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/EP3133RZ
The Operator is: Uniper UK Limited
The Installation is: Ratcliffe On Soar Power Station
This Variation Notice number is: EPR/EP3133RZ/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 (LCP) 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 BAT Conclusions for (LCP) 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
Derogation	from BAT AELs stated in BAT Conclusions under specific circumstances as detailed under Article 15(4) of IED where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs
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
IC	Improvement Condition
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
LCP	Large Combustion Plant subject to Chapter III of IED
MSUL/MSDL	Minimum start up load/minimum shut-down load
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
NPV	Net Present Value
OCGT	Open Cycle Gas Turbine
PHE	Public Health England
SAC	Special Area of Conservation
SGN	Sector guidance note
TGN	Technical guidance note
TNP	Transitional National Plan
TOC	Total Organic Carbon
WFD	Water Framework Directive (2000/60/EC)

1 Our decision

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

As part of our decision we have decided to grant the Operator's request for a derogation from the requirements of BAT Conclusions 20, 21 and 22 as identified in the LCP BAT Conclusions document. The way we assessed the Operator's requests for derogation and how we subsequently arrived at our conclusion is recorded in section 7 of this document.

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 01st May 2018 requiring the Operator to provide information to demonstrate how the operation of their installation currently meets, or will subsequently meet, the revised standards described in the large combustion plant BAT Conclusions document. The Notice also required that where the revised standards are not currently met, the operator should provide information that:

- Describes the techniques that will be implemented before 17th August 2021, which will then ensure that operations meet the revised standard, or
- Justifies why standards will not be met by 17th August 2021, and confirmation of the date when the operation of those processes will cease within the installation or an explanation of why the revised BAT standard is not applicable to those processes, or

- Justifies why an alternative technique will achieve the same level of environmental protection equivalent to the revised standard described in the BAT Conclusions.

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

The Regulation 61 Notice response from the Operator was received on 14 November 2018.

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: see below.

Description	Received
Regulation 61 Notice response	14/11/2018
Derogation request from BAT Conclusions 20,21 & 22 (requested on 03/04/19) – confirmation of derogation criteria	15/04/2019
Revised CBA report to Derogation request from BAT Conclusions 21 & 22	27/11/2019
BAT9 and JEP report – 'Characterisation of power plant fuels	12/05/2020

The Operator claimed that certain information was commercially confidential and should be withheld from the public register. We considered this request and determined that:

Four documents containing detailed cost benefit analysis (CBA) assessments to support the derogation application documents:

RAT-UUK-DustREPCIC-311018;
RAT-UUK-NOxREPCIC-311018;
RAT-UUK-S02REPCIC-311018; and
Section 4 and Appendix 1 RAT-UUK-RFIREPCIC – 271119.

These documents contain the detailed costing information and should be withheld from the public register as the release of this information would severely influence the outcome of the tender process and the information meets the criteria in Regulation 51(c) (i), (ii) and (iii):

(i) The information is commercial;
(ii) Its confidentiality is provided by law to protect a legitimate economic interest; and

(iii) In all the circumstances, the public interest in maintaining the confidentiality of the information outweighs the public interest in including it on the register.

Separate documents referenced:

RAT-UUK-DustREP-311018;
RAT-UUK-NOxREP-311018;
RAT-UUK-SO2REP-311018: and
RAT-UUK-RFIREP-271119

Include sufficient cost data to support the justification of derogation request have been made available on the public register.

Apart from the issues and information just described, we have not received any information in relation to the Regulation 61 Notice response that appears to be confidential in relation to any party.

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

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

In relation to BAT Conclusions 4, 5, 7, 15 and 23 we agree with the operator in respect to their current stated capability as recorded in their Regulation 61 Notice response that improvements are required.

We have therefore included improvement conditions IC19 and IC22 in the consolidated variation notice, which requires them to upgrade their operational techniques so that the requirements of the BAT Conclusions are delivered by 17 August 2021. This is discussed in more detail in Sections 5, 6, 7 and 8 of this document.

2.3 Summary of how we considered the responses from public consultation

We have consulted on our draft decision from 03/06/2020 to 01/07/2020. We did not receive any consultation responses. See Annex 2.

3 The legal framework

The consolidated variation notice will be issued, if appropriate, 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.

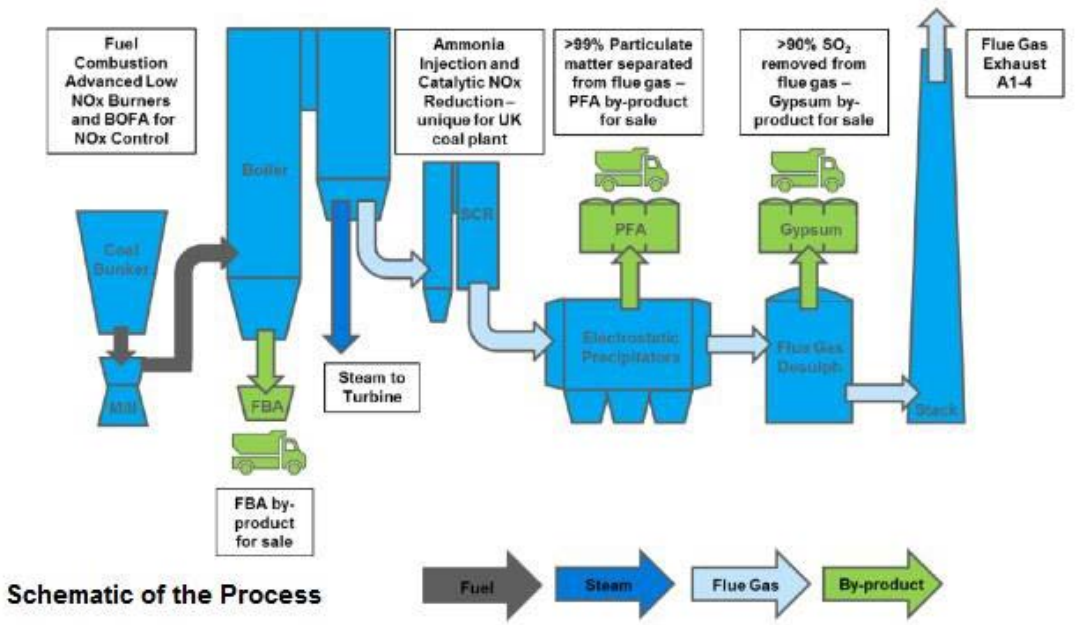
We consider that, if it is issued, the consolidated variation notice will ensure that the operation of the Installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

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

4 Overview of the site and installation

Ratcliffe on Soar Coal Power Station was constructed in the 1960's as part of major modernisation of power generating capacity across the country. The location of the station was determined by the access to cooling water from the River Trent, the proximity of coalfields and the 400KV transmission lines.

The installation comprises of 4 pulverised coal fired boilers with associated turbine and generator sets which vent via multiple flues within a single 199 m high windshield at emission points A1, A2, A3 and A4. See Schematic below:



The permit allows coal, petcoke and biomass with processed fuel oil (PFO) to be burnt although for the last 10 years they only use coal as a fuel together with light fuel oil (LFO) for start-up and support. Each generating unit has a net thermal input of 1,326 MW which equates to an electrical output of 500 MW and together they constitute an LCP and are given the DEFRA Large Combustion Plant Reference LCP116.

The boilers have the burners on the front wall and have been up-graded over the years and are fitted with advanced Low NOx Burners (ALNB's), installed 2014-2017. In addition, in 2004 all of the boilers were modified to utilise a boosted over fire air (BOFA) system to further reduce emissions of nitrogen oxides to air. The plant has been retro-fitted with Selective Catalytic Reduction (SCR) technology to each unit to further reduce the emissions of NOx. The current permit allows operation of the SCR plant in a flexible manner to meet higher ELV's and trade the resulting difference of NOx emissions under the Transitional National Plan (TNP), or to reduce NOx emissions through the operation of the SCR plant and meet the tighter IED Annex V limits. Currently the SCR plant is not in operation.

Emissions of dust are controlled by the use of Electrostatic Precipitator (ESP) on each unit. These units were comprehensively upgraded with the addition of two new

“piggy-back” ESPs per boiler as such over 99% of the particulate emissions from the exhaust gases are captured before they enter the FGD plant.

Emissions of SO_2 are controlled by Wet FGD units which were commissioned between 1994 and 1996. The FGD technology is based on a chemical reaction that occurs when the warm exhaust gases from the coal-fired boiler come into contact with limestone. This reaction removes 90% of the sulphur dioxide from the flue gas and converts the limestone into Calcium Sulphite.

The design performance of various key plant items including ESP’s and FGD was based on an original set of fuel specifications which the plant is expected to burn. Performance of ESPs is affected by the characteristics of the coal burned and the properties of the ash liberated. An important element of this is the ash resistivity. If ash resistivity is too low, the electric charge holding the ash to the collector plates is low and consequently dust is re-entrained in the gas flow, leading to higher dust emissions. If ash resistivity is too high, the flow of negatively charged particles towards the collector plates is much reduced due to the resistance of the collected ash layer lowering the corona current, therefore less dust is collected leading to a higher dust concentration leaving the ESPs.

The origins of this station’s fuel basket was exclusively from North Nottinghamshire, Derbyshire and South Yorkshire, all consistent with a medium to high sulphur content, typical of the area, of between 1.2 to 2.4% sulphur. The ESP’s work optimally on ash created from these fuels.

The plant is currently operating under the Transitional National Plan (TNP), ELVs are set which have been derived for the period 01st January 2016 – 30 June 2020 (the duration of the TNP). At the end of this period it is expected that both Annex V and the revised LCP BREF will become applicable, in which case Annex V or the BAT conclusions must be achieved (whichever is stricter), or operators must have applied for a derogation from the BAT conclusion if that is stricter: Annex V will apply in any event.

The station also maintains two gas turbine generating sets fired on gas oil which each have a net thermal input of 75 MW. These are black start turbines which are used in the event of a grid collapse to restart the station and to provide short term load support as requested by the National Grid. The gas turbines exhaust through separate flues within a common 96 m windshield. The gas turbines are a separate LCP which is operated under the 500 hour derogation, LCP number LCP455.

5 The key issues

The key issues arising during this permit review are:

- The review and assessment of the derogation applications from meeting the relevant AELs for BAT Conclusions 20, 21 and 22 detailed in Section 7 of this document.
- Emissions to air and the emission limits applied to the plant.
- The energy efficiency levels associated with the Best Available Techniques (BAT-AEELs). Refer to Section 5.2 of this document.
- BAT Conclusion 4, demonstration of sufficiently stable emissions. Refer to Section 5.3 of this document.
- BAT Conclusion 7 for emissions of NH_3 to air from the use of SCR.
- BAT Conclusion 9 characterisation of fuel. Refer to Section 5.4 of this document.
- BAT Conclusions 5 and 15, BAT AEL's and monitoring of emissions to water from flue-gas treatment. Refer to Section 8 of this document.

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

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

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

- The upper value of the BAT AELs ranges specified were used unless use of the tighter limit was justified.
- The principle of no backsliding where if existing limits in the permit were already tighter than those specified in the BREF, the existing permit limits were retained.
- Where a limit was specified in both IED Annex V and the BAT Conclusions for a particular reference period, the tighter limit was applied and in the majority of cases this was from the BAT Conclusions.
- Where AELs are indicative in the BAT Conclusions, these were applied unless adequate justification was provided by the operator to demonstrate that an alternative limit was more appropriate.

LCP116 Four coal fired boilers – unlimited hours of operation

The LCP116 consists of four pulverised coal fired boilers with associated turbine and generator sets. Each generating unit has a net thermal input of 1326 MW which equates to an electrical output of 500 MW

This LCP operates under the Transitional National Plan (TNP). For this plant operating under the TNP, oxides of nitrogen (NOx), sulphur dioxide (SO_2) and dust ELVs were set which were derived for the period 01 January 2016 to 30 June 2020 (the duration of the TNP). At the end of this period both Annex V and the LCP BREF are applicable (whichever is stricter).

