		**None**	**None**
Note 2: Footnote 2 to BAT conclusion 4 specifies that the monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement.								

LCP 102 is used only for balancing services operations for less than 500 hours per year. Therefore we consider applicable and relevant footnote 2 to BAT conclusion 4 that specifies that the monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement. The operator has explained that the schedule for running LCP 102 is unknown, making not feasible to plan monitoring. We agree with the operator's assessment because, according to the UK Regulators Interpretation Document on the BAT conclusions on Large Combustion Plants, we don't consider BAT running a large combustion plant for the sole purpose of testing emissions.

We have specified in the revised permit monitoring and reporting requirements for LCP 102 based on calculation of emissions according to the agreed protocol established in JEP Report JEP17EMG02 / UTG/18/ERG/CT/773/R 'Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year', October 2018.

LCP 103, LCP 104, 105

Type	Combined Cycle Gas Turbine
Age	Permitted **before** publication of the LCP BREF
Operating Hours	Unlimited
Fuel	Natural gas

Summary of relevant technical features:

Electrical Generating Efficiency (EE) > 55%.Thermal input > 600 MWth. Respectively:

LCP 103 (Unit 6) = 737MWth input, EE = 58.57%, 431.69MW net electrical power output

LCP 104 (Unit 7) = 746MWth input, EE = 58.44%, 436.027MW net electrical power output

LCP 105 (Unit 8) = 744MWth input, EE = 58.36%, 434.244MW net electrical power output

Low load design concept as per BATc 42 (d.) is implemented on LCP103 and LCP104.

NOx limits (mg/Nm³)								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Annual	**None**	**40** (≥600 MW_{th}, η <75%)[1,2]	**40** (≥600 MW_{th}, η <75%)[1,2]	BREF	E-DLN	Continuous	**None**	**42.5** [3]

NOx limits (mg/Nm^3)								
Averaging	**IED (Annex V Part 1) - Existing**	**LCP BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Monthly	**50** *(75 if EE>55% or η >75%)*	**None**	**75**	IED	E-DLN		**50**	**50** [5]
Daily	**55** *(82.5 if EE>55% or η >75%)*	**50** (≥600 MW_{th}, η <75%)[1,2]	**50** (≥600 MW_{th}, η <75%)[1,2]	BREF - IED compliance.	E-DLN		**50 (83 MSUL/MSDL to base load)**	**50** [5] **(75 MSUL/MSDL to base load)**[4]
95th %ile of hr means	**100** *(150 if EE>55% or η >75%)*	**None**	**100** *(150 if EE>55% or η >75%)*	IED	E-DLN		**75**	**75** [5]

1 - If electrical generating efficiency (EE) > 55% then limit is [limit] x EE/55
2 - Overall plant efficiency, η, based on 'net total fuel utilisation'
3 – Considering uplift for EE higher than 55%, calculated as 40 x EE/55
4 – Revised, reduced limit proposed by operator in response to Regulation 61(1) Notice.
5 – Current limit retained based on no-backsliding principle

CO limits (mg/Nm^3) – indicative in *italics*								
Averaging	**IED (Annex V Part 1) - Existing**	**BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**	**Current Permit Limit**	**Revised Permit Limit**
Annual	**None**	***30*** *(50 for plant operating at low load)*	***30*** *(50 for plant operating at low load)*	BREF	E-DLN	Continuous	**None**	**50**
Monthly	**100**	**None**	**100**	IED	E-DLN		**50**	**50**
Daily	**110**	**None**	**110**	IED	E-DLN		**50 (110 MSUL/MSDL to base load)**	**50 (110 MSUL/MSDL to base load)**
95th %ile of hr means	**200**	**None**	**200**	IED	E-DLN		**100**	**100**

For LCP 103, LCP 104 and LCP 105, the operator has requested an emission limit for emissions of CO of 50 mg/m^3, higher than the indicative BAT-AEL of 30 mg/m^3.

The operator has provided a justification based on the technical characteristics of the installed Alstom GT26 gas turbines as described in the following paragraphs.

The emission limit requested by the operator is to align this parameter with the commercial guarantee provided by the equipment manufacturer. The operator has declared that the commercial guarantee is based on maintaining CO emissions below 50 mg/m^3 when operating above 60% of ISO base load (i.e. the proposed E-DLN point for these machines) and that this is the equipment manufacturer's assessment of achievable emissions performance, taking into account the technical characteristics of the gas turbines.
The operator has provided information showing that, under normal circumstances, when the gas turbines operate above the E-DLN point, CO emissions are below the indicative BAT-AEL of 30 mg/m^3 range for most of the time.

However, the operator has explained that these machines are sensitive to degradation of the gas turbine components across three-yearly major outage cycles and this degradation leads to increase CO emissions over time, especially around the 60% ISO base load point. According to the technical explanation provided, this is because the GT26 annular combustors are manufactured in two halves and the seals along the split-line are prone to degradation and in-leakage of compressed air into the combustor. The combustors are also segmented, due to their physical size, and the seals between the segments and at various other hardware interfaces are also prone to compressed air in-leakage. The introduction of relatively cool compressor discharge air, by in-leakage, into the flame zone or the hot combustion products leads to quenching and survival of CO within the hot gases.

The operator has confirmed that the gas turbines of LCP 103, LCP 104 and LCP 105 are maintained according to the manufacturer's recommendations. These include preventing air in-leakage by regular borescope inspections of the combustion system internals to identify unanticipated component damage. Typically, major outages are at three-yearly intervals with the exact time-scale dictated by the number of operating hours and the number of starts. During a major outage, the gas turbine is stripped down, repaired and re-built with new seals.

In conclusion, although CO emissions are generally below the indicative BAT-AEL of 30 mg/m^3 at high loads above the E-DLN point, the possibility of components degradation causing CO emissions up to 50 mg/m^3, cannot be ruled out and this figure has therefore been proposed as the ELV by the operator.

We consider the technical justification provided by the operator is adequate and we have set the annual emission limits for CO at 50 mg/m^3 in the revised and consolidated permit.

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.

For LCP 102, Table 21 of the BAT Conclusions specifies that the AEELs for this type of plant are not applicable to plant operating less than 1500 hours per year. We have therefore not assessed this operational aspect of the plant for LPC 102. We have however included a process monitoring requirement in table S3.3 of the consolidated variation notice. This is required to demonstrate that efficiency levels are maintained following any significant overhauls of equipment in order to fulfil the requirement of BAT Conclusion 2.

For LCP 103, LCP 104 and LCP 105, the table below sets out the AEELs specified in Table 23 the 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 based on the determination, according to equipment manufacturer's standards, of the Net Heat Rate (kJ/kWh) and net power output, corrected to ISO base load conditions (ambient temperature 15degC, ambient pressure 1.013 bar(a) and relative humidity of 60% consistent with ISO Standard 3977 Part 2). We consider these plants are 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
LCP 103: CCGT >= 600 MWth – existing unit					
50 - 60	None	None	58.57	NA	NA
LCP 104: CCGT >= 600 MWth – existing unit					
50 - 60	None	None	58.44	NA	NA
LCP 105: CCGT >= 600 MWth – existing unit					
50 - 60	None	None	58.36	NA	NA

LCP 103, 104 and 105 are designed (and operated) as CHP units by provision of exporting hot water to a nearby LNG regasification plant. Footnote 2 to Table 23 of the LCP BAT Conclusions states that in case of CHP units only one between the Net Total Fuel Utilisation and the Net Electrical Efficiency should apply depending on the CHP unit design (i.e. either more oriented towards electricity generation or heat generation).

Therefore, since the operation of LCP 103, 104 and 105 can be considered more oriented towards electricity generation than heating generation, we have assessed the plant efficiency against BAT-AEEL for Net Electrical Efficiency. Nevertheless, the operator has stated for completeness that the Net Fuel Utilisation, when operating in CHP mode, is 73%. This figure is within the range of 65-95% BAT-AEEL Net Fuel Utilisation for CCGT combustion plants (>= 600 MWth).

4.3 Availability of NOx reduction techniques for existing gas turbines operating <500 hours per year

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

For the gas turbines of LCP 102, the operator has provided BAT assessment for emissions of NOx that follows the approach described in this JEP report.

The techniques considered in the BAT assessment submitted by the operator, are those potentially applicable to gas turbines firing gas oil and operating less than 500 hours per year, according to BAT conclusion 37, namely:

a. Water/Steam injection;
b. Use of Dry Low NOx burners.

The technical information on the two Avon gas turbines installed in LCP 102, provided in support of this assessment, can be found in the JEP report JEP19AIB08 / UTG/18/PMP/774/R, '*BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year*'.