BAT Conclusion 20 NOx, BAT Conclusion 21 SO_2 and BAT Conclusion 22 dust AELs are stricter and the Operator requested a derogation from meeting the AELs and compliance instead with IED Annex V ELVs. By the end of the TNP on 30 June 2020, as a minimum, plant must meet the limits set out in Annex V of the IED subject to BAT assessment and the principle of no backsliding.

The IED Annex V limits will apply for NOx , SO_2 and dust from the 1 July 2020 at the end of the TNP.

The following tables outline the limits that have been incorporated into the permit for LCP116, where these were derived from, and the reference periods at which they apply. The emission limits and monitoring tables have been incorporated into Schedule 3 of the consolidated variation notice.

LCP 116 BAT Conclusion 21 NOx emission limits & indicative CO limits

We have set the NOx limits for combustion of coal in accordance with Part 1 of Annex V (applicable to existing plant) of the IED, which will apply from 01 July 2020. The annual average BAT AEL limit reporting requirement will come into effect from 17 August 2021. Refer to Section 7 of this document for the detailed derogation assessment and explanation of the various limits.

NOx limits (mg/Nm^3) – corrected to 6% oxygen								
Averaging	**IED (Annex V Part 1) – Existing plant**	**BREF (Table 3 BAT-c)** Note 1	**Existing to 30 June 2020 TNP ELV**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021**	**Permit limits from 17 August 2021**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**150**	**None**	**None**	**200** Note 2	Derogation from BREF	MSUL/MSDL to baseload	Continuous
Monthly	**200**	**None**	**450**	**200**	**200**	IED	MSUL/MSDL to baseload	
Daily	**220**	**200**	**550**	**220**	**220** Note 2	IED and Derogation from BREF	MSUL/MSDL to baseload	
95th %ile of hourly means	**400**	**None**	**None**	**400**	**400**	IED	MSUL/MSDL to baseload	

Note 1 Footnotes (7) to Table 3 states In the case of plants put into operation no later than 7 January 2014, the higher end of the range is 200 mg/Nm^3 for plants operated ≥ 1500 h/yr, and (8) to Table 3 The higher end of the BAT-AEL range is 200 mg/Nm^3 for plants put into operation no later than 7 January 2014.

Note 2: Tighter limit may be set subject to outcome of IC19 in table S1.3 of the permit.

Indicative CO limits (mg/Nm^3)								
Averaging	**IED (Annex V Part 1) – for existing plant**	**BREF (end of BAT 20 Table BAT-C) Note 1**	**Existing to 30 June 2020 TNP ELV**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021 IED ELV**	**Permit limits from 17 August 2021 Weighted Average Note [2]**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	100	None	None	400	Note 2	MSUL/MSDL to baseload	Periodic
Note 1 The higher end of the range may be up to 140 mg/Nm3 in the case of limitations due to boiler design, and/or in the case of fluidised bed boilers not fitted with secondary abatement techniques for NOX emissions reduction. Note 2: The operator has provided a historic PPC benchmark CO concentration of 400mg/Nm^3, which has been used as the limit in the permit.								

NH3 limits (mg/Nm^3) Note [1]								
Averaging	**IED (Annex V Part 1) – for existing plant**	**BREF (BAT 7 BAT-C)**	**Existing to 30 June 2020 TNP ELV**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021**	**Permit limits from 17 August 2021**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	10	None	Subject to IC19	3 Note 3	BREF	MSUL/MSDL to baseload	Continuous or Periodic Note 2
Note 1: SCR is fitted to boilers 1-4 but has yet to be fully commissioned, due by 1st July 2020. Limit to be set on completion of IC19. Note 2: BAT 4 - footnote 4 of Table In the case of use of SCR, the minimum monitoring frequency may be at least once every year, if the emission levels are proven to be sufficiently stable. The operator is proposing to demonstrate sufficiently stable conditions and agree annual monitoring. Note 3 BAT 7 states The BAT-associated emission level (BAT-AEL) for emissions of NH3 to air from the use of SCR and/or SNCR is < 3–10 mg/Nm^3 as a yearly average or average over the sampling period. The lower end of the range can be achieved when using SCR. The operators has proposed a limit of 5mg/m^3. ELV to be set on completion of IC19.								

BAT21 - SO_2, HCl and HF emissions to air

We have set the SO_2 limits for coal firing in accordance with Part 1 of Annex V (applicable to existing plant) of the IED, which will apply from 01 July 2020. The annual average and daily BAT AEL limits reporting requirements will come into effect from 17 August 2021. Refer to Section 7 of this document for the detailed derogation assessment and explanation of the various limits.

SO_2 limits (mg/Nm^3) – corrected to 6% oxygen								
Averaging	**IED (Annex V Part 1) – for existing plant**	**BREF (Table 4 BAT-C)**	**Existing to 30 June 2020 TNP ELV**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021**	**Permit limits from 17 August 2021**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	130	None	None	200	Derogation from BREF	MSUL/MSDL to baseload	Continuous
Monthly	200	None	350	200	200	IED	MSUL/MSDL to baseload	
Daily	220	205 Note 5	440 (95% daily means)	220	220	Derogation from BREF	MSUL/MSDL to baseload	
95th %ile of hr means	400	None	None	400	400	IED	MSUL/MSDL to baseload	
Note 5 to Table 4 The higher end of the BAT-AEL range is 220 mg/Nm^3 in the case of plants put into operation no later than 7 January 2014 and operated < 1 500 h/yr. For other existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is **205** mg/Nm^3.								

We have set the hydrogen chloride (HCl) and hydrogen fluoride (HF) limits for coal firing in accordance with Table 4 of the BAT Conclusion.

HCl limits (mg/Nm^3)							
Averaging	**IED (Annex V Part 1) – for existing plant**	**BREF (Table 4) Note 1**	**Existing to 30 June 2020 TNP ELV**	**Permit limits from 17 August 2021**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	20	None	20	BREF	MSUL/MSDL to baseload	Note2
Note 1: As per footnote 3, the higher end of the BAT-AEL range is 20 mg/Nm3 in the following cases: plants combusting fuels where the average chlorine content is 1 000 mg/kg (dry) or higher; plants operated < 1 500 h/yr; FBC boilers. For plants operated < 500 h/yr, these levels are indicative. when firing coal with an annual average chlorine content ≥ 0.1% dry basis. Note 2: The Operator is proposing to demonstrate sufficiently stable conditions in line with an improvement condition, IC22. Monitoring frequency will be available following completion of this IC.							

HF limits (mg/Nm^3)							
Averaging	**IED (Annex V Part 1) – for existing plant**	**BREF (Table 4) Note 1**	**Existing to 30 June 2020 TNP ELV**	**Permit Limits from 17 August 2021**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	7	None	7	BREF	MSUL/MSDL to baseload	Note 2 At least once per year
Note 1: As per footnote 4 : The higher end of the BAT-AEL range is 7 mg/Nm3 in the following cases: plants fitted with wet FGD with a downstream gas-gas heater. Note 2: The Operator is proposing to demonstrate sufficiently stable conditions in line with an improvement condition, IC22. Monitoring frequency will be available following completion this IC.							

BAT Conclusion 22 – Dust limits

We have set the dust limits for coal firing in accordance with Part 1 of Annex V (applicable to existing plant) of the IED, which will apply from 01 July 2020. The annual average BAT AEL limit reporting requirement will come into effect from 17 August 2021. Refer to Section 7 of this document for the detailed derogation assessment and explanation of the various limits.

Dust limits (mg/Nm^3)								
Averaging	**IED (Annex V Part 1) – for existing plant** Note 2	**BREF (Table 6 BAT-C)**	**Existing to 30 June 2020 TNP ELV**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021**	**Permit limits from 17 August 2021**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	8	None	None	20	Derogation from BREF	MSUL/MSDL to baseload	Continuous
Monthly	20	None	20	20	20	IED	MSUL/MSDL to baseload	
Daily	22	14 Note 7	35 (95% daily means)	22	22	Derogation from BREF	MSUL/MSDL to baseload	
95th %ile of hr means	40	None	None	40	40	IED	MSUL/MSDL to baseload	
Note 7 to Table 6: The higher end of the BAT-AEL range is 14 mg/Nm^3 in the case of plants put into operation no later than 7 January 2014.								

BAT 23 - Mercury Emissions

There is no limit specified in the existing permit. We have set the applicable yearly average BAT AEL of 4 µg/Nm^3 as set out in Table 7 of this BAT Conclusion.

Hg limits (µg/Nm3)									
Averaging	**IED (Annex V Part 1) – for existing plant**	**BREF (Table 7 and BAT23 BAT-C)**	**Existing to 30 June 2020 TNP ELV Weighted Average**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021 IED ELV Weighted Average**	**Permit limits from 01 July 2020 (after TNP) to 16 August 2021 Weighted Average**	**Permit limits from 17 August 2021 Weighted Average**	**Basis**	**Limits apply**	**Monitoring**
Annual	None	4	None	None	None	4	BREF	MSUL/MSDL to baseload	Note 1
Note 1: operator is proposing to demonstrate sufficiently stable conditions in line with Improvement Condition IC22. Monitoring frequency will be available following completion this IC.									

LCP455 – two gas-oil fired OCGT - <500 hours/year

Each LCP comprises of a 75 MWth black-start open cycle gas turbine (OCGT), GT1 and GT4, which vent via separate stacks at emission points A13 and A15 respectively. The units burn gas-oil.

These LCPs operate under the ELV compliance route. No ELVs were set in line with Annex V of the IED, for LCPs that requested a derogation for <500 hours/year operation.

For non-emergency gas turbines operating for <500 hours/year:

Classification of emergency plant

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

Indicative BAT limits for non-emergency plant operating <500 hours/year

Where there is an indicative AEL for this type of plant in the BAT Conclusions we have decided that we will set the limits in the permit. Validation will be 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.

An appropriate BAT justification must be made for any deviation from this value. However, a formal derogation under Article 15(4) is not required where it is proven that alternative values can be regarded as BAT.

The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit.

BAT Conclusions 37 – NOx limits from the combustion of gas oil in gas turbines

There are no limits specified in the existing permit. We have applied a NOx limit (applicable to all < 500 hour/year plant) based on what the plant can achieve. Refer to Section 6 of this document.

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**
Annual	None	None	None	NA	NA	Continuous **Note 2**	None	None
Monthly	None	None	None	NA	NA		None	None
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 LCP455, because gas turbines 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 LCP455, because gas turbines within LCP455 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 LCP455.

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.

BAT Conclusion 39 – SO_2 and dust limits

There are no limits specified in the existing permit. Footnotes to Table 22 of this BAT Conclusion confirm that:

Note 1: yearly averages do not apply to existing plants operated <1,500 hours/year.
Note 2: For existing plants operated <500 hours/year, daily average limits are indicative.

We have set the indicative daily limits consistent with this BAT Conclusion as follows:

Parameter	Indicative daily limit (mg/Nm^3)
SO_2	66
Dust	10

5.2 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.

BAT Conclusion 19 – energy efficiency of the combustion of coal (LCP116)

The table below sets out the BAT-AEELs specified in the LCP BAT Conclusions for the LCP on the site and the energy efficiency levels confirmed through the Regulation 61 notice response. The evidence provided to demonstrate that the AEELs are met was in the form of email dated 12/5/2020 and Section B2.7 for further information of PPC Application AP3330LB. We consider this plant is BAT in relation to the AEELs.

BAT AEELs (%)			Plant efficiency (%)		
Net electrical efficiency	**Net total fuel utilisation**	**Net mechanical efficiency**	**Net electrical efficiency**	**Net total fuel utilisation**	**Net mechanical efficiency**
LCP116: Coal-fired, ≥ 1 000 MWth – unlimited hours					
33.5-44	75 – 97	None	U1- 39.6% U2 - 39.6% U3 - 39.6% U4 - 39.6%	NA	NA

BAT Conclusion 36 - energy efficiency of gas oil combustion in gas turbines (LCP455)

Note 1 to Table 21 of this LCP BAT Conclusion specifies that the BAT AEELs for this type of plant are not applicable to plant operating <1,500 hours/year. We have therefore not assessed this operational aspect of the plant. We have however included a process monitoring requirement in table S3.4 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 this <500 hours/year plant we have specified that the assessment of efficiency can be based on calculation. This is because we will not require plant to fire up with the sole purpose of carrying out an assessment of efficiency.

5.3 Sufficiently stable BAT Conclusion 4

When coal is used as a fuel BAT Conclusion 4 requires the Operator to carry out monitoring of HCl and HF once every three months, and monitoring of Hg on a continuous basis. The frequency of monitoring can be reduced for these parameters where sufficiently stable conditions can be demonstrated, as detailed at the end of BAT Conclusion 4 in footnotes 10 and 13 respectively.

The Operator proposes to demonstrate sufficiently stable conditions in line with Joint Environmental Programme (JEP) Protocol For LCP Bref Compliance With Trace Species Monitoring Requirements at Coal Fired Power Plant. We have therefore included an improvement condition (IC) in the consolidated variation notice IC22 requiring the Operator to submit a plan outlining how this will be carried out for approval prior to the implementation date for the BAT Conclusions.

5.4 Fuel characterisation BAT Conclusion 9

This BAT conclusion requires the operator to carry out fuel characterisation.

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

The Operator confirmed in their response received 12/05/2020, that they will adhere to the requirements of this BAT Conclusion through application of the JEP report.

6 Decision checklist regarding relevant BAT Conclusions

BAT Conclusions for LCP, 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 section provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This section should be read in conjunction with the consolidated variation notice.

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

BAT Conclusion requirement topic	**Permit conditions**	**Permit tables**
Environmental Management System	1.1.1	S1.2
BAT AELs	3.1.1 and 3.5.1	S3.1b and S3.2a
Monitoring	2.3, 3.5 and 3.6	S1.2, S1.4, S3.1b and S3.2a
Energy efficiency	1.2 and 2.3	S3.4
Noise	2.3 and 3.4	S1.2
Other operating techniques	1.2	S1.2

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

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

BAT Concn No	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 Operator confirmed that: There is an EMS certified to ISO14001:2015 Certificate No: 10053269 in place and it meets requirements (i to xiii), as standard for all operational sites and then site specific procedure (i) through to (xvi) set out in the BAT Conclusion. We agree that as operations do not involve the combustion of malodourous substances, an odour management plan is not necessary providing that that procedures are in place to review any complaints received which could include those related to odour which is the case. We agree with the Operator's stated compliance.

<table>
<tr><th>BAT Concn No</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/CC/ FC/NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>ix. application of sectoral benchmarking on a regular basis.
Etc - see BAT Conclusions

Applicability. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.</td><td></td><td></td></tr>
<tr><td>2</td><td>BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification, IGCC and/or combustion units by carrying out a performance test at full load (1), according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</td><td>CC</td><td>The Operator confirmed that the efficiencies by unit are as follows:

Rat U1 39.6% (525/1326),
U2 39.6% (525/1326),
U3 39.6% (525/1326),
U4 39.6% (525/1326).

and are as provided in chapter 3 permit review and as detailed in PPC Application Section B2.7 for further information.</td></tr>
<tr><td>3</td><td>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.
<table>
<tr><th>Stream</th><th>Parameter(s)</th><th>Monitoring</th></tr>
<tr><td rowspan="3">Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr>
<tr><td>Oxygen content, temperature, and pressure</td><td rowspan="2">Periodic or continuous measurement</td></tr>
<tr><td>Water vapour content (3)</td></tr>
<tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
</table></td><td>CC</td><td>The Operator confirmed that monitoring of key parameters is undertaken in accordance with BAT Conclusion 3.

Monitoring of flue gas is carried out in accordance with the requirements of EN14181 and other associated standards for oxygen content, temperature, pressure and water vapour content on a continuous basis. Flow is determined via annual periodic test and continuous flow monitoring is carried out by calculation, as required by EN ISO 16911-2.

Monitoring of waste water from flue-gas treatment for flow, pH and temperature is carried out on a continuous basis in accordance with MCERTS, M18 and BAT requirements.

We agree with the Operator’s stated compliance.</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.</td><td>FC</td><td>The Operator confirmed that:

For LCP116</td></tr>
</table>

<table>
<tr><th>BAT Concn No</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>Substance/ Parameter</th><th>Fuel/Process/Type of combustion plant</th><th>Combustion plant total rated thermal input</th><th>Standard(s) (4)</th><th>Minimum monitoring frequency (5)</th><th>Monitoring associated with</th></tr>
<tr><td>NH_3</td><td>— When SCR and/or SNCR is used</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (7)</td><td>BAT 7</td></tr>
<tr><td>NO_x</td><td>— Coal and/or lignite including waste co-incineration
— Solid biomass and/or peat including waste co-incineration
— HFO- and/or gas-oil-fired boilers and engines
— Gas-oil-fired gas turbines
— Natural-gas-fired boilers, engines, and turbines
— Iron and steel process gases
— Process fuels from the chemical industry
— IGCC plants</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (8)</td><td>BAT 20
BAT 24
BAT 28
BAT 32
BAT 37
BAT 41
BAT 42
BAT 43
BAT 47
BAT 48
BAT 56
BAT 64
BAT 65
BAT 73</td></tr>
<tr><td></td><td>— Combustion plants on offshore platforms</td><td>All sizes</td><td>EN 14792</td><td>Once every year (9)</td><td>BAT 53</td></tr>
</table>
</td><td></td><td>NOx/SO_2/dust are monitored continuously and will remain subject to the QA/QC requirements of EN14181.

As detailed in document Reg 61 Response to BAT4: CO monitoring and compliance at Ratcliffe Power Station – carbon monoxide is continuously measured at the ID fan outlet of the FGD unit. We have set

As detailed in documents - Reg 61 BAT4 Response: HCl monitoring at Ratcliffe Power Station

HCl & HF – shall be periodically measured every 3 months until stability is demonstrated thereafter annually as per footnote 10 of this BAT Conclusion. The Operator is proposing demonstrate sufficient stability by adopting the procedure agreed between JEP and the Environment Agency (Trace Species Protocol).

Hg – shall be periodically measured every 3 months until stability is demonstrated thereafter on a six monthly basis as per footnote 13 of this BAT Conclusion. The Operator shall demonstrate sufficient stability by adopting the procedure agreed between JEP and the Environment Agency (Trace Species Protocol).

The footnotes state that if the emission levels are proven to be sufficiently stable, periodic measurements may be undertaken at least once every six months, or each time that there is a change that may have an impact on the emissions.

In such cases “sufficiently stable” emission levels will be demonstrated through quarterly reporting of monthly HCl/HF/Hg fuel content. This will be carried out in advance of the implementation of the emission monitoring requirements and utilise accepted retention factors along with a calculated demonstration that the BAT Conclusions are being met for the plant.

Subject to demonstration of sufficiently stable, periodic monitoring will be required at least once a year for HCl & HF and at least once in every six month period for Hg. We have set an improvement condition to address this.</td></tr>
</table>

BAT Concn No	Summary of BAT Conclusion requirement						Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	N_2O	— Coal and/or lignite in circulating fluidised bed boilers — Solid biomass and/or peat in circulating fluidised bed boilers	All sizes	EN 21258	Once every year (10)	BAT 20 BAT 24		**Refer to section 5.3 of this document.** Metals & metalloids (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Ti, V and Zn) - emissions are well understood due to ongoing fuel characterisation and as such periodic monitoring is not required as per footnote 15 of this BAT Conclusion, unless a fuel source is changed and is assessed as having an impact on emissions, subject to agreement with JEP and the Environment Agency. **Refer section 5.4 of this document.** Where SCR is installed BAT 4 sets continuous monitoring of NH3. Footnote 4 allows monitoring to be reduced stating that in the "case of use of SCR, the minimum monitoring frequency may be at least once every year, if the emission levels are proven to be sufficiently stable". The operator is proposing annual periodic monitoring to ISO 17179:2016 unless annual operating hours are below 500 h/yr in which case the plant will not be run for the sole purpose of performing an emissions test [BAT 4, Footnote (2)]. However, since ammonia is completely removed by the other downstream abatement processes, as described below, it should be noted that Uniper does not consider it to be technically meaningful to perform these measurements and have been examining the use of an alternative method. See also BAT 7. NH_3 emissions are strongly influenced by the flue gas abatement installations downstream of the SCR. In air preheaters and dust abatement installations (an electrostatic precipitator in this case) the ammonia slip is almost totally adsorbed by the fly ash. The small amount not fixed by the fly ash is absorbed in the FGD unit since ammonia is highly soluble in both water and acid solutions. Measurements during SCR commissioning have consistently indicated that the stack emission is below limit of detection. We have therefore set manual extractive monitoring in Table S3.1b subject to demonstration of emissions levels being sufficiently stable through Improvement condition IC22.
	CO	— Coal and/or lignite including waste co-incineration — Solid biomass and/or peat including waste co-incineration — HFO- and/or gas-oil-fired boilers and engines — Gas-oil-fired gas turbines — Natural-gas-fired boilers, engines, and turbines — Iron and steel process gases — Process fuels from the chemical industry — IGCC plants	All sizes	Generic EN standards	Continuous (6) (8)	BAT 20 BAT 24 BAT 28 BAT 33 BAT 38 BAT 44 BAT 49 BAT 56 BAT 64 BAT 65 BAT 73		
		— Combustion plants on offshore platforms	All sizes	EN 15058	Once every year (9)	BAT 54		

BAT Concn No	Summary of BAT Conclusion requirement						Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	SO_2	— Coal and/or lignite incl waste co-incineration — Solid biomass and/or peat incl waste co-incineration — HFO- and/or gas-oil-fired boilers — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants	All sizes	Generic EN standards and EN 14791	Continuous (6) (11) (12)	BAT 21 BAT 25 BAT 29 BAT 34 BAT 39 BAT 50 BAT 57 BAT 66 BAT 67 BAT 74		**LCP455 -** Open Cycle Gas Turbines (OCGTs) operate for less than 500 hours per year. Footnotes 3, 5, 12, 16, 17 and 20 to BAT Conclusion 4 relate to plant operated less than 1,500 and/or 500 hours/year – these footnotes set out when alternative monitoring requirements are acceptable or may apply. Compliance monitoring is based on emission factors and this will continue. We agree with the Operator's stated compliance.
	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	All sizes	No EN standard available	Once every three months (6) (13)	BAT 21 BAT 57		

BAT Concn No	Summary of BAT Conclusion requirement						Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
		— Process fuels from the chemical industry in boilers			(14)			
		— Solid biomass and/or peat	All sizes	No EN standard available	Once every year	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous (6) (16)	BAT 66 BAT 67		
	Dust	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines	All sizes	Generic EN standards and EN 13284-1 and EN 13284-2	Continuous (6) (17)	BAT 22 BAT 26 BAT 30 BAT 35 BAT 39 BAT 51 BAT 58 BAT 75		
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69		
	Metals and metalloids except mercury (As, Cd,	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or	All sizes	EN 14385	Once every year (18)	BAT 22 BAT 26 BAT 30		

BAT Concn No	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
	Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V, Zn)	gas-oil-fired boilers and engines						
		— Waste co-incineration	< 300 MW$_{th}$	EN 14385	Once every six months [13]	BAT 68 BAT 69		
			≥ 300 MW$_{th}$	EN 14385	Once every three months [19] [13]			
		— IGCC plants	≥ 100 MW$_{th}$	EN 14385	Once every year [18]	BAT 75		
	Hg	— Coal and/or lignite including waste co-incineration	< 300 MW$_{th}$	EN 13211	Once every three months [13] [20]	BAT 23		
			≥ 300 MW$_{th}$	Generic EN standards and EN 14884	Continuous [16] [21]			
		— Solid biomass and/or peat	All sizes	EN 13211	Once every year [22]	BAT 27		
		— Waste co-incineration with solid biomass and/or peat	All sizes	EN 13211	Once every three months [13]	BAT 70		
		— IGCC plants	≥ 100 MW$_{th}$	EN 13211	Once every year [23]	BAT 75		
	TVOC	— HFO- and/or gas-oil-fired engines — Process fuels from chemical industry in boilers	All sizes	EN 12619	Once every six months [13]	BAT 33 BAT 59		
		— Waste co-incineration with coal, lignite, solid biomass and/or peat	All sizes	Generic EN standards	Continuous	BAT 71		
	Formaldehyde	— Natural-gas in	All sizes	No EN standard	Once every year	BAT 45		

BAT Concn No	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

	spark-ignited lean-burn gas and dual fuel engines		available		
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

5

BAT is to monitor emissions to water from flue-gas treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

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

FC

The Operator confirmed that improvements are required:

The site monitors a range of parameters on a 24-hour flow proportional basis with samples being analysed weekly, therefore meets BAT monitoring frequency. Parameters currently monitored include F, Cl, As, Cd, Cr, Cu, Ni, Pb, Zn and Hg. Samples are monitored and analysed in accordance with methods described in the Ratcliffe Laboratory Manual and M18.