According to this report, endorsed by us, the original equipment manufacturer and third-party service organisations advise that there are no commercially available options for NOx reduction for Avon gas turbines when firing on gas oil.

Based on this supporting information, and in line with the methodology set out in the JEP report '*BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year'*, the Operator has concluded that techniques a. and b. of BATc 37 are not available for LCP 102 and that the currently permitted performance, along with continued appropriate maintenance, are BAT to prevent or reduce emissions of NOx from these gas turbines.

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

We agree with the conclusions of the assessment provided by the operator and we consider accordingly that the techniques reported under BATc 37 are not applicable to LCP 102.

4.4 BAT 9 - Fuel Characterisation

BATc 9 requires the operator to carry out fuel characterisation.

LCP 103, 104 and 105 burn natural gas. We consider that for plants which burn natural gas from the National Grid as a fuel that it is not necessary for the operator to replicate the testing carried out by the National Grid.

For LCP 102, the operator tests a sample of gas oil every 6 months including sulphur content and calorific value. The operator also tests a composite of a batch of deliveries for the same parameters. The operator has stated that, at the present, samples are not tested for N, C and Ash, which are required parameters for gas oil according to BATc 9.

We have therefore included an improvement condition in the consolidated variation notice (IC11) requiring the operator to submit for approval a plan outlining how the gas oil characterisation will be carried out in order to fully meet the requirements of BATc 9, prior to the implementation date for the BAT Conclusions.

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

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

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
General			
1	**In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:** i. commitment of the management, including senior management; ii. definition of an environmental policy that includes the continuous improvement of the installation by the management; iii. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; iv. implementation of procedures (a) Structure and responsibility (b) Training (c) Communication (d) Employee involvement (e) Documentation (f) Efficient process control (g) Maintenance programmes (h) Emergency preparedness and response (i) Safeguarding compliance with environmental legislation v. checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (see also the Reference Document on the General Principles of Monitoring) (b) corrective and preventive action (c) maintenance of records (d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; vi. review of the EMS and its continuing suitability, adequacy and effectiveness by senior management; vii. following the development of cleaner technologies; viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life; viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life;	CC	The site operates according to an environmental management system (EMS) accredited to ISO Standard 14001:2015. Sites within the UK operated by the same operator have a shared corporate EMS that sets central system procedures. This is complemented by site specific procedures. The operator has confirmed that their corporate EMS addresses all the features described in BATc 1 (i. to xiii.), with site specific procedures and systems in place at Grain Power Station to address topics listed in BATc 1 x. to xvi., where relevant to the operations of the site and the associated environmental aspects and risk assessment. The permit does not include activities that require a dust management plan, since only natural gas and gas oil with low content of ashes are permitted to be burned. Conditions 3.2.1 and 3.2.2 of the variation and consolidation notice regulate fugitive emissions (emissions of substances not controlled by emission limits), including fugitive emissions of dust, should this become a relevant aspect. The permit does not include activities requiring an odour management plan, since the combustion of malodorous substances is not permitted. However, conditions 3.3.1 and 3.3.2 of the variation and consolidation notice regulate odorous emissions, should this become a relevant aspect.

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
	ix. application of sectoral benchmarking on a regular basis. Etc - see BAT Conclusions **Applicability**. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.		
2	BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification, IGCC and/or combustion units by carrying out a performance test at full load (1), according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	CC	The operator carried out performance tests on the CCGTs of LCP 103 (Unit 6), LCP 104 (Unit 7) and LCP 105 (Unit 8) after commissioning the units in 2011. The results of these performance tests are referred in Table S1.1 'Operating Techniques' of the variation and consolidation notice (document dated 30/06/15). The calculation provided by the operator was based on the determination, according to equipment manufacturer's standards, of the Net Heat Rate (kJ/kWh) and net power output, corrected to ISO base load conditions (ambient temperature 15degC, ambient pressure 1.013 bar(a) and relative humidity of 60% consistent with ISO Standard 3977 Part 2). According to this document, the following figures corrected to ISO base load conditions are declared by the operator: LCP 103 (Unit 6) = 737MWth input, 58.57% net electrical efficiency, 431.69MW net electrical power output LCP 104 (Unit 7) = 746MWth input, 58.44% net electrical efficiency, 436.027MW net electrical power output

<table>
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<tr><td></td><td></td><td></td><td>LCP 105 (Unit 8) = 744MWth input, 58.36% net electrical efficiency, 434.244MW net electrical power output
The operator has also reported that, under the long term maintenance agreement contract between the operator and the equipment manufacturer, a performance test is also completed pre and post outage for maintenance.

The OCGTs of LCP 102 operate for <500 hours per year. For these gas turbines, the operator has referred to efficiency data reported within the Joint Environmental Programme (JEP) Report, ‘BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year'. According to this report, endorsed by us, the reported net electrical efficiency for the Rolls Royce Avon gas turbines of LCP 102 (installed circa 1978), running on gas oil, is 26.5%.

We consider the information provided is of equivalent scientific quality of EN standards and demonstrates current compliance with this BAT conclusion.

A process monitoring requirement has been set in table S3.3 which requires energy efficiency monitoring after an overhaul.</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>Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr></table></td><td>CC</td><td>Process parameters for oxygen, stack gas temperature, and stack gas pressure are all continuously monitored on CCGT Units 6, 7 & 8 at Grain Power Station.
Water vapour is not monitored because the stack gas is dried before entering CEMS. Stack gas flow rate is</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 rowspan="2"></td><td>Oxygen content, temperature, and pressure</td><td rowspan="2">Periodic or continuous measurement</td></tr>
<tr><td>Water vapour content (1)</td></tr>
<tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
</table>
(1) The continous measurement of the water vapour content of the flue-gas is not necessary if the sampled flue-gas is dried before analysis</td><td></td><td>determined from the metered unit fuel consumption and this has been verified by the operator according to EN ISO 16911-2.

The OCGTs of LCP 102 operate for less than 500 hours per year, therefore emissions monitoring and reporting requirements are based on calculation, as opposed to direct measurement of flue gas parameters (refer to BATc 4). As specified in Note 2 to BATc 4, the specified monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement. We therefore consider the flue-gas monitoring requirements of BATc 3 not applicable to LCP 102.

Process parameters for emissions to water:
BATc 3 specifies monitoring of process water only applicable to waste water from flue gas treatment which does not apply at Grain Power Station.</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</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (8)</td><td>BAT 20
BAT 24
BAT 28
BAT 32</td></tr>
</table></td><td>CC</td><td>The installation meets the monitoring requirements that are relevant to natural gas fired turbines as set out in BATc 4, these being NOx, CO, and O2 for correction purposes, as set out in the current environmental permit. Continuous emissions monitoring is specified according to standard BS EN 14181.

The OCGTs of LCP 102 are operated for less than 500 hours per year and the schedule for running is unknown, making not feasible to plan monitoring. As specified in Note 2 to BATc 4, the specified monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement. Concentrations of NOx,</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 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				BAT 37 BAT 41 BAT 42 BAT 43 BAT 47 BAT 48 BAT 56 BAT 64 BAT 65 BAT 73		
		— Combustion plants on offshore platforms	All sizes	EN 14792	Once every year ([9])	BAT 53		
	N_2O	— Coal and/or lignite in circulating fluidised bed boilers — Solid biomass and/or peat in circulating fluidised bed boilers	All sizes	EN 21258	Once every year ([10])	BAT 20 BAT 24		
	CO	— Coal and/or lignite including waste co-incineration	All sizes	Generic EN standards	Continuous ([6]) ([8])	BAT 20 BAT 24 BAT 28 BAT 33 BAT 38		CO, dust and SO2 are calculated every 4380 operational hours or 2 years, whichever is sooner, based on fuel usage and emissions factors, according to the agreed protocol described in JEP Report JEP17EMG02 / UTG/18/ERG/CT/773/R 'Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year', October 2018.