In Table S3.2a of the permit we have included the methods as defined in BAT Conclusion 15.

The BREF introduces new determinands TOC/COD and Sulphate (SO_4^{2-}), sulphide, easily released (S^{2-}) and Sulphite (SO_3^{2-}).

Footnote 1 states that either the BAT-AEL for TOC or the BAT-AEL for COD applies. TOC is the preferred option because its monitoring does not rely on the use of very toxic compounds.

They have looked at the feasibility of monitoring of either TOC or COD but found results to be inconsistent. This is due to the high chloride concentrations, up to 40,000ppm [Cl-] found in the influent entering the waste water treatment plant which causes interference during analysis, resulting in widely differing results.

<table>
<tr><th>BAT Concn No</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>Cu</td><td>EN ISO 17294-2)</td><td></td><td></td></tr>
<tr><td></td><td>Ni</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Pb</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Zn</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Hg</td><td>Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)</td><td></td><td></td></tr>
<tr><td colspan="2">Chloride (Cl^-)</td><td>Various EN standards available (e.g. EN ISO 10304-1 or EN ISO 15682)</td><td></td><td>—</td></tr>
<tr><td colspan="2">Total nitrogen</td><td>EN 12260</td><td></td><td>—</td></tr>
</table>
</td><td></td><td>The site does not currently monitor for sulphate, they assert that as wet FGD is employed, setting a BAT-AEL is not considered appropriate due to sulphate being present at super-saturation. The WWTP process is not designed to reduce the concentration of sulphate in the discharge as super-saturated concentration of sulphate are required within the process to prevent scaling on the internal surface of the absorber and to ensure gypsum product quality. The FGD absorber design and operational parameters utilises forced oxidation to complete oxidation of sulphide and sulphite to sulphate They assert that it is not possible to consistently analyse for sulphite and sulphide. It has only been possible to obtain sulphite and sulphide results on a very limited basis. This is due to chemical interference. Refer to BAT 15 and Section 8 of this document.</td></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>Generally applicable</td></tr>
<tr><td>b.</td><td>Maintenance of the combustion system</td><td>Regular planned maintenance according to suppliers' recommendations</td><td></td></tr>
<tr><td>c.</td><td>Advanced control system</td><td>See description in Section 8.1</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>d.</td><td>Good design of the</td><td>Good design of furnace, combustion chambers, burners and associated</td><td>Generally applicable to new combustion plants</td></tr>
</table>
</td><td>CC</td><td>The Operator has confirmed that a combination of techniques: a), b) and d) for existing combustion plant are used. Fuel blending and mixing is modelled and assessed on plant to achieve optimum combustion conditions and minimise emissions. Plant maintenance strategies ensure appropriate planned routines are carried out.

Techniques c) and e) are more applicable to new combustion plant, and particularly e) is limited by configuration and design of plant.

We agree with Operators stated compliance.</td></tr>
</table>

BAT Concn No	Summary of BAT Conclusion requirement	Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	<table><tr><td></td><td>combustion equipment</td><td>devices</td><td></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>		
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.	FC	As outlined in document reference 'Coal NH3 Monitoring Reg 61 Response Final' and BAT4 the Operator confirmed that improvements are required: SCR has been installed to each of the coal fired boilers to abate NOx emissions but this is yet to be commissioned due for completion by 01st July 2020. Design is to meet BREF. Commissioning will include optimisation of operation of SCR to achieve reduced emissions of NH_3. They have proposed a BAT AEL limit of 5mg/$m^{3.}$ which is within range for emissions of NH_3 to air from the use of SCR and/or SNCR is < 3–10 mg/Nm3, where the lower end of the range can be achieved when using SCR. NH_3 emissions are strongly influenced by the flue gas abatement installations downstream of the SCR. In air preheaters and dust abatement installations (an electrostatic precipitator in this case) the ammonia slip is almost totally adsorbed by the fly ash. The small amount not fixed by the fly ash is absorbed in the FGD unit since ammonia is highly soluble in both water and acid solutions. Measurements during SCR commissioning have consistently indicated that the stack emission is below limit of detection.

BAT Concn No	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
			On this basis they propose to demonstrate compliance by using "Default Eurelectric Retention Factors" and apply the general principles of Protocol for LCP BREF Compliance with trace species monitoring requirements, 2018. The default Eurelectric Retention Factor for this plant category is 1.0, i.e. 100% of the ammonia is retained within the process, for the reasons given above, i.e. complete absorption by the ash and the FGD unit based on operating experience to date. Graham D P, Weatherstone S, Site-specific Retention Factors for Demonstrating Sufficiently Stable Operation at Ratcliffe Power Station, 2019. We agree in principle but are requiring more monitoring to demonstrate that the plant performance has been optimised. The limit and monitoring is to be agreed in writing with the Environment Agency following completion of IC19 in Table S1.3. We agree with the Operator's stated compliance.
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 confirmed that: The abatement systems for air at the installation are electrostatic precipitators (ESPs), flue gas desulphurisation (FGD) and selective catalytic reduction (SCR) plant to reduce emissions of dust, sulphur dioxide and oxides of nitrogen respectively. Combustion is optimised in accordance with plant efficiency, environmental compliance drivers and acceptable CO control. The design parameters of the abatement systems are appropriate to achieve reduction of air emissions during normal operating conditions. We agree with the Operator's stated compliance.
9	In order to improve the general environmental performance of combustion and/or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/quality control programmes for all the fuels used, as part of the environmental management system (see BAT 1):	CC	The Operator confirmed that all fuels used at the site are purchased against a specification provided by the supplier, which is based on analysis of samples to international standards (e.g. ISO or ASTM). The fuel specification is reviewed to ensure technical suitability for the power station before supply contracts are placed. Internationally traded coals are sampled and analysed at the port of loading and at

<table>
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<tr><td></td><td>(i) Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. ISO, national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality;
(ii) Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters chosen from the table below are based on the variability of the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed);
(iii) Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system (see description in Section 8.1)).
Description
Initial characterisation and regular testing of the fuel can be performed by the operator and/or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee.
<table>
<tr><th>Fuel(s)</th><th>Substances/Parameters subject to characterisation</th></tr>
<tr><td rowspan="2">Biomass/peat</td><td>— LHV
— moisture</td></tr>
<tr><td>— Ash
— C, Cl, F, N, S, K, Na
— Metals and metalloids (As, Cd, Cr, Cu, Hg, Pb, Zn)</td></tr>
<tr><td rowspan="3">Coal/lignite</td><td>— LHV
— Moisture
— Volatiles, ash, fixed carbon, C, H, N, O, S</td></tr>
<tr><td>— Br, Cl, F</td></tr>
<tr><td>— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr>
<tr><td>HFO</td><td>— Ash</td></tr>
</table></td><td></td><td>the port of discharge in the UK to ensure that the coal meets the specification. Internationally traded coals and all local coals are also sampled and analysed again upon delivery to the power station. The primary analysis parameters (calorific value, moisture, ash, volatile matter, sulphur, chlorine and fluorine) are determined on every sample, while full analyses (elemental composition of coal and ash) are undertaken at a frequency dependent on the origin and homogeneity of the coal type (but at least once every year): more frequent analysis is undertaken for new coal types and those identified as containing elevated levels of pollutant species.

Depending on each coal’s specification, coal blending requirements are known before the coal is delivered to the power station. Only those coals that do not require blending before use are delivered directly to the units, while all other coals are stockpiled before use. Required levels of coal blending are achieved by stockpile management and using a dedicated blending facility.

Fuel oils are procured against an agreed contract specification and compliance with Sulphur Content of Liquid Fuels (SCOLF) and regular testing of fuel quality is carried out to ensure on-going compliance with the specification.

The fuel supplied to the site has been assessed in accordance with technique (i) and is monitored in accordance with technique (ii). The data supplied from monitoring is used to assess the performance of the plant in accordance with technique (iii) on an as and when needed basis and where practicable."

We agree with the Operator’s stated compliance.</td></tr>
</table>

BAT Concn No	Summary of BAT Conclusion requirement	Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	<table><tr><td></td><td>— C, S, N, Ni, V</td></tr><tr><td>Gas oil</td><td>— Ash — N, C, S</td></tr><tr><td>Natural gas</td><td>— LHV — CH_4, C_2H_6, C_3, C_4+, CO_2, N_2, Wobbe index</td></tr><tr><td>Process fuels from the chemical industry (27)</td><td>— Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr><tr><td>Iron and steel process gases</td><td>— LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index</td></tr><tr><td>Waste (28)</td><td>— LHV — Moisture — Volatiles, ash, Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr></table>		
10	In order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC), BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: — appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines), — set-up and implementation of a specific preventive maintenance plan for these relevant systems, — review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary, — periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	FC	The Operator confirmed that OTNOC is managed through the EMS which includes a review of potential impacts of OTNOC. Unit starts are optimised based on plant condition (i.e. warmth category) to minimise emissions during start-up. The power station is maintained in accordance with plant preventative maintenance programme (known as SAP). All plant components are included within this and the frequency of maintenance is dependent on component duty and manufacturers requirements, as optimised through operational experience. This programme is supported by risk assessments to identify environmentally critical plant (ECP) and emergency procedures for plant/component failure. The site records and reviews air and water emissions caused by OTNOC. Periodic assessment is undertaken as part of EMS review.

<table>
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<tr><td></td><td></td><td></td><td>Waste water treatment plant utilises continuous monitoring for process parameters and if OTNOC occurs, the dedicated control system prevents discharge to water by automatic diversion of flow to internal recirculation.

From 1/7/2020, the station will utilise the three parameter approach for start-up and shutdown (MSUL and MSDL), following commissioning of SCR. Refer to Table S1.5 of the permit.

We agree with the Operator’s stated compliance.</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>The Operator confirmed that emissions during start-up and shut down operations are monitored and reviewed to identify if corrective actions are required.

The site undertakes an annual environmental performance review of emissions to air and water. In the event of an accident or environmental incident, a review of the emissions, cause etc. would take place as part of the incident investigation process and ensure any relevant corrective and/or preventive action is implemented.

Site meets requirements of BAT with emissions to air and water being monitored during OTNOC by direct measurement of key process parameters listed in BAT Conclusion 3 i.e. continuous determination of Oxygen content, temperature, and pressure.

We agree with the Operator’s stated compliance.</td></tr>
<tr><td>12</td><td>In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td>See description in Section 8.2.
Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues</td><td>Generally applicable</td></tr>
</table></td><td>CC</td><td>The operator has confirmed that the following combination of techniques a), b), c), d), e), f), h), p), r) are being used.
g) NA advanced combustion control system is not installed.

We agree with the Operator’s stated compliance.</td></tr>
</table>

BAT Concn No	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.	Optimisation of the working medium conditions	Operate at the highest possible pressure and temperature of the working medium gas or steam, within the constraints associated with, for example, the control of NO_X emissions or the characteristics of energy demanded			
	c.	Optimisation of the steam cycle	Operate with lower turbine exhaust pressure by utilisation of the lowest possible temperature of the condenser cooling water, within the design conditions			
	d.	Minimisation of energy consumption	Minimising the internal energy consumption (e.g. greater efficiency of the feed-water pump)			
	e.	Preheating of combustion air	Reuse of part of the heat recovered from the combustion flue-gas to preheat the air used in combustion	Generally applicable within the constraints related to the need to control NO_X emissions		
	f.	Fuel preheating	Preheating of fuel using recovered heat	Generally applicable within the constraints associated with the boiler design and the need to control NO_X emissions		
	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		

BAT Concn No	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

			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
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-	The reduction of fuel moisture	Applicable to the

BAT Concn No	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
		drying	content before combustion to improve combustion conditions	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 achieve increased steam/combustion process efficiencies	Only applicable to new plants		
	r.	Steam turbine upgrades	This includes techniques such as increasing the temperature and pressure of medium-pressure steam, addition of a low-pressure turbine, and modifications to the geometry of the turbine rotor blades	The applicability may be restricted by demand, steam conditions and/or limited plant lifetime		
	s.	Supercritical and ultra-supercritical steam conditions	Use of a steam circuit, including steam reheating systems, in which steam can reach pressures above 220,6 bar and temperatures	Only applicable to new units of ≥ 600 MW_{th} operated > 4 000 h/yr. Not applicable when the		

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<tr><td></td><td><table>
<tr><td></td><td></td><td>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>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 confirmed that water recycling wherever possible is undertaken and provided a number of examples in the FGD processes; a rainwater harvesting system is installed.

Dry ash handling is not possible as the current process for bottom ash handling is based upon coarse ash being collected from the furnace bottom which is transferred to ash settling pits and the settled ash is removed for reuse. This system is integral to current boiler design and it is not technically or economically feasible to retrofit dry ash handling.

Water usage is optimised and minimised where plant design and quality allows.

The water within the cooling water system is not of suitable quality to be re-used in other processes on site and is optimised through the management of concentration factors within the circuit itself. Waste water is unable to be recycled due to the high concentration of salts present, following treatment.

We agree with the Operator’s stated compliance.</td></tr>
<tr><td>14</td><td>In order to prevent the contamination of uncontaminated waste water and to reduce emissions to water, BAT is to segregate waste water streams and to treat them separately, depending on the pollutant content.</td><td>CC</td><td>The Operator has confirmed that waste water streams are segregated and treated separately. Surface water run-off is segregated, as is cooling water.</td></tr>
</table>

<table>
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<tr><td></td><td>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></td><td>The existing plant drainage system configuration brings the water system discharges together immediately prior to discharge to river in order for there to be one common release point at W1.

We agree with the Operator’s stated compliance.</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 colspan="2">Technique</th><th>Typical pollutants prevented/abated</th><th>Applicability</th></tr>
<tr><td colspan="4">Primary techniques</td></tr>
<tr><td>a.</td><td>Optimised combustion (see BAT 6) and flue-gas treatment systems (e.g. SCR/SNCR, see BAT 7)</td><td>Organic compounds, ammonia (NH_3)</td><td>Generally applicable</td></tr>
<tr><td colspan="4">Secondary techniques (29)</td></tr>
<tr><td>b.</td><td>Adsorption on activated carbon</td><td>Organic compounds, mercury (Hg)</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Aerobic biological treatment</td><td>Biodegradable organic compounds, ammonium (NH_4^+)</td><td>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)</td></tr>
<tr><td>d.</td><td>Anoxic/anaerobic biological treatment</td><td>Mercury (Hg), nitrate (NO_3^-), nitrite (NO_2^-)</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Coagulation and</td><td>Suspended solids</td><td>Generally applicable</td></tr>
</table></td><td>FC</td><td>The Operator has confirmed that improvements are required.

They confirmed that techniques a, e, j k, l and m are used and provided the following justification for the techniques in use and not in use:

a. optimised combustion and flue-gas treatment systems
b. This is applicable. Optimised combustion and flue-gas treatment system, as well as suitable fuel,
c. adsorption on activated carbon NA. The optimised combustion process results in very low levels of organic carbon compounds in the FGD waste water treatment plant (WWTP). Similarly, the FGD WWTP is designed to treat mercury and therefore records results typically below the limit of detection.
d. aerobic biological treatment- NA High chloride concentrations greater than 10 g/l preclude use of aerobic biological treatment.
e. Anoxic / anaerobic biological treatment – NA high chloride concentrations greater than 10 g/l preclude use of anoxic/anaerobic biological treatment
f. coagulation and flocculation -This is applicable and a technique which is part of the FGD WWTP design. FGD WWTP design uses coagulation and flocculation and precipitation, rather than filtration to achieve abatement of suspended solids and metals.
g. crystallisation -NA as FGD WWTP design uses (e) coagulation and flocculation and precipitation, rather than filtration to achieve abatement of suspended solids and metals.
h. filtration- NA as FGD WWTP design uses (e) coagulation and flocculation and precipitation, rather than filtration to achieve abatement of suspended solids and metals.
i. flotation - NA. As described above (e) there is coagulation and flocculation</td></tr>
</table>

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	flocculation		
f.	Crystallisation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
g.	Filtration (e.g. sand filtration, microfiltration, ultrafiltration)	Suspended solids, metals	Generally applicable
h.	Flotation	Suspended solids, free oil	Generally applicable
i.	Ion exchange	Metals	Generally applicable
j.	Neutralisation	Acids, alkalis	Generally applicable
k.	Oxidation	Sulphide (S^{2-}), sulphite (SO_3^{2-})	Generally applicable
l.	Precipitation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
m.	Sedimentation	Suspended solids	Generally applicable
n.	Stripping	Ammonia (NH_3)	Generally applicable

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

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

Substance/Parameter	BAT-AELs
	Daily average
Total organic carbon (TOC)	20–50 mg/l [30] [31] [32]
Chemical oxygen demand (COD)	60–150 mg/l [30] [31] [32]
Total suspended solids (TSS)	10–30 mg/l
Fluoride (F^-)	10–25 mg/l [32]
Sulphate (SO_4^{2-})	1,3–2,0 g/l [32] [33] [34] [35]
Sulphide (S^{2-}), easily released	0,1–0,2 mg/l [32]
Sulphite (SO_3^{2-})	1–20 mg/l [32]

is for suspended solids. Free oil is not an issue.

j. ion exchange -NA due to the use of technique (e) crystallisation, as described above rather than use of ion exchange for abatement of metals.

k. neutralisation -This is applicable and in use. The pH is raised as part of the FGD WWTP design, in order to treat the raw effluent. Later chemical addition, as part of the treatment process, neutralises the effluent by default.

l. oxidation -This is applicable. FGD absorber design and operational parameters utilises forced oxidation to complete oxidation of sulphide and sulphite to sulphate.

m. precipitation -This is applicable and a technique which is part of the FGD WWTP design. Through the addition of relevant chemicals, metals are crystallised / precipitated.

n. sedimentation- This is applicable and is part of the FGD WWTP design, i.e. it includes steps which promote settling out.

o. stripping -This is not applicable. FGD WWTP design does not include stripping as a technique for removal of ammonia, see BAT Conclusion 20. SCR has been retro fitted rather than SNCR, this limits the ammonia slip to FGD, therefore significantly reduced concentration of ammonia entering FGD. Process stripping is not required.

On this basis they confirm that the following parameters and BAT AEL's are currently met: Fluoride 20 mg/l, As 0.05 mg/l, Cd 0.005 mg/l, Cr 0.05 mg/l, Cu 0.05 mg/l ,Hg 0.0025 mg/l, Ni 0.04 mg/l, Pb 0.02 mg/l and Zn 0.1 mg/l when applied at point of discharge, W1 installation boundary.

BAT Conclusion 15 introduces new parameters not previously monitored:

TOC/COD , Sulphate (SO_4^{2}), Sulphide (S^{2-}), easily released and Sulphite (SO_3^{2-}) Monitoring is being investigated to achieve compliance by 17th August 2021 but to date the results are unreliable.

Regarding sulphite and sulphide, we have included a requirement in the permit for the method to be agreed in writing with the Environment Agency. As part of this we suggest consideration of method ISO 13358 Water quality — Determination of

<table>
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<tr><td></td><td>
<table>
<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>easily released sulphide and information on the problems with interference for the different methods.

Refer to Section 8 for detailed discussions and limits set.

We agree with the Operator’s stated compliance.</td></tr>
<tr><td>16</td><td>In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking:

(a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;
(b) waste preparation for reuse, e.g. according to the specific requested quality criteria;
(c) waste recycling;
(d) other waste recovery (e.g. energy recovery), by implementing an appropriate combination of techniques such as:

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Generation of gypsum as a by-product</td><td>Quality optimisation of the calcium-based reaction residues generated by the wet FGD so that they can be used as a substitute for mined gypsum (e.g. as raw material in the plasterboard industry). The quality of limestone used in the wet FGD influences the purity of the gypsum produced</td><td>Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions</td></tr>
<tr><td>b.</td><td>Recycling or recovery of residues in the construction</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</td><td>Generally applicable within the constraints associated with the required material quality (e.g. physical properties,</td></tr>
</table>
</td><td>CC</td><td>The Operator has confirmed that the existing management system and local procedures are in place in line with BAT. The site has a waste strategy and waste hierarchy in place and thus implements all four techniques - a) b) c) and d) are undertaken.

We agree with the Operator’s stated compliance.</td></tr>
</table>

BAT Concn No	Summary of BAT Conclusion requirement	Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	<table><tr><td></td><td>sector</td><td>road building, to replace sand in concrete production, or in the cement industry)</td><td>content of harmful substances) associated to each specific use, and by the market conditions</td></tr><tr><td>c.</td><td>Energy recovery by using waste in the fuel mix</td><td>The residual energy content of carbon-rich ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat or biomass can be recovered for example by mixing with the fuel</td><td>Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber</td></tr><tr><td>d.</td><td>Preparation of spent catalyst for reuse</td><td>Preparation of catalyst for reuse (e.g. up to four times for SCR catalysts) restores some or all of the original performance, extending the service life of the catalyst to several decades. Preparation of spent catalyst for reuse is integrated in a catalyst management scheme</td><td>The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_X and NH_3 emissions</td></tr></table>		
17	In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below. <table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a.</td><td>Operational measures</td><td>These include: — improved inspection and maintenance of equipment — closing of doors and windows of enclosed areas, if possible — equipment operated by experienced staff — avoidance of noisy activities at night, if possible — provisions for noise control during maintenance activities</td><td>Generally applicable</td></tr></table>	CC	The Operator confirmed that techniques a), b), c) and d) are used. We agree with the Operator's stated compliance.