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 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				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	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
		— Gas-oil-fired gas turbines — Iron and steel process gases — 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	All sizes	Generic EN standards and	Continuous [6] [17]	BAT 22 BAT 26		

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 — HFO- and/or gas-oil-fired boilers — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines		EN 13284-1 and EN 13284-2		BAT 30 BAT 35 BAT 39 BAT 51 BAT 58 BAT 75		
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69		
	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		< 300 MW_{th}	EN 13211	Once every three months [13] [20]	BAT 23		

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
		— Coal and/or lignite including waste co-incineration	≥ 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		
	Formaldehyde	— Natural-gas in spark-ignited lean-burn gas and dual fuel engines	All sizes	No EN standard available	Once every year	BAT 45		
	CH_4	— Natural-gas-fired engines	All sizes	EN ISO 25139	Once every year [24]	BAT 45		
	PCDD/F	— Process fuels from chemical industry in boilers — Waste co-incineration	All sizes	EN 1948-1, EN 1948-2, EN 1948-3	Once every six months [13] [25]	BAT 59 BAT 71		

<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>5</td><td>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 colspan="2">Substance/Parameter</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 rowspan="15">Once every month</td><td rowspan="14">BAT 15</td></tr>
<tr><td colspan="2">Chemical oxygen demand (COD) ([26])</td><td>No EN standard available</td></tr>
<tr><td colspan="2">Total suspended solids (TSS)</td><td>EN 872</td></tr>
<tr><td colspan="2">Fluoride (F^-)</td><td>EN ISO 10304-1</td></tr>
<tr><td colspan="2">Sulphate (SO_4^{2-})</td><td>EN ISO 10304-1</td></tr>
<tr><td colspan="2">Sulphide, easily released (S^{2-})</td><td>No EN standard available</td></tr>
<tr><td colspan="2">Sulphite (SO_3^{2-})</td><td>EN ISO 10304-3</td></tr>
<tr><td rowspan="8">Metals and metalloids</td><td>As</td><td rowspan="7">Various EN standards available (e.g. EN ISO 11885 or EN ISO 17294-2)</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>
<tr><td>Zn</td></tr>
<tr><td>Hg</td><td>Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)</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></tr>
<tr><td colspan="2">Total nitrogen</td><td>EN 12260</td><td>—</td></tr>
</table></td><td>NA</td><td>Not applicable to Grain Power Station - no FGD is installed at Grain Power Station</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>6</td><td>In order to improve the general environmental performance of combustion plants and to reduce emissions to air of CO and unburnt substances, BAT is to ensure optimised combustion and to use an appropriate combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel blending and mixing</td><td>Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>b.</td><td>Maintenance of the combustion system</td><td>Regular planned maintenance according to suppliers' recommendations</td></tr>
<tr><td>c.</td><td>Advanced control system</td><td>See description in Section 8.1</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>d.</td><td>Good design of the combustion equipment</td><td>Good design of furnace, combustion chambers, burners and associated devices</td><td>Generally applicable to new combustion plants</td></tr>
<tr><td>e.</td><td>Fuel choice</td><td>Select or switch totally or partially to another fuel(s) with a better environmental profile (e.g. with low sulphur and/or mercury content) amongst the available fuels, including in start-up situations or when back-up fuels are used</td><td>Applicable within the constraints associated with the availability of suitable types of fuel with a better environmental profile as a whole, which may be impacted by the energy policy of the Member State, or by the integrated site's fuel balance in the case of combustion of industrial process fuels.
For existing combustion plants, the type of fuel chosen may be limited by the configuration and the design of the plant</td></tr>
</table></td><td>CC</td><td><u>LCP 103, LCP 104 and LCP 105</u>
The operator has confirmed that they undertake regular maintenance of the combustion equipment in accordance with the suppliers' recommendations and that good design of the equipment ensures combustion optimisation (EV and SEV are designed to optimise combustion) (b & d for BATc 6). The operator has also confirmed that engine mapping is also carried out as part of the Return to Service procedure after every outage for maintenance and periodically as part of ongoing maintenance when this is required.
Sequential low NOx burners are in use at Grain and the plant operates with an advanced control system (c for BATc 6) which is currently controlled through advanced computer system (DCS). This includes the monitoring of acoustic pulsations and the uniformity of circumferential gas temperature profiles in order to maintain the health of the lean premix combustion system.
Fuel blending and mixing and the potential for alternative fuels to reduce emissions to air (a and e for BATc 6) are not applied for the CCGTs at Grain.

<u>LCP 102</u>
The operator provided an assessment of compliance against this BATc in response to the Regulation 61(1) notice responded on 31/10/18 and subsequent additional information [document titled: “Follow-up Response (April 2019 v2) to the Environmental Permitting (England and Wales) Regulations 2016 Regulation 61(1) request for further information on compliance with BREF requirements for Large Combustion Plant”].</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
			The operator has confirmed that, in order to improve the general environmental performance of the OCGTs, regular planned maintenance (b) is carried out according to the equipment manufacturer recommendations. Low sulphur fuel (e) (to meet legal requirements) is also utilised. Due to the nature and age of the plant and the fuels used on the OCGTs at Grain, the following techniques are not carried out: fuel blending and mixing (a), it does not have an advanced control system (c) and good design of the combustion equipment (d) is generally only applicable to new plant. The OCGTs of LCP 102 have been in operation since around 1979. The operator has confirmed that LCP 102 had a programmable logic controller (PLC) upgrade in 1990s to allow remote control to the central control room.
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	Not applicable to Grain Power Station – no SCR / SNCR installed.
8	In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.	CC	The operator provided an assessment of compliance against this BATc in response to the Regulation 61(1) notice responded on 31/10/18 and subsequent additional information [document titled: “Follow-up Response (April 2019 v2) to the Environmental Permitting (England and Wales) Regulations 2016

<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>Regulation 61(1) request for further information on compliance with BREF requirements for Large Combustion Plant”].

The operator confirmed that the installation meets the requirements of this BAT conclusion as follows:
- The operator undertakes regular maintenance of the combustion equipment in accordance with the suppliers’ recommendations for LCP 102, LCP 103, LCP 104 and LCP 105;
- The performance of the CCGTs of LCP 103, LCP 104 and LCP 105 is monitored and DLN technology is in operation.</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>Biomass/peat</td><td>— LHV</td></tr>
</table></td><td>FC</td><td>The CCGTs of LCP 103, LCP 104 and LCP 105 at the installation meet the requirements of BATc 9 and the corresponding table.
Natural gas is the only fuel used on the CCGTs and is supplied from the National Grid. This gas has to meet a nationally agreed specification for all the parameters listed. In addition to this, gas chromatographs are installed at the installation to measure the calorific value and other gas constituents of the incoming fuel. All of the parameters specified for natural gas in BATc 9 are therefore measured or calculated semi-continuously.
In addition, the GT26 control system makes allowance for the instantaneous level of higher hydrocarbons (C2+) within the fuel and this is additionally measured, as a separate parameter, using a fast-response infra-red measurement system. There is a maintenance strategy in place to ensure the gas chromatograph is calibrated and functioning as per design. There is also a quality assurance</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
		— Moisture		check on the gas chromatograph which is carried out annually by a 3rd party. For LCP 102, the operator has confirmed that they test a sample of gas oil every 6 months for sulphur content and calorific value. The operator also tests a composite of a batch of deliveries for the same parameters. Currently, samples are not tested for N, C and Ash. An improvement conditions has been included requiring the operator to submit a plan outlining how the fuel characterisation will be carried out in order to fully meet the requirements of BATc 9 for gas oil.
		— Ash — C, Cl, F, N, S, K, Na — Metals and metalloids (As, Cd, Cr, Cu, Hg, Pb, Zn)		
	Coal/lignite	— LHV — Moisture — Volatiles, ash, fixed carbon, C, H, N, O, S		
		— Br, Cl, F		
		— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		
	HFO	— Ash — C, S, N, Ni, V		
	Gas oil	— Ash — N, C, S		
	Natural gas	— LHV — CH_4, C_2H_6, C_3, C_4+, CO_2, N_2, Wobbe index		
	Process fuels from the chemical industry ([27])	— Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		
	Iron and steel process gases	— LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index		
	Waste ([28])	— LHV — Moisture — Volatiles, ash, Br, C, Cl, F, H, N, O, S		

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
	— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		
10	In order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC), BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: — appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines), — set-up and implementation of a specific preventive maintenance plan for these relevant systems, — review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary, — periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	CC	The installation EMS incorporates the key aspects of BATc 10 as follows: - The site operates a risk based review within the EMS (aspects and impacts) which includes a review of potential impacts of OTNOC. - The power station was designed to minimise environmental impact during operational / non-operational conditions. This includes primary, secondary and tertiary containment measures to prevent emissions to soil or water from incidents. - Emissions to air and water are continually monitored with early warning alarms set on all notable parameters to bring instant notification of potential issue to plant operators. - Start up and shut down times are minimised as much as possible to reduce emissions and inefficient use of fuel. - Control systems are designed to ensure if the plant is operating in low load then emission limits are still met. Gas turbine starts are optimised based on plant condition to minimise emissions during start-up. - The power station is maintained in accordance with a full and active

<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>preventative maintenance program operated via computer software. All plant components are included within the site specific preventative maintenance programmes. The frequency of maintenance is dependent on component duty and manufacturers requirements. This programme is supported by risk assessment to identify environmentally critical plant (ECP), and emergency procedures for plant failure.</td></tr>
<tr><td>11</td><td>BAT is to appropriately monitor emissions to air and/or to water during OTNOC.
Description
The monitoring can be carried out by direct measurement of emissions or by monitoring of surrogate parameters if this proves to be of equal or better scientific quality than the direct measurement of emissions. Emissions during start-up and shutdown (SU/SD) may be assessed based on a detailed emission measurement carried out for a typical SU/SD procedure at least once every year, and using the results of this measurement to estimate the emissions for each and every SU/SD throughout the year.</td><td>CC</td><td>Emissions are continuously recorded during potential periods of OTNOC for CCGTs of LCP 103, LCP 104, LCP 105. There is no requirement for continuous monitoring of emissions of LCP 102 that is permitted to operate for less than 500 hours per year. In the event of an accident or environmental incident, the operator’s EMS requires that a review the emissions, causes, etc. is carried out as part of an incident investigation process and ensure any relevant corrective and / or preventive actions are implemented.</td></tr>
<tr><td>12</td><td>In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td>See description in Section 8.2. Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>b.</td><td>Optimisation of the working medium conditions</td><td>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</td></tr>
</table></td><td>CC</td><td>The operator provided an assessment of compliance against this BATc in response to the Regulation 61(1) notice responded on 31/10/18 and subsequent additional information [document titled: “Follow-up Response (April 2019 v2) to the Environmental Permitting (England and Wales) Regulations 2016 Regulation 61(1) request for further information on compliance with BREF requirements for Large Combustion Plant”].

Not applicable to the OCGTs (LCP 102) at Grain Power Station because the plant operates for <500 hrs/yr.</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
	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			For LCPs 103,104 & 105 the operator has confirmed that compliance is achieved by use of the following combination of techniques: - Combustion optimisation and advanced control systems (a. and g.); - Optimisation of the working medium conditions (b.); - Optimisation of the steam cycle (c.); - Minimisation of energy consumption (d.); - Fuel preheating (f.); - Feed-water preheating using recovered heat (h.); - Heat recovery by cogeneration (CHP) consisting of exporting hot water to the nearby LNG re-gasification terminal operated by the National Grid (i.); - Use of advanced materials (q.).
	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		
	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		

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
	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 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	Only applicable to new plants		

<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>achieve increased steam/combustion process efficiencies</td><td></td></tr>
<tr><td>r.</td><td>Steam turbine upgrades</td><td>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</td><td>The applicability may be restricted by demand, steam conditions and/or limited plant lifetime</td></tr>
<tr><td>s.</td><td>Supercritical and ultra-supercritical steam conditions</td><td>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</td><td>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</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>13</td><td>In order to reduce water usage and the volume of contaminated waste water discharged, BAT is to use one or both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water recycling</td><td>Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant</td><td>Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present</td></tr>
<tr><td>b.</td><td>Dry bottom ash handling</td><td>Dry, hot bottom ash falls from the furnace onto a mechanical conveyor system and is cooled down by ambient air. No water is used in the process.</td><td>Only applicable to plants combusting solid fuels.
There may be technical restrictions that prevent retrofitting to existing combustion plants</td></tr>
</table>
</td><td>CC</td><td>The operator has confirmed that, in addition to reducing water as far as possible, Grain employs a system whereby the Heat Recovery Steam Generators blow-down is recycled to the water treatment plant for reuse. This represents BAT for water usage (water recycling, BATc 13 a.).

BATc 13 b. is not applicable to the installation CCGTs as this applies only to plants using solid fuel.

BATc 13 is not applicable to the OCGTs of LCP 102 at the installation as there is no steam or cooling circuit for this plant and therefore no use of water in the process.</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>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 provided an assessment of compliance against this BATc in response to the Regulation 61(1) notice responded on 31/10/18 and subsequent additional information [document titled: “Follow-up Response (April 2019 v2) to the Environmental Permitting (England and Wales) Regulations 2016 Regulation 61(1) request for further information on compliance with BREF requirements for Large Combustion Plant”].

In line with the requirements of this BAT conclusion, the operator has confirmed that segregation of water streams is carried out at the site into the following streams:
• Precipitation waste water
• Sanitary waste water
• Process waste water
• Oily/contaminated waste water
Cooling water flow is discharged separately to the combined monitoring basin (CMB) wastewater.

Each of the above mentioned streams undertakes different treatment stages that depend on the likely contaminants and final disposal route. Treatment include oil separation on oily/contaminated streams, grit and oil filtration on surface (precipitation) streams, neutralisation on process waste water streams.</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 to Grain Power Station - no FGD is installed at Grain Power Station</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