<table>
<tr><th>BAT Concn No</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>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></td></tr>
<tr><td colspan="4">Combustion of solid fuels only (LCP116) coal fired boilers- unlimited hours of operation</td></tr>
<tr><td>18</td><td>In order to improve the general environmental performance of the combustion of coal and/or lignite, and in addition to BAT 6, 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>Integrated combustion process ensuring high boiler efficiency and including primary techniques for NO_X reduction (e.g. air staging, fuel staging, low-NO_X burners (LNB) and/or flue-gas recirculation)</td><td>Combustion processes such as pulverised combustion, fluidised bed combustion or moving grate firing allow this integration</td><td>Generally applicable</td></tr>
</table>
</td><td>CC</td><td>The Operator confirmed that the following techniques are used a) air staging, low-NOx burners (LNB)) meeting this requirement.

We agree with the Operator’s stated compliance.</td></tr>
<tr><td>19</td><td>In order to increase the energy efficiency of the combustion of coal and/or lignite, BAT is to use an appropriate combination of the</td><td>CC</td><td>The Operator has confirmed that dry ash handling is not used and there are technical reasons why this cannot be retrofitted.</td></tr>
</table>

<table>
<tr><th>BAT Concn No</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>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>Dry bottom ash handling</td><td>Dry hot bottom ash falls from the furnace onto a mechanical conveyor system and, after redirection to the furnace for reburning, is cooled down by ambient air. Useful energy is recovered from both the ash reburning and ash cooling</td><td>There may be technical restrictions that prevent retrofitting to existing combustion units</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for coal and/or lignite combustion
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="3">BAT-AEELs [36] [37]</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) [38]</th><th>Net total fuel utilisation (%) [38] [39] [40]</th></tr>
<tr><th>New unit [41] [42]</th><th>Existing unit [41] [43]</th><th>New or existing unit</th></tr>
<tr><td>Coal-fired, ≥ 1 000 MW_{th}</td><td>45 – 46</td><td>33,5 – 44</td><td>75 – 97</td></tr>
<tr><td>Lignite-fired, ≥ 1 000 MW_{th}</td><td>42 – 44 [44]</td><td>33,5 – 42,5</td><td>75 – 97</td></tr>
<tr><td>Coal-fired, < 1 000 MW_{th}</td><td>36,5 – 41,5 [45]</td><td>32,5 – 41,5</td><td>75 – 97</td></tr>
<tr><td>Lignite-fired, < 1 000 MW_{th}</td><td>36,5 – 40 [46]</td><td>31,5 – 39,5</td><td>75 – 97</td></tr>
</table></td><td></td><td>The current system is a wet based system, bottom ash handling is based upon coarse ash being collected from the furnace bottom and transferred to ash settling pits and the settled ash is removed for reuse. This system is integral to current boiler design.

Applicable AEEL(s) 33.5-44%"

Refer to Section 5.2 of this document.

We agree with the Operator’s stated compliance.</td></tr>
<tr><td>20</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO and N_2O emissions to air from the combustion of coal and/or lignite, 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>See description in Section 8.3. Generally used in combination with other techniques</td><td>Generally applicable</td></tr>
</table></td><td>NC</td><td>The Operator confirmed the following:

That they will not be compliant and a derogation from the NOx BAT AELs has been requested. Refer to Section 7 of this document for the detailed assessment.

A range of techniques are implemented at the installation to minimise emissions of NOx and CO to air. However, due to the technical characteristics of the existing installation, the Operator is requesting a derogation from the NOx BAT AELs.</td></tr>
</table>

BAT Concn No	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.	Combination of other primary techniques for NO_X reduction (e.g. air staging, fuel staging, flue-gas recirculation, low-NO_X burners (LNB))	See description in Section 8.3 for each single technique. The choice and performance of (an) appropriate (combination of) primary techniques may be influenced by the boiler design			The following techniques are implemented: a. Combustion optimisation - Implemented as described above (BAT Conclusion 12). b. Low-NOx burners (LNB) c. Air staging - Boosted over-fire air (BOFA) system d. Fuel staging - Not implemented. Not considered applicable to the installation. Refer to Section 7 of this document for details. e. Flue-gas recirculation - Not implemented. Not considered applicable at the installation. f. Selective non-catalytic reduction (SNCR) - Not implemented. Refer to Section 7 of this document for details. g. Selective catalytic reduction (SCR) – SCR has been fitted but has yet to be commissioned. The achievable NOx performance of the SCR units is still to be demonstrated following completion of commissioning, optimisation and performance guarantee of design specification. The performance of the plant is to be reviewed and reported through existing improvement condition IC19. Where the operational performance achieves better than Annex V limits then tighter ELV's will be set. **Refer to Section 7 of this document for details.** NOx limits and CO indicative BAT-AEL have been set as detailed in Sections 5.1 and 7 this document. We agree with the Operator's stated compliance.
	c.	Selective non-catalytic reduction (SNCR)	See description in Section 8.3. Can be applied with 'slip' SCR	The applicability may be limited in the case of boilers with a high cross-sectional area preventing homogeneous mixing of NH_3 and NO_X. The applicability may be limited in the case of combustion plants operated < 1 500 h/yr with highly variable boiler loads		
	d.	Selective catalytic reduction (SCR)	See description in Section 8.3	Not applicable to combustion plants of < 300 MW_{th} operated < 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr and for existing		

BAT Concn No	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

			combustion plants of ≥ 300 MW_{th} operated < 500 h/yr
e.	Combined techniques for NO_X and SO_X reduction	See description in Section 8.3	Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of coal and/or lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (47)	New plant	Existing plant (48) (49)
< 100	100–150	100–270	155–200	165–330
100–300	50–100	100–180	80–130	155–210
≥ 300, FBC boiler combusting coal and/or lignite and lignite-fired PC boiler	50 – 85	< 85 – 150 (50) (51)	80 – 125	140 – 165 (52)
≥ 300, coal-fired PC boiler	65 – 85	65 – 150	80 – 125	< 85 – 165 (53)

As an indication, the yearly average CO emission levels for existing combustion plants operated ≥ 1 500 h/yr or for new combustion plants will generally be as follows:

Combustion plant total rated thermal input (MW_{th})	CO indicative emission level (mg/Nm^3)
< 300	< 30–140

<table>
<tr><th>BAT Concn No</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>≥ 300, FBC boiler combusting coal and/or lignite and lignite-fired PC boiler</td><td>< 30–100 (54)</td></tr>
<tr><td>≥ 300, coal-fired PC boiler</td><td>< 5–100 (54)</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>21</td><td>In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of coal and/or lignite, 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>Boiler sorbent injection (in-furnace or in-bed)</td><td>See description in Section 8.4</td><td rowspan="5">Generally applicable</td></tr>
<tr><td>b.</td><td>Duct sorbent injection (DSI)</td><td>See description in Section 8.4.
The technique can be used for HCl/HF removal when no specific FGD end-of-pipe technique is implemented</td></tr>
<tr><td>c.</td><td>Spray dry absorber (SDA)</td><td rowspan="2">See description in Section 8.4</td></tr>
<tr><td>d.</td><td>Circulating fluidised bed (CFB) dry scrubber</td></tr>
<tr><td>e.</td><td>Wet scrubbing</td><td>See description in Section 8.4.
The techniques can be used for HCl/HF removal when no specific FGD end-of-pipe technique is implemented</td></tr>
</table>
</td><td>NC</td><td>The Operator confirmed that they will not be compliant and a derogation from the SO_2 BAT AELs has been requested. Refer to Section 7 of this document for the detailed assessment.

SO_2, HCl and HF limits have been set as detailed in Section 5.1 of this document.

We agree with the Operator’s stated compliance.</td></tr>
</table>

BAT Concn No	Summary of BAT Conclusion requirement				Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	f.	Wet flue-gas desulphurisation (wet FGD)	See description in Section 8.4	Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}, and for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr		
	g.	Seawater FGD				
	h.	Combined techniques for NO_X and SO_X reduction		Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process		
	i.	Replacement or removal of the gas-gas heater located downstream of the wet FGD	Replacement of the gas-gas heater downstream of the wet FGD by a multi-pipe heat extractor, or removal and discharge of the flue-gas via a cooling tower or a wet stack	Only applicable when the heat exchanger needs to be changed or replaced in combustion plants fitted with wet FGD and a downstream gas-gas heater		
	j.	Fuel choice	See description in Section 8.4. Use of fuel with low sulphur (e.g. down to 0,1 wt-%, dry basis), chlorine or fluorine content	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. The applicability may be limited due to design constraints in the case of combustion plants		

BAT Concn No	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

			combusting highly specific indigenous fuels

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of coal and/or lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average	Daily average or average over the sampling period
	New plant	Existing plant (55)	New plant	Existing plant (56)
< 100	150–200	150–360	170–220	170–400
100–300	80–150	95–200	135–200	135–220 (57)
≥ 300, PC boiler	10–75	10–130 (58)	25–110	25–165 (59)
≥ 300, Fluidised bed boiler (60)	20–75	20–180	25–110	50–220

For a combustion plant with a total rated thermal input of more than 300 MW, which is specifically designed to fire indigenous lignite fuels and which can demonstrate that it cannot achieve the BAT-AELs mentioned in Table 4 for techno-economic reasons, the daily average BAT-AELs set out in Table 4 do not apply, and the upper end of the yearly average BAT-AEL range is as follows:

(i) for a new FGD system: RCG × 0,01 with a maximum of 200 mg/Nm^3;

(ii) for an existing FGD system: RCG × 0,03 with a maximum of 320 mg/Nm^3;

in which RCG represents the concentration of SO_2 in the raw flue-gas as a yearly average (under the standard conditions given under General considerations) at the inlet of the SO_X abatement system, expressed at a reference oxygen content of

<table>
<tr><th>BAT Concn No</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>6 vol- % O_2.
(iii) If boiler sorbent injection is applied as part of the FGD system, the RCG may be adjusted by taking into account the SO_2 reduction efficiency of this technique (η_{BSI}), as follows: RCG (adjusted) = RCG (measured)/(1-η_{BSI}).
BAT-associated emission levels (BAT-AELs) for HCl and HF emissions to air from the combustion of coal and/or lignite
<table>
<tr><th rowspan="3">Pollutant</th><th rowspan="3">Combustion plant total rated thermal input (MW_{th})</th><th colspan="2">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average or average of samples obtained during one year</th></tr>
<tr><th>New plant</th><th>Existing plant (61)</th></tr>
<tr><td rowspan="2">HCl</td><td>< 100</td><td>1–6</td><td>2–10 (62)</td></tr>
<tr><td>≥ 100</td><td>1–3</td><td>1–5 (62) (63)</td></tr>
<tr><td rowspan="2">HF</td><td>< 100</td><td>< 1–3</td><td>< 1–6 (64)</td></tr>
<tr><td>≥ 100</td><td>< 1–2</td><td>< 1–3 (64</td></tr>
</table></td><td></td><td></td></tr>
<tr><td>22</td><td>In order to reduce dust and particulate-bound metal emissions to air from the combustion of coal and/or lignite, 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>Electrostatic precipitator (ESP)</td><td rowspan="2">See description in Section 8.5</td><td rowspan="4">Generally applicable</td></tr>
<tr><td>b.</td><td>Bag filter</td></tr>
<tr><td>c.</td><td>Boiler sorbent injection (in-furnace or in-bed)</td><td rowspan="2">See descriptions in Section 8.5.
The techniques are mainly used for SO_X, HCl and/or HF control</td></tr>
<tr><td>d.</td><td>Dry or semi-dry FGD system</td></tr>
</table></td><td>NC</td><td>The Operator confirmed the following:

That they will not be compliant and a derogation from the dust BAT AELs has been requested. Refer to Section 7 of this document for the detailed assessment.

The following relevant BAT techniques are applied::

a. Electrostatic precipitator (ESP)
b. Bag filter - Not implemented
d. Dry or semi-dry FGD system – not applicable as Wet FGD undertaken
e. Wet flue-gas desulphurisation (wet FGD) is undertaken
Fuel choice – lower sulphur coals are in use

Dust limits have been set as detailed in Section 4.1 of this document.