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><th colspan="2" rowspan="2">Substance/Parameter</th><th>BAT-AELs</th></tr>
<tr><th>Daily average</th></tr>
<tr><td colspan="2">Total organic carbon (TOC)</td><td>20–50 mg/l [30] [31] [32]</td></tr>
<tr><td colspan="2">Chemical oxygen demand (COD)</td><td>60–150 mg/l [30] [31] [32]</td></tr>
<tr><td colspan="2">Total suspended solids (TSS)</td><td>10–30 mg/l</td></tr>
<tr><td colspan="2">Fluoride (F^-)</td><td>10–25 mg/l [32]</td></tr>
<tr><td colspan="2">Sulphate (SO_4^{2-})</td><td>1,3–2,0 g/l [32] [33] [34] [35]</td></tr>
<tr><td colspan="2">Sulphide (S^{2-}), easily released</td><td>0,1–0,2 mg/l [32]</td></tr>
<tr><td colspan="2">Sulphite (SO_3^{2-})</td><td>1–20 mg/l [32]</td></tr>
<tr><td rowspan="8">Metals and metalloids</td><td>As</td><td>10–50 µg/l</td></tr>
<tr><td>Cd</td><td>2–5 µg/l</td></tr>
<tr><td>Cr</td><td>10–50 µg/l</td></tr>
<tr><td>Cu</td><td>10–50 µg/l</td></tr>
<tr><td>Hg</td><td>0,2–3 µg/l</td></tr>
<tr><td>Ni</td><td>10–50 µg/l</td></tr>
<tr><td>Pb</td><td>10–20 µg/l</td></tr>
<tr><td>Zn</td><td>50–200 µg/l</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>16</td><td>In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking:
(a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;
(b) waste preparation for reuse, e.g. according to the specific requested quality criteria;
(c) waste recycling;
(d) other waste recovery (e.g. energy recovery),
by implementing an appropriate combination of techniques such as:
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td><td>CC</td><td>In terms of general waste management at the installation, the operator has confirmed that their EMS considers life cycle thinking (this is considered within the environmental aspects for the site) and ensures the waste hierarchy is applied when disposing of other waste streams which arise as part of site operations. The operator waste management policy strives to achieve zero waste to landfill where possible.
Specific techniques of BATc 16 are not applicable to the installation because there are no wastes arising from the combustion process and abatement techniques for the LCPs.</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>a.</td><td>Generation of gypsum as a by-product</td><td>Quality optimisation of the calcium-based reaction residues generated by the wet FGD so that they can be used as a substitute for mined gypsum (e.g. as raw material in the plasterboard industry). The quality of limestone used in the wet FGD influences the purity of the gypsum produced</td><td>Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions</td></tr>
<tr><td>b.</td><td>Recycling or recovery of residues in the construction sector</td><td>Recycling or recovery of residues (e.g. from semi-dry desulphurisation processes, fly ash, bottom ash) as a construction material (e.g. in road building, to replace sand in concrete production, or in the cement industry)</td><td>Generally applicable within the constraints associated with the required material quality (e.g. physical properties, content of harmful substances) associated to each specific use, and by the market conditions</td></tr>
<tr><td>c.</td><td>Energy recovery by using waste in the fuel mix</td><td>The residual energy content of carbon-rich ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat or biomass can be recovered for example by mixing with the fuel</td><td>Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber</td></tr>
<tr><td>d.</td><td>Preparation of spent catalyst for reuse</td><td>Preparation of catalyst for reuse (e.g. up to four times for SCR catalysts) restores some or all of the original performance, extending the service life of the catalyst to several decades. Preparation of spent catalyst for reuse is integrated in a catalyst management scheme</td><td>The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_X and NH_3 emissions</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>17</td><td>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Operational measures</td><td>These include:
— improved inspection and maintenance of equipment
— closing of doors and windows of enclosed areas, if possible</td><td>Generally applicable</td></tr>
</table>
</td><td>CC</td><td>LCP 103, LCP 104 and LCP105 at Grain Power Station have been constructed relatively recently (commissioning in 2011) and their design has included noise abatement features. The operator has confirmed that the following appropriate combination of techniques is used in order to reduce noise emissions at the installation:
- Operational measures (BATc 17 a.) which include inspection and maintenance of equipment, ensuring doors are closed on the</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>— equipment operated by experienced staff
— avoidance of noisy activities at night, if possible
— provisions for noise control during maintenance activities</td><td></td></tr>
<tr><td>b.</td><td>Low-noise equipment</td><td>This potentially includes compressors, pumps and disks</td><td>Generally applicable when the equipment is new or replaced</td></tr>
<tr><td>c.</td><td>Noise attenuation</td><td>Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings</td><td>Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space</td></tr>
<tr><td>d.</td><td>Noise-control equipment</td><td>This includes:
— noise-reducers
— equipment insulation
— enclosure of noisy equipment
— soundproofing of buildings</td><td>The applicability may be restricted by lack of space</td></tr>
<tr><td>e.</td><td>Appropriate location of equipment and buildings</td><td>Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens</td><td>Generally applicable to new plant</td></tr>
</table>
</td><td></td><td>plant, avoidance of noisy activities where possible and ensuring staff are appropriately trained to operate plant.
- Low-noise equipment (BATc 17 b.) is considered and installed where plant and equipment may need to be replaced with new.
- Noise attenuation (BATc 17 c.);
- Noise-control equipment (BATc 17 d.)
- Appropriate location of equipment and buildings (BATc 17 e.).
The operator has confirmed that noise surveys are carried out yearly instead of bi-yearly required by regulations. Noise surveys cover both environmental and occupational health noise and help the site to identify potential areas for improvement and these are put into the Noise Action Plan for the site.
In order to reduce noise emissions from the OCGTs of LCP 102, the following techniques are used:
- Low-noise equipment (BATc 17 b.);
- Noise attenuation (BATc 17 c.); and
- Appropriate location of equipment and buildings (BATc 17 e.).</td></tr>
<tr><td>3.1.1
Table 13</td><td>BAT-associated energy efficiency levels (BAT-AEELs) for HFO and/or gas oil combustion in boilers
<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="4">BAT-AEELs ([99]) ([100])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th colspan="2">Net total fuel utilisation (%) ([101])</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th>New unit</th><th>Existing unit</th></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</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>HFO- and/or gas-oil-fired boiler</td><td>> 36,4</td><td>35,6–37,4</td><td>80–96</td><td>80–96</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>28</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Air staging</td><td rowspan="6">See descriptions in Section 8.3</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>b.</td><td>Fuel staging</td></tr>
<tr><td>c.</td><td>Flue-gas recirculation</td></tr>
<tr><td>d.</td><td>Low-NO_X burners (LNB)</td></tr>
<tr><td>e.</td><td>Water/steam addition</td><td>Applicable within the constraints of water availability</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 rowspan="2">See descriptions in Section 8.3</td><td>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.
Not generally applicable to combustion plants of < 100 MW_{th}</td></tr>
<tr><td>h.</td><td>Advanced control system</td><td>Generally applicable to new combustion plants. The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</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>i.</td><td>Fuel choice</td><td></td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of HFO and/or gas oil in boilers
<table>
<tr><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (102)</th><th>New plant</th><th>Existing plant (103)</th></tr>
<tr><td>< 100</td><td>75–200</td><td>150–270</td><td>100–215</td><td>210–330 (104)</td></tr>
<tr><td>≥ 100</td><td>45–75</td><td>45–100 (105)</td><td>85–100</td><td>85–110 (106) (107)</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— 10-30 mg/Nm^3 for existing combustion plants of < 100 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of <100 MW_{th},
— 10–20mg/Nm^3 for existing combustion plants of ≥ 100 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of ≥ 100 MW_{th}.
</td><td></td><td></td></tr>
<tr><td>29</td><td>
In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Duct sorbent injection (DSI)</td><td rowspan="4">See description in Section 8.4</td><td rowspan="3">Generally applicable</td></tr>
<tr><td>b.</td><td>Spray dry absorber (SDA)</td></tr>
<tr><td>c.</td><td>Flue-gas condenser</td></tr>
<tr><td>d.</td><td>Wet flue-gas desulphurisation (wet FGD)</td><td>There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}.</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.
.</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>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>e.</td><td>Seawater FGD</td><td></td><td>There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}.
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>f.</td><td>Fuel choice</td><td></td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in boilers
<table>
<tr><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs for SO_2 (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (108)</th><th>New plant</th><th>Existing plant (109)</th></tr>
<tr><td>< 300</td><td>50–175</td><td>50–175</td><td>150–200</td><td>150–200 (110)</td></tr>
<tr><td>≥ 300</td><td>35–50</td><td>50–110</td><td>50–120</td><td>150–165 (111) (112)</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>30</td><td>In order to reduce dust and particulate-bound metal emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</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.	Electrostatic precipitator (ESP)	See description in Section 8.5	Generally applicable
b.	Bag filter		
c.	Multicyclones	See description in Section 8.5. Multicyclones can be used in combination with other dedusting techniques	
d.	Dry or semi-dry FGD system	See descriptions in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	
e.	Wet flue-gas desulphurisation (wet FGD)	See description in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	See applicability in BAT 29
f.	Fuel choice	See description in Section 8.5	Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State

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

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for dust (mg/Nm^3)	
	Yearly average	Daily average or average over the sampling period

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><th></th><th>New plant</th><th>Existing plant (113)</th><th>New plant</th><th>Existing plant (114)</th></tr>
<tr><td>< 300</td><td>2–10</td><td>2–20</td><td>7–18</td><td>7–22 (115)</td></tr>
<tr><td>≥ 300</td><td>2–5</td><td>2–10</td><td>7–10</td><td>7–11 (116)</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>31</td><td>In order to increase the energy efficiency of HFO and/or gas oil combustion in reciprocating engines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="2">BAT-AEELs (119)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) (120)</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — single cycle</td><td>41,5–44,5 (121)</td><td>38,3–44,5 (121)</td></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — combined cycle</td><td>> 48 (122)</td><td>No BAT-AEEL</td></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
<tr><td>32</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Low-NO_X combustion concept in diesel engines</td><td rowspan="2">See descriptions in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Exhaust-gas recirculation (EGR)</td><td>Not applicable to four-stroke engines</td></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</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>c.</td><td>Water/steam addition</td><td></td><td>Applicable within the constraints of water availability.
The applicability may be limited where no retrofit package is available</td></tr>
<tr><td>d.</td><td>Selective catalytic reduction (SCR)</td><td></td><td>Not applicable to combustion plants operated < 500 h/yr.
There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>33</td><td>
In order to prevent or reduce emissions of CO and volatile organic compounds to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td></td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>See descriptions in Section 8.3</td><td>Not applicable to combustion plants operated < 500 h/yr.
The applicability may be limited by the sulphur content of the fuel</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="3">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (123)</th><th>New plant</th><th>Existing plant (124) (125)</th></tr>
<tr><td>≥ 50</td><td>115–190 (126)</td><td>125–625</td><td>145–300</td><td>150–750</td></tr>
</table>
As an indication, for existing combustion plants burning only HFO and operated ≥ 1 500 h/yr or new combustion plants burning only HFO,
</td><td>NA</td><td>Not applicable to gas turbines.</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>— the yearly average CO emission levels will generally be 50–175 mg/Nm^3,
— the average over the sampling period for TVOC emission levels will generally be 10–40 mg/Nm^3.</td><td></td><td></td></tr>
<tr><td>34</td><td>In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td rowspan="3">See descriptions in Section 8.4</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>b.</td><td>Duct sorbent injection (DSI)</td><td>There may be technical restrictions in the case of existing combustion plants
Not applicable to combustion plants operated < 500 h/yr</td></tr>
<tr><td>c.</td><td>Wet flue-gas desulphurisation (wet FGD)</td><td>There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}.
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>
</table>
BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="3">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs for SO_2 (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (127)</th><th>New plant</th><th>Existing plant (128)</th></tr>
<tr><td>All sizes</td><td>45–100</td><td>100–200 (129)</td><td>60–110</td><td>105–235 (129)</td></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
<tr><td>35</td><td>In order to prevent or reduce dust and particulate-bound metal emissions from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</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>a.</td><td>Fuel choice</td><td rowspan="3">See descriptions in Section 8.5</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>b.</td><td>Electrostatic precipitator (ESP)</td><td>Not applicable to combustion plants operated < 500 h/yr</td></tr>
<tr><td>c.</td><td>Bag filter</td><td></td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="3">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs for dust (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (130)</th><th>New plant</th><th>Existing plant (131)</th></tr>
<tr><td>≥ 50</td><td>5–10</td><td>5–35</td><td>10–20</td><td>10–45</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>36</td><td>
In order to increase the energy efficiency of gas oil combustion in gas turbines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for gas-oil-fired gas turbines
<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="2">BAT-AEELs (132)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) (133)</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas-oil-fired open-cycle gas turbine</td><td>> 33</td><td>25–35,7</td></tr>
<tr><td>Gas-oil-fired combined cycle gas turbine</td><td>> 40</td><td>33–44</td></tr>
</table>
</td><td>N/A</td><td>Not applicable to the OCGTs at Grain because the plant operates for <500 hrs/yr. Technique BATc 36 (a) only applies to plant operating for ≥1500 hrs/yr. BAT-AEELs do not apply to units operating < 1500 hrs/y.

Refer also to assessment of BATc 12.</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>37</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water/steam addition</td><td rowspan="3">See description in Section 8.3</td><td>The applicability may be limited due to water availability</td></tr>
<tr><td>b.</td><td>Low-NO_X burners (LNB)</td><td>Only applicable to turbine models for which low-NO_X burners are available on the market</td></tr>
<tr><td>c.</td><td>Selective catalytic reduction (SCR)</td><td>Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table></td><td>NA</td><td>We consider that the techniques described by this BAT conclusion are not applicable to the OCGTs of LCP102 because:
- They operate less than 500 hours per year;
- There are currently no NOx emission reduction options available for the type of turbines installed within LCP102 (Rolls-Royce Avon)

In making this assessment, we have considered the reference technical information available within the Joint Environmental Programme (JEP) report UTG/18/PMP/774/R, ‘BAT Assessment for Existing Gas & Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50 MWth or Greater Operating <500 Hours Per Year’. Further details are discussed in the key issues section.</td></tr>
<tr><td>38</td><td>In order to prevent or reduce CO emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td rowspan="2">See description in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>Not applicable to combustion plants operated < 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
As an indication, the emission level for NO_X emissions to air from the combustion of gas oil in dual fuel gas turbines for emergency use operated < 500 h/yr will generally be 145–250 mg/Nm^3 as a daily average or average over the sampling period.</td><td>CC</td><td>The operator provided an assessment of compliance against this BATc in response to a request for additional information [document titled: “Follow-up Response (April 2019 v2) to the Environmental Permitting (England and Wales) Regulations 2016 Regulation 61(1) request for further information on compliance with BREF requirements for Large Combustion Plant”].

The operator has confirmed that combustion optimisation is implemented as a technique to prevent or reduce CO emissions air from the combustion of gas oil in gas turbines of LCP 102. Combustion optimisation is implemented by ensuring that an appropriate inspection and maintenance regime is followed for this combustion equipment, in line with the JEP report JEP17EMG02 /</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
			UTG/18/ERG/CT/773/R 'Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year', October 2018. The operator has confirmed that, once set-up, the diffusion flame combustion system of the Avon gas turbines installed within LCP 102 is robust and is expected to deliver good combustion performance subject to maintaining i) the mechanical integrity of the combustor and ii) the fuel injection nozzles which should remain clean (un-coked) and undamaged, in line, with the maintenance requirements outlined in the above mentioned JEP report. The operator has confirmed that Grain power station follows these maintenance guidelines. The indicative NOx BAT-AEL for oil firing on dual-fuel fired gas turbines does not apply to LCP102 because it does not consists of dual-fuel gas turbines. The operator has provided an assessment of their current NOx emission levels and available techniques for their reduction. The current emission level is 300 mg/m^3. We consider that there are currently no NOx emission reduction options available for the type of turbines installed within LCP102 (Rolls-Royce Avon). In making this assessment, we have considered the reference technical information available within the Joint Environmental Programme (JEP) report UTG/18/PMP/774/R, 'BAT Assessment for Existing Gas & Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50 MWth or Greater Operating <500 Hours Per Year'.

<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 have therefore accepted that the currently NOx emission levels, along with appropriate maintenance of the gas turbines, is BAT for the installation. Accordingly, we have set an indicative emission level of 300 mg/m^3 in the varied and consolidated permit. It is noted that the indicative emission level set in the permit is an industry benchmark emission level from reported industry performance documented in JEP report JEP17EMG02 / UTG/18/ERG/CT/773/R ‘Maintaining the Emissions Performance of Open Cycle Gas Turbines that operate for less than 500 hours per year’, October 2018.

Further details are discussed in the key issues section.</td></tr>
<tr><td>39</td><td>In order to prevent or reduce SO_X and dust emissions to air from the combustion of gas oil in gas turbines, BAT is to use the technique given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td>See description in Section 8.4</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
</table>
BAT-associated emission levels for SO_2 and dust emissions to air from the combustion of gas oil in gas turbines, including dual fuel gas turbines
<table>
<tr><th rowspan="3">Type of combustion plant</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">SO_2</th><th colspan="2">Dust</th></tr>
<tr><th>Yearly average (134)</th><th>Daily average or average over the sampling period (135)</th><th>Yearly average (134)</th><th>Daily average or average over the sampling period (135)</th></tr>
<tr><td>New and existing plants</td><td>35–60</td><td>50–66</td><td>2–5</td><td>2–10</td></tr>
</table></td><td>CC</td><td>The operator has confirmed that the installation implements ‘fuel choice’ as a technique to prevent and reduce emissions of SOx and dust from combustion of liquid fuel in LCP 102.
LCP 102 is permitted to operate for no more than 500 hours per year.
The yearly BAT-AELs for SO_2 and dust are not applicable to existing plants operating for less than 1500 hours per year.
The daily (or over sampling period) BAT-AELs for SO_2 and dust are indicative for existing plants operating for less than 500 hours per year.
LCP 102 meets the indicative daily (or over sampling period) BAT-AEL as follows:
- The indicative BAT-AEL requirement for SO_2 is satisfied for gas oil by restricting the sulphur content of the fuel to 0.1%, by mass, in line with the Sulphur Content of Liquid Fuels Regulations;</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>- The indicative BAT-AEL for dust is satisfied by restricting the maximum ash content of gas oil to 0.01% by mass.
We have specified the indicative BAT-AELs in the permit.</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>LCP 103, LCP 104 and LCP105 at Grain Power Station operate in combined cycle mode in accordance with BATc 40.
Refer also to the assessment provided for BATc 12 (energy efficiency techniques).

The BAT AEEL range for net electrical efficiency applicable to the Grain CCGTs is 50-60% (based on a thermal input ranging between 737MWth and 746MWth input for the three LCPs). The CCGTs at Grain Power Station meet the BAT AEEL as follows:

LCP 103 (Unit 6) = 737MWth input, 58.6% net electrical efficiency, 431.69MW net electrical power output

LCP 104 (Unit 7) = 746MWth input, 58.44% net electrical efficiency, 436.027MW net electrical power output

LCP 105 (Unit 8) = 744MWth input, 58.36% net electrical efficiency, 434.244MW net electrical power output</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}.</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines</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>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></td><td></td></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>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></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>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>
</table>
</td><td>CC</td><td>In order to prevent or reduce NOx emissions to air, the following combination of techniques from BATc 42 Table are implemented in LCP 103, LCP 104 and LCP 105:
- Advanced control system (BATc 42a),
- Dry-low NOx (DLN) burners (BATc 42c),
- Low NOx burners (BATc 42e) (a combination of both (c) and (e) as the site has sequential low NOx burners); and
- Low load design concept (BATc 42d) which is installed on LCP 103 and LCP 104.</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>f.</td><td>Selective catalytic reduction (SCR)</td><td></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 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</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines</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>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>
<tr><td colspan="4">Open-cycle gas turbines (OCGTs) (146) (147)</td></tr>
<tr><td>New OCGT</td><td>≥ 50</td><td>15–35</td><td>25–50</td></tr>
<tr><td>Existing OCGT (excluding turbines for mechanical drive applications) — All but plants operated < 500 h/yr</td><td>≥ 50</td><td>15–50</td><td>25–55 (148)</td></tr>
<tr><td colspan="4">Combined-cycle gas turbines (CCGTs) (146) (149)</td></tr>
<tr><td>New CCGT</td><td>≥ 50</td><td>10–30</td><td>15–40</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of < 75 %</td><td>≥ 600</td><td>10–40</td><td>18–50</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of ≥ 75 %</td><td>≥ 600</td><td>10–50</td><td>18–55 (150)</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of < 75 %</td><td>50–600</td><td>10–45</td><td>35–55</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of ≥ 75 %</td><td>50–600</td><td>25–50 (151)</td><td>35–55 (152)</td></tr>
<tr><td colspan="4">Open- and combined-cycle gas turbines</td></tr>
<tr><td>Gas turbine put into operation no later than 27 November 2003, or existing gas turbine for emergency use and operated < 500 h/yr</td><td>≥ 50</td><td>No BAT-AEL</td><td>60–140 (153) (154)</td></tr>
</table></td><td>CC</td><td>The operator provided an assessment of compliance against this BATc in response to the Regulation 61(1) notice responded on 31/10/18 and subsequent additional information [document titled: “Follow-up Response (April 2019 v2) to the Environmental Permitting (England and Wales) Regulations 2016 Regulation 61(1) request for further information on compliance with BREF requirements for Large Combustion Plant”].