We agree with the Operator’s stated compliance.</td></tr>
</table>

<table>
<tr><th>BAT Concn No</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>e.</td><td>Wet flue-gas desulphurisation (wet FGD)</td><td></td><td>See applicability in BAT 21</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of coal and/or lignite
<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 (65)</th><th>New plant</th><th>Existing plant (66)</th></tr>
<tr><td>< 100</td><td>2–5</td><td>2–18</td><td>4–16</td><td>4–22 (67)</td></tr>
<tr><td>100–300</td><td>2–5</td><td>2–14</td><td>3–15</td><td>4–22 (68)</td></tr>
<tr><td>300–1 000</td><td>2–5</td><td>2–10 (69)</td><td>3–10</td><td>3–11 (70)</td></tr>
<tr><td>≥ 1 000</td><td>2–5</td><td>2–8</td><td>3–10</td><td>3–11 (71)</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>23</td><td>
In order to prevent or reduce mercury emissions to air from the combustion of coal and/or lignite, 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 colspan="4">Co-benefit from techniques primarily used to reduce emissions of other pollutants</td></tr>
<tr><td>a</td><td>Electrostatic precipitator (ESP)</td><td>See description in Section 8.5.
Higher mercury removal efficiency is achieved at flue-gas temperatures below 130 °C.
The technique is mainly used for dust control</td><td>Generally applicable</td></tr>
<tr><td>b</td><td>Bag filter</td><td>See description in</td><td></td></tr>
</table>
</td><td>FC</td><td>
The Operator confirmed that the following techniques are used :

a. Electrostatic precipitators – YES
b. Bag filters – NO
c. Dry or semi-dry FGD system – NO
d. Wet flue-gas desulphurisation (wet FGD) – YES
e. Selective catalytic reduction (SCR) from 01st July 2020

Specific techniques used and applicable to reduce mercury emissions are:

f. Carbon sorbent injection in the flue-gas – NO
g. Use of halogenated additives in the fuel or injected in the furnace – NO
h. Fuel pre-treatment – NO
i. Fuel choice – YES
</td></tr>
</table>

BAT Concn No	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
			Section 8.5. The technique is mainly used for dust control			The combination of existing techniques as well as the specific technique of fuel choice, will enable: The BAT AEL for Mercury of - 4 µg/Nm^3 (yearly average) to be met. BAT 4 Table Footnote (10) states: If the emissions levels are proven to be sufficiently stable, periodic measurements may be carried out each time that a change of the fuel …may have an impact on the emissions, but in any case, at least once every six months. The operator confirmed that the following techniques a), d) and e) are used in document reference 'Coal Hg Monitoring Reg 61 Response Final The Operator has proposed that sufficiently stable emission levels will be demonstrated by reporting the monthly fuel mercury content on a quarterly basis. The annual average fuel mercury content will then be maintained below a threshold mercury value that is equivalent to emitting at the annual BAT- AEL when retention of mercury by the process is taken into account. They make reference to Default Eurelectric Retention Factors, threshold mercury values and the detailed methodology in development by Graham D P, Weatherstone S, Protocol for LCP BREF Compliance with trace species monitoring requirements, 2018. The default Eurelectric Retention Factor for this plant category, when operating with SCR, is 0.85, i.e., 85% of the mercury is retained within the process and this is appropriate for Ratcliffe Power Station. For the above BAT-AEL, the equivalent fuel mercury threshold is then 0.27 mg/kg (dry basis). Anticipated average fuel mercury contents and Hg emission concentrations are expected to be lower than these thresholds and indicative values will be given within the site-site specific plan to be submitted in 2020 under the above protocol. The lower historic UK Pollution Inventory Retention Factor of 0.75 was specific to plants without SCR abatement and this was the same as the Eurelectric factor for plants without SCR abatement. SCR increases the oxidation of elemental mercury into soluble components that are removed by the FGD absorber. Historic performance measurements at Ratcliffe Power Station indicate greater than
	c	Dry or semi-dry FGD system	See descriptions in Section 8.5. The techniques are mainly used for SO_X, HCl and/or HF control			
	d	Wet flue-gas desulphurisation (wet FGD)		See applicability in BAT 21		
	e	Selective catalytic reduction (SCR)	See description in Section 8.3. Only used in combination with other techniques to enhance or reduce the mercury oxidation before capture in a subsequent FGD or dedusting system. The technique is mainly used for NO_X control	See applicability in BAT 20		
	Specific techniques to reduce mercury emissions					
	f	Carbon sorbent (e.g. activated carbon or halogenated activated carbon) injection in the flue-gas	See description in Section 8.5. Generally used in combination with an ESP/bag filter. The use of this technique may require additional treatment steps to further segregate the mercury-containing carbon fraction prior to further reuse of the fly ash	Generally applicable		
	g	Use of halogenated additives in the fuel or injected	See description in Section 8.5	Generally applicable in the case of a low halogen content in the fuel		

BAT Concn No	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

	in the furnace		
h	Fuel pretreatment	Fuel washing, blending and mixing in order to limit/reduce the mercury content or improve mercury capture by pollution control equipment	Applicability is subject to a previous survey for characterising the fuel and for estimating the potential effectiveness of the technique
i.	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 mercury emissions to air from the combustion of coal and lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs ($\mu g/Nm^3$)			
	Yearly average or average of samples obtained during one year			
	New plant		Existing plant ([72])	
	coal	lignite	coal	lignite
< 300	< 1–3	< 1–5	< 1–9	< 1–10
≥ 300	< 1–2	< 1–4	< 1–4	< 1–7

85% retention, even without SCR is already achieved. [Graham D P, Weatherstone S, Site-specific Retention Factors for Demonstrating Sufficiently Stable Operation at Ratcliffe Power Station, 2018]

We have set limits as set out in Section 5.1 of this document.

We agree with the Operator's stated compliance.

BAT conclusions 24-27 for the combustion of solid biomass and/or peat are not applicable and deleted

BAT conclusions 28 to 30 for the combustion of liquid fuels in boilers not applicable – deleted

BAT conclusions 31 to 35 for the combustion of liquid fuels in reciprocating engines not applicable - deleted

<table>
<tr><th>BAT Concn No</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 colspan="4">Gas oil combustion in gas turbines, LCP455 is authorised to operate for < 500 hours/year.</td></tr>
<tr><td>36</td><td>In order to increase the energy efficiency of gas oil combustion in gas turbines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for gas-oil-fired gas turbines
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="2">BAT-AEELs ([132])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) ([133])</th></tr>
<tr><th></th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas-oil-fired open-cycle gas turbine</td><td>> 33</td><td>25–35,7</td></tr>
<tr><td>Gas-oil-fired combined cycle gas turbine</td><td>> 40</td><td>33–44</td></tr>
</table></td><td>NA</td><td>Note 1 to Table 21 confirms that these BAT AEELS do not apply to plants operated < 1,500 hours/year. Refer to document reference 'OCGT Monitoring Reg 61 Response Final'.

LCP455 is authorised to operate for < 500 hours/year.

The name-plate thermal efficiency of the A rated Olympus is within the technology specific BAT-AEEL ranges and is not subject to additional BAT for Balancing constraints

Refer to Section 5.2 of this document.

We agree that this BAT Conclusion is not applicable to the activities carried out at the installation.</td></tr>
<tr><td>37</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water/steam addition</td><td 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</td></tr>
</table></td><td>CC</td><td>As outlined in document reference 'OCGT Monitoring Reg 61 Response Final'

OCGTs that operate for <500 hours/year are subject to indicative daily BAT AELs only. The Operator has confirmed that the Olympus are within the Dual-fuel indicative BAT-AEL for NOX range during normal operation,145 – 250mg/m3

The Operator has also stated that there are no commercially available NOx reduction options for this type of plant. The combustion technology produces a very stable NOx emission that is insensitive to combustor degradation whilst smoke emissions could be affected by air in-leakage into the combustor. The current maintenance based approach is to be adopted, to demonstrate emissions stability, in which an annual borescope inspection of the combustor parts is combined with 2-yearly inspection and cleaning of the oil injection nozzles to maintain general</td></tr>
</table>

BAT Concn No	Summary of BAT Conclusion requirement	Status NA/CC/ FC/NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	<table><tr><td></td><td></td><td></td><td>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>		emissions performance will be undertaken We have set limits as set out in Section 5.1 of this document. We agree with the Operator's stated compliance.
38	In order to prevent or reduce CO emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below. <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.	CC	The Operator has confirmed that the units Olympus GT's are compliant with the applicable indicative daily BAT-AELs during normal operation. Refer to response to BAT Conclusion 37 above. We have set limits as set out in Section 5.1 of this document. We agree with the Operator's stated compliance.

<table>
<tr><th>BAT Concn No</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>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 Olympus GT’s emissions are compliant with the applicable indicative daily BAT-AELs during normal operation since the fuel sulphur and ash contents are low and the smoke emission is acceptably low. Refer to response to BAT Conclusion 37.

We have set limits as set out in Section 5.1 of this document.

We agree with the Operator’s stated compliance.</td></tr>
<tr><td colspan="4">BAT Conclusions 40 to 75 are not applicable to this installation and-are deleted</td></tr>
</table>

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

Article 15(4)

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

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

> *(a) the geographical location or the local environmental conditions of the installation concerned; or*
>
> *(b) the technical characteristics of the installation concerned.*

Cost Benefit Analysis

If a derogation is applicable under Article 15(4) of the IED, then Cost Benefit Analysis (CBA) is undertaken. The CBA allows calculation to indicate whether the costs of compliance are greater or less than the environmental benefits.

It essentially groups all the costs on one side, with all the benefits, as far as possible, on the other side. It then includes the effect of time on the value of those costs and benefits in order to produce a Net Present Value (NPV).

This gives an indication of whether those costs are disproportionate or not, but there are many sensitivities in the analysis and many aspects of the environment that cannot yet be monetised so the actual decision on disproportionality rests with the National Derogation Panel (NDP).

Where the NPV is positive, this indicates that the cost of compliance with the BAT AEL(s) does not outweigh the environmental benefits.

Where the NPV is negative, this indicates that the costs of compliance with the BAT AEL(s) outweigh the environmental benefits.

Derogation requests

As part of their Regulation 61 Notice response, the Operator has requested a derogation from compliance with the AEL values included in BAT Conclusions 20, 21 and 22.

Although information was provided in their response to allow us to commence assessment of the derogation requests it was insufficient to enable us to complete the determination and further information was requested and subsequently supplied on 27/11/2019 - Document reference RAT-UUK-RFIREPCIC – 271119 – revised CBA for meeting BAT AEL's for SO_2 and dust, contains redacted CBA information for the public register

We have decided to grant the derogations requested by the Operator in respect to the AEL values described in BAT Conclusion 20, 21 and 22. We have set ELVs that are higher than the BAT-AELs in the Consolidated Variation Notice that will ensure suitable protection of the environment.

The justification for our decision to allow derogations in respect of the AEL values associated with BAT Conclusions 20, 21 and 22 is set out below.

7.1 Derogation from BAT 20 NOx AELs

Description of the derogation request

BAT Conclusion: BAT Conclusion 20 , In order to prevent or reduce NOX emissions to air while limiting CO and N_2O emissions to air from the combustion of coal and/or lignite, BAT is to use one or a combination of the techniques and achieve the NOx BAT AELs set out in Table 3 of the BAT Conclusion.

7.1.1 Part 1: First stage assessment

BAT Conclusion 20 to prevent or reduce NOx emissions apply to this emission. There are no valid applicability exclusions to achieve the NOx BAT AELs set out in Table 3 of the BAT Conclusion.