The operator has confirmed that BATc 44 is implemented for LCP 103, LCP 104 and LCP 105 by using optimised combustion.

BAT AELs for emissions of NOx from LCP 103, LCP 104 and LCP 104 (existing CCGT with a net total fuel utilisation of <75% for ≥600MWth input plant) are met as follows:
- Yearly average NOx limit of 42.5 mg/Nm^3 (considering adjustment for energy efficiency EE > 55%);
- Daily average NOx limit of 50 mg/Nm^3 ; in this case the adjustment for energy efficiency is not considered on the ground of no backsliding from the limits specified in the permit prior to this review

These limits have been reflected in Table S3.1a of the varied and consolidated permit.</td></tr>
</table>

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

Existing gas turbine for mechanical drive applications — All but plants operated < 500 h/yr	≥ 50	15–50 ([155])	25–55 ([156])

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

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

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

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in boilers and engines

Type of combustion plant	BAT-AELs (mg/Nm^3)			
	Yearly average ([157])		Daily average or average over the sampling period	
	New plant	Existing plant ([158])	New plant	Existing plant ([159])
Boiler	10–60	50–100	30–85	85–110
Engine ([160])	20–75	20–100	55–85	55–110 ([161])

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,

Refer to the key issues section for further details of how the limits for NOx have been worked out from the comparison and review of the LCP BAT conclusions, IED Chapter III limits and limits retained from the current permit based on the no-backsliding principle.

The operator has proposed a deviation from the upper end of the indicative BAT-AEL for CO emissions based on the technical characteristics of the turbines installed: the proposed ELV increases the indicative BAT-AEL to 50 mg/m^3 in order to allow for the combustion characteristics of this gas turbine and potential combustor degradation relating to combustor air in-leakage.

We consider the justification provided by the operator is satisfactory and we have set the annual emission limits for CO at 50 mg/m^3 in the revised and consolidated permit.

Refer to the key issues section for further details.

<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>— < 5–15 mg/Nm^3 for new boilers,
— 30–100 mg/Nm^3 for existing engines operated ≥ 1 500 h/yr and for new engines.</td><td></td><td></td></tr>
<tr><td>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="3">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>Not applicable to gas turbines</td></tr>
<tr><td>46</td><td>In order to increase the energy efficiency of the combustion of iron and steel process gases, 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>Process gas management system</td><td>See description in Section 8.2</td><td>Only applicable to integrated steelworks</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of iron and steel process gases in boilers
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="2">BAT-AEELs (164) (165)</th></tr>
<tr><th>Net electrical efficiency (%)</th><th>Net total fuel utilisation (%) (166)</th></tr>
<tr><td>Existing multi-fuel firing gas boiler</td><td>30–40</td><td>50–84</td></tr>
<tr><td>New multi-fuel firing gas boiler (167)</td><td>36–42,5</td><td>50–84</td></tr>
</table></td><td>NA</td><td>Not applicable to Grain Power Station</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of iron and steel process gases in CCGTs
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="3">BAT-AEELs ([168]) ([169])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th>Net total fuel utilisation (%) ([170])</th></tr>
<tr><th></th><th>New unit</th><th>Existing unit</th><th></th></tr>
<tr><td>CHP CCGT</td><td>> 47</td><td>40–48</td><td>60–82</td></tr>
<tr><td>CCGT</td><td>> 47</td><td>40–48</td><td>No BAT-AEEL</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>47</td><td>
In order to prevent or reduce NO_X emissions to air from the combustion of iron and steel process gases 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>Low-NO_X burners (LNB)</td><td>See description in Section 8.3.
Specially designed low-NO_X burners in multiple rows per type of fuel or including specific features for multi-fuel firing (e.g. multiple dedicated nozzles for burning different fuels, or including fuels premixing)</td><td rowspan="4">Generally applicable</td></tr>
<tr><td>b.</td><td>Air staging</td><td rowspan="3">See descriptions in Section 8.3</td></tr>
<tr><td>c.</td><td>Fuel staging</td></tr>
<tr><td>d.</td><td>Flue-gas recirculation</td></tr>
<tr><td>e.</td><td>Process gas management system</td><td>See description in Section 8.2.</td><td>Generally applicable within the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>f.</td><td>Advanced control system</td><td>See description in Section 8.3.
This technique is used in combination with other techniques</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>g.</td><td>Selective non-catalytic reduction (SNCR)</td><td>See descriptions in Section 8.3</td><td>Not applicable to combustion plants operated < 500 h/yr</td></tr>
</table>
</td><td>NA</td><td>Not applicable to Grain Power Station</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>h.</td><td>Selective catalytic reduction (SCR)</td><td></td><td>Not applicable to combustion plants operated < 500 h/yr.
Not generally applicable to combustion plants of < 100 MW_{th}.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space and by the combustion plant configuration</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>48</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of iron and steel process gases in CCGTs, 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>Process gas management system</td><td>See description in Section 8.2</td><td>Generally applicable within the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>b.</td><td>Advanced control system</td><td>See description in Section 8.3.
This technique is used in combination with other techniques</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>c.</td><td>Water/steam addition</td><td>See description in Section 8.3.
In dual fuel gas turbines using DLN for the combustion of iron and steel process gases, water/steam addition is generally used when combusting natural gas</td><td>The applicability may be limited due to water availability</td></tr>
<tr><td>d.</td><td>Dry low-NO_X burners(DLN)</td><td>See description in Section 8.3.
DLN that combust iron and steel process gases differ from those that combust natural gas only</td><td>Applicable within the constraints associated with the reactiveness of iron and steel process gases such as coke oven gas.
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>e.</td><td>Low-NO_X burners (LNB)</td><td>See description in Section 8.3</td><td>Only applicable to supplementary firing for heat recovery steam generators (HRSGs) of combined-cycle gas turbine (CCGT) combustion plants</td></tr>
</table>
</td><td>NA</td><td>Not applicable to Grain Power Station</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>f.</td><td>Selective catalytic reduction (SCR)</td><td></td><td>Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>49</td><td>
In order to prevent or reduce CO emissions to air from the combustion of iron and steel process gases, 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>Combustion optimisation</td><td rowspan="2">See descriptions in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>Only applicable to CCGTs.
The applicability may be limited by lack of space, the load requirements and the sulphur content of the fuel</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of 100 % iron and steel process gases
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">O_2 reference level (vol-%)</th><th colspan="2">BAT-AELs (mg/Nm^3) ([171])</th></tr>
<tr><th>Yearly average</th><th>Daily average or average over the sampling period</th></tr>
<tr><td>New boiler</td><td>3</td><td>15–65</td><td>22–100</td></tr>
<tr><td>Existing boiler</td><td>3</td><td>20–100 ([172]) ([173])</td><td>22–110 ([172]) ([174]) ([175])</td></tr>
<tr><td>New CCGT</td><td>15</td><td>20–35</td><td>30–50</td></tr>
<tr><td>Existing CCGT</td><td>15</td><td>20–50 ([172]) ([173])</td><td>30–55 ([175]) ([176])</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— < 5–100 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,
— < 5–35 mg/Nm^3 for new boilers,
— < 5–20 mg/Nm^3 for existing CCGTs operated ≥ 1 500 h/yr or new CCGTs.
</td><td>NA</td><td>Not applicable to Grain Power Station</td></tr>
<tr><td>50</td><td>
In order to prevent or reduce SO_X emissions to air from the combustion of iron and steel process gases, BAT is to use 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>Process gas management system</td><td>See description in Section 8.2.</td><td>Generally applicable within</td></tr>
</table>
</td><td>NA</td><td>Not applicable to Grain Power Station</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>and auxiliary fuel choice</td><td>To the extent allowed by the iron- and steel-works, maximise the use of:
— a majority of blast furnace gas with a low sulphur content in the fuel diet,
— a combination of fuels with a low averaged sulphur content, e.g. individual process fuels with a very low S content such as:
— Blast furnace gas with a sulphur content < 10 mg/Nm^3,
— coke oven gas with a sulphur content < 300 mg/Nm^3,
— and auxiliary fuels such as:
— natural gas,
— liquid fuels with a sulphur content of ≤ 0,4 % (in boilers).
Use of a limited amount of fuels with a higher sulphur content</td><td>the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>b.</td><td>Coke oven gas pretreatment at the iron- and steel-works</td><td>Use of one of the following techniques:
— desulphurisation by absorption systems,
— wet oxidative desulphurisation</td><td>Only applicable to coke oven gas combustion plants</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of 100 % iron and steel process gases
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">O_2 reference level (%)</th><th colspan="2">BAT-AELs for SO_2 (mg/Nm^3)</th></tr>
<tr><th>Yearly average [177]</th><th>Daily average or average over the sampling period [178]</th></tr>
<tr><td>New or existing boiler</td><td>3</td><td>25–150</td><td>50–200 [179]</td></tr>
<tr><td>New or existing CCGT</td><td>15</td><td>10–45</td><td>20–70</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>51</td><td>In order to reduce dust emissions to air from the combustion of iron and steel process gases, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td><td>NA</td><td>Not applicable to Grain Power Station</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>a.</td><td>Fuel choice/management</td><td>Use of a combination of process gases and auxiliary fuels with a low averaged dust or ash content</td><td>Generally applicable within the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>b.</td><td>Blast furnace gas pretreatment at the iron- and steel-works</td><td>Use of one or a combination of dry dedusting devices (e.g. deflectors, dust catchers, cyclones, electrostatic precipitators) and/or subsequent dust abatement (venturi scrubbers, hurdle-type scrubbers, annular gap scrubbers, wet electrostatic precipitators, disintegrators)</td><td>Only applicable if blast furnace gas is combusted</td></tr>
<tr><td>c.</td><td>Basic oxygen furnace gas pretreatment at the iron- and steel-works</td><td>Use of dry (e.g. ESP or bag filter) or wet (e.g. wet ESP or scrubber) dedusting. Further descriptions are given in the Iron and Steel BREF</td><td>Only applicable if basic oxygen furnace gas is combusted</td></tr>
<tr><td>d.</td><td>Electrostatic precipitator (ESP)</td><td rowspan="2">See descriptions in Section 8.5</td><td rowspan="2">Only applicable to combustion plants combusting a significant proportion of auxiliary fuels with a high ash content</td></tr>
<tr><td>e.</td><td>Bag filter</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of 100 % iron and steel process gases
<table>
<tr><th rowspan="2">Type of combustion plant</th><th colspan="2">BAT-AELs for dust (mg/Nm^3)</th></tr>
<tr><th>Yearly average ([180])</th><th>Daily average or average over the sampling period ([181])</th></tr>
<tr><td>New or existing boiler</td><td>2–7</td><td>2–10</td></tr>
<tr><td>New or existing CCGT</td><td>2–5</td><td>2–5</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>52</td><td>In order to improve the general environmental performance of the combustion of gaseous and/or liquid fuels on offshore platforms, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Process optimisation</td><td>Optimise the process in order to minimise the mechanical power requirements</td><td>Generally applicable</td></tr>
</table>
</td><td>NA</td><td>Not applicable to Grain Power Station</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement				Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	b.	Control pressure losses	Optimise and maintain inlet and exhaust systems in a way that keeps the pressure losses as low as possible			
	c.	Load control	Operate multiple generator or compressor sets at load points which minimise emissions			
	d.	Minimise the 'spinning reserve'	When running with spinning reserve for operational reliability reasons, the number of additional turbines is minimised, except in exceptional circumstances			
	e.	Fuel choice	Provide a fuel gas supply from a point in the topside oil and gas process which offers a minimum range of fuel gas combustion parameters, e.g. calorific value, and minimum concentrations of sulphurous compounds to minimise SO_2 formation. For liquid distillate fuels, preference is given to low-sulphur fuels			
	f.	Injection timing	Optimise injection timing in engines			
	g.	Heat recovery	Utilisation of gas turbine/engine exhaust heat for platform heating purposes	Generally applicable to new combustion plants. In existing combustion plants, the applicability may be restricted by the level of heat demand and the combustion plant layout (space)		
	h.	Power integration of multiple gas fields/oilfields	Use of a central power source to supply a number of participating platforms located at different gas fields/oilfields	The applicability may be limited depending on the location of the different gas fields/oilfields and on the organisation of the different participating platforms, including alignment of time schedules regarding planning, start-up and cessation of production		
53	In order to prevent or reduce NO_X emissions to air from the combustion of gaseous and/or liquid fuels on offshore platforms, BAT is to use one or a combination of the techniques given below.				NA	Not applicable to Grain Power Station

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Advanced control system</td><td rowspan="4">See descriptions in Section 8.3</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>Dry low-NO_X burners (DLN)</td><td>Applicable to new gas turbines (standard equipment) within the constraints associated with fuel quality variations.
The applicability may be limited for existing gas turbines by: availability of a retrofit package (for low-load operation), complexity of the platform organisation and space availability</td></tr>
<tr><td>c.</td><td>Lean-burn concept</td><td>Only applicable to new gas-fired engines</td></tr>
<tr><td>d.</td><td>Low-NO_X burners (LNB)</td><td>Only applicable to boilers</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>54</td><td>In order to prevent or reduce CO emissions to air from the combustion of gaseous and/or liquid fuels in gas turbines on offshore platforms, 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>Combustion optimisation</td><td rowspan="2">See descriptions in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>Not applicable to combustion plants operated < 500 h/yr.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space and by weight restrictions</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of gaseous fuels in open-cycle gas turbines on offshore platforms
<table>
<tr><th rowspan="2">Type of combustion plant</th><th>BAT-AELs (mg/Nm^3) ([182])</th></tr>
<tr><th>Average over the sampling period</th></tr>
<tr><td>New gas turbine combusting gaseous fuels ([183])</td><td>15–50 ([184])</td></tr>
<tr><td>Existing gas turbine combusting gaseous fuels ([183])</td><td>< 50–350 ([185])</td></tr>
</table>
As an indication, the average CO emission levels over the sampling period will generally be:</td><td>NA</td><td>Not applicable to Grain Power Station</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
	— < 100 mg/Nm^3 for existing gas turbines combusting gaseous fuels on offshore platforms operated ≥ 1 500 h/yr, — < 75 mg/Nm^3 for new gas turbines combusting gaseous fuels on offshore platforms.		

6 Emissions to Water

The consolidated permit incorporates the one current discharge to controlled waters (River Medway) identified as W1 that consists of cooling water and process water.

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.

7 Additional IED Chapter II requirements:

The BAT for balancing plant guidance (Draft V9, 2017) sets out additional restrictions on hours for <1500 hour non-emergency plant which are low efficiency. Table 1 of the guidance sets out categories for LCP peaking plant. LCP 102 at Grains Power Station falls into category B because its NOx emissions are below the threshold of 500 mg/m^3 (dry at 15% O_2) and its efficiency at 26.5% is above that set out in table 2 of the guidance for OCGTs operating with liquid fuels. Table 1 of the guidance therefore confirms that there are no additional restrictions applied to the hours of operation below 500 hours per year.

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

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

Aspect considered	Decision
Receipt of application	
Confidential information	A claim for commercial or industrial confidentiality has not been made.
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential.
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	Based on the information on the application, we consider that we need to impose an improvement programme. We have imposed an improvement programme to ensure that the operator will have a plan in place to ensure that the gas oil is characterised in line with BATc 9.
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 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 BATc 2. Based on the information in the application we are satisfied that the operator's techniques, personnel and equipment have either MCERTS certification or MCERTS accreditation as appropriate.
Reporting	We have specified reporting in the permit for the following parameters: • Nitrogen dioxide • Carbon monoxide • Sulphur dioxide • Dust These are described in the relevant BAT Conclusions in Section 5 of this document.
Operator competence	
Management system	There is no known reason to consider that the operator will not have the management system to enable it to comply with the permit conditions.
Growth Duty	

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.