7.1.2 Operator derogation evidence:

The Operator has concluded that they cannot meet the BAT AEL as defined in BAT Conclusion 20 by the BAT Conclusions implementation date of 17 August 2021. To support this conclusion the Operator supplied a number of reports which are listed below. We have provided a summary of this evidence below:

- Document reference 'RAT-UUK-NOxREP-311018' which contains redacted CBA information for the public register
- Document reference RAT-UUK-NOxREPCinC-311018' – Full CBA
- EA Further Information Request 090819

(a) Primary and secondary techniques

BAT is to use one or a combination of primary and secondary techniques described by the BAT Conclusion in order to meet the BAT AELs.

Type of techniques considered	Technique description	General applicability
a. Primary measures Combustion optimisation	Good design, optimisation of temperature and residence time in combustion zone & use of an advanced control system.	Generally applicable
b. Primary measures Low-NOx burners (LNB)	Reducing peak flame temperature, reducing the conversion of fuel-bound nitrogen to NOx and the formation of thermal NOx	Generally applicable
c. Primary measures Air staging	Creation of several combustion zones in the combustion chamber with different oxygen contents.	Generally applicable
d. Primary measures Fuel staging	Reduction of flame temperature by creation of several combustion zones with different injection levels of fuel and air.	Generally applicable
e. Primary measures Flue gas recirculation	Recirculation of part of the flue gas to replace part of the fresh combustion air. Reduces the temperature and limits the oxygen content available for nitrogen oxidation.	Generally applicable
f. Secondary measures Selective non-catalytic reduction (SNCR)	Reaction of NOx with ammonia or urea at high temperatures between 800°C and 1000°C	For existing combustion plants, applicable within the constraints associated with the required temperature window and residence time for the injected reactants. SCR is already fitted, either SCR/SNCR are applicable.
g. Secondary measures Selective catalytic reduction (SCR)	Reaction of NOx with ammonia or urea in the presence of a catalyst at temperatures between 300°C and 450°C	Not applicable to combustion plants of <300MWth operated <500h/yr. Not generally applicable to combustion plants of <100 MWth. There may be technical and economic restrictions for

Type of techniques considered	Technique description	General applicability
		retrofitting existing combustion plants operated between 500h/yr. and 1,500h/yr. and for existing combustion plants of ≥300MWth operated <500h/yr. SCR was installed in 2009 to meet the performance standards at that time of 200mg/m3 (monthly average), IED Annex V. The plant is in the TNP and able to achieve the compliance limits (much higher) set until 30th June 2020 without the use of the SCR. From 1st July 2020 the SCR will be in use but the design of plant is such that it is not expected to meet the required BAT AEL NOx emissions yearly average emission concentration of 150mg/Nm^3 and/or the daily average emission concentration of 220 mg/Nm3 without significant upgrading, re-commissioning and testing/tuning of the SCR system. Newer SCR systems can achieve better performance (50-120mg/m3) than SNCR. SCR performance is better than SNCR. Modern SCR Systems fitted as part of new build can reduce emissions to 50 - 120mg/m^3.
Additional technique or option that could be considered.	Limited the annual operating hour to 500 hr or 1500 hr. Thereby exemption from emission limits based on operating hours would apply.	Footnote 2 to Table 7 allows for coal-fired PC boiler plants put into operation no later than 1 July 1987, which are operated <1,500h/yr. and for which SCR and/or SNCR is not applicable, the higher end

Type of techniques considered	Technique description	General applicability
		of the range is 340mg/Nm^3. SCR has already been fitted which was designed to achieve an ELV of 200mg/m^3. On the basis of no backsliding this is not applicable.
Additional technique or option that could be considered.	Closure of the plant on or before 17th August 2021	The operator has not considered this as an option as they have contract in place to provide power to the grid until the end of 2022.

Techniques not progressing to CBA	
a. Combustion optimisation	Already applied at the installation.
b. Low-NOx burners (LNB)	Already applied at the installation. Advanced LNB were installed in 2014-2017
c. Air staging	Already applied at the installation.
d. Fuel staging	**Not appropriate at the installation** Low efficiency for NOx <200mg/Nm^3. Reduction in boiler efficiency and capacity.
e. Flue gas recirculation	**Not appropriate at the installation** Low efficiency for NOx <200mg/Nm^3. Reduction in boiler efficiency and capacity. Higher temperatures at the ESPs which are already operating at their upper limit.
f. Selective non-catalytic reduction (SNCR)	SCR has already been fitted able performance is better

(b) <u>Emission Limit Values (ELV's):</u>

The Operator has proposed an ELV compared to the BAT AEL value as set out below until 2025 or earlier closure. The derogation will not extend beyond 2025 at the latest.

NOx – Emission Limit Values (ELV's) Comparison Table mg/Nm^3				
ELVs in mg/Nm^3	**Proposed**	**Current Applies until 30/06/20**	**IED Annex V applies from 1/07/20**	**BAT AEL**
Annual Average	200	None	None	150
Monthly Average	200	450	200	None
Daily Average	220	None	220	200
95%ile validated daily means within a calendar year	400	550	400	None

Current ELV's effective until 30 June 2020 (TNP ELV's)
Previous variation EPR/EP3133RZ/V004 set limits for operating under the Transitional National Plan (TNP). NOx (also SO_2 and dust) ELVs derived for the period 01 January 2016 to 30 June 2020 (the duration of the TNP). At the end of this period both Annex V and the LCP BREF are applicable (whichever is stricter). The BAT Conclusion NOx AELs are stricter with the Operator requesting a derogation and compliance with IED Annex V ELVs.

Proposed ELVs (derogation) / IED Annex V – from 01 July 2020
The proposed ELVs are significantly below the current TNP ELVs. The proposed ELVs are aligned with the IED Annex V ELVs. IED Annex V ELVs are mandatory and so must be met once the TNP finishes on 30 June 2020.

Mandatory limits:
The mandatory minimum emission limit values in Annex V apply to this release and the proposed emission does not exceed the Annex V limits. These limits will apply at the end of the TNP from 1st July 2020. The derogation request is to maintain these limits until plant closure on or before 1st October 2025.

BAT AELs – from 17 August 2021
The BAT AELs are set out in Table 3 of the BAT Conclusion, for plants ≥ 300 MWth, coal-fired PC boiler with footnote 7 being applicable to the installation i.e. applicable to plant operated ≥ 1 500 h/yr. and put into operation no later than 07 January 2014 .

(c) Criteria:

The derogation request is required for all four generating units based on the technical characteristics of the combustion plant. Their primary criteria is that they have already made significant investment in reducing NO_X emissions by the installation of SCR to each unit and the cost of improving the SCR plant to the new plant standards that has a limited operational life (whole plant is closing on or before 1st October 2025) outweigh any environmental improvement achieved.

This is supported in para 4.41 of the DEFRA IED EPR Guidance for Part A installations:

- *Recent history of pollution control investment for reducing emissions of NOX.*
- The *intended remaining operational lifetime of the installation as a whole or of the part of it giving rise to the emission of the pollutant(s), where the operator is prepared to commit to a timetable for closure.*

https://www.gov.uk/government/publications/environmental-permitting-regulations-guidance-on-part-a-installations

Ratcliffe Power Station is the only UK coal-fired power that has installed SCR on each of its four units to meet the IED Annex V limits for NOx. The SCR project commenced in late 2007 with a trial of SCR of emissions of nitrogen oxides from one boiler, to be followed by the full implementation of SCR units to each of the other 3 boilers, phased in with annual planned unit outages. Commissioning of the plant has not been completed and is to be completed by 1st July 2020 when IED Annex limits will apply.

The BAT AEL limits are tighter and the performance of the plant falls short of that required by BAT20 from 17th August 2021 requiring operation of the SCR plant beyond its original design intent; requiring significant modification of the SCR plant and additional pollution control investment.

Derogation criteria assessment		
Criteria detail	**Operator proposal – linked to DEFRA IED EPR guidance**	**Environment Agency view**
Technical - Recent history of pollution control investment for reducing emissions of NOX	Significant investment was made in 2007 to install SCR to each of the 4 generators to meet the IED Annex V limits NOx, to the required performance standards at that time, ahead of the BAT Conclusion being published. The performance of SCR falls short of that required by BAT 20 requiring further investment to upgrade the SCR abatement plant.	There is a clear link. We accept that Uniper has made significant investment in the reduction of NOX and that there is investment needed to update the SCR to new plant standards.
Technical – investment cycle and prepared to commit to timetable for closure.	Investment decisions in abatement plant are made on a 5 year cycle based on certainty of the standards required. At the time of making regulation 61 response there was no certainty in the viability of coal generation in the UK with the publication of the Government's final position paper 'Implementing the End of Unabated Coal by 2025'1 in	There is a clear link. We accept that market uncertainty in future coal generation levels in the intervening years before closure will influence further investment being made. We are aware that investment decisions are complex and are not made in isolation. They are influenced by

Derogation criteria assessment		
Criteria detail	**Operator proposal – linked to DEFRA IED EPR guidance**	**Environment Agency view**
	January 2018 to introduce a concentration based limit on Carbon Dioxide emissions to coal units, at 450g CO_2/kWh from 1st October 2025 this effectively mandates the closure of this plant by 1st October 2025 and has undermined the development of any further abatement projects and investment therein. This has a significant impact on the scope of works to be carried out between investment cycles and whether it is cost effective. They assert that as coal generation has fallen particularly in last few years, reducing by more than 80% since 2012 this has placed greater uncertainty of what the future plant generation levels will be between August 2021 and October 2025 further compounding making investment in improving pollution control measures viable and in any case the investment cycle is too short They cite that when the investment case for fitting SCR was made it was based on much higher generation figures (80% load factor), 17.52TWh, based on the SCR having an operational life of 15 years and an expected return on investment. They make the comparison to current generation estimates being reduced to 3.5TWh per year and remaining operational life of the whole plant (4 years and 2 months from the BAT Conclusions implementation	combination of national and international policies such as the introduction of concentration based limit on Carbon Dioxide emissions to coal units from 1st October 2025 referred, but this doesn't preclude investment being made where there is environmental benefit. We have therefore scrutinised the CBA.

Derogation criteria assessment		
Criteria detail	**Operator proposal – linked to DEFRA IED EPR guidance**	**Environment Agency view**
	date) makes the investment cost outweigh the environmental benefit. They cite that when the investment case for fitting SCR was made it was based on much higher generation figures (80% load factor), 17.52TWh, based on the SCR having an operational life of 15 years and an expected return on investment. They make the comparison to current generation estimates being reduced to 3.5TWh per year and remaining operational life of the whole plant (4 years and 2 months from the BAT Conclusions implementation date) makes the investment cost outweigh the environmental benefit.	
Flexibilities offered to coal fired plants operating less than 1500 hours that did not fit SCR/SNCR abatement	They also claim that previous investment was taken prior to the introduction of additional flexibilities under the IED being agreed that allow coal-fired stations to continue to operate at much higher emission levels in return for limitations on future operating hours, less than 1500 hours. They maintain that those operating less than 1500 hours per year will be at a significant competitive advantage incurring no financial burden of catalyst, reagent costs or fan power consumption making them commercially more attractive in the marketplace, notwithstanding the investment capital avoided in NOx reduction equipment, thereby having the potential to run ahead of environmentally cleaner plant with SCR.	This is not a relevant derogation criteria of article 15(4) or DEFRA guidance and is counter argument to that made earlier. We do not accept that they are being penalised for having made the investment compared to other coal plants that are only operating under 1500 hours.

7.1.3 Demonstrating disproportionality of costs and benefits

The Operator has satisfactorily demonstrated that the stated technical criterion would result in disproportionate costs for achieving the BAT AEL compared to the environmental impacts.

Cost Benefit Analysis (CBA): The Operator submitted their application in November 2018. They used CBA tool version number 6.17 which is based on HM Treasury's Green Book guidance based on the old figures, pre January 2019 damage cost. They did not provide a copy of the tool choosing to provide step by step screen shots of the output within the report.

In our assessment we took the figures presented in the report and put them into our CBA tool v6.20 to see if we could replicate the outputs. We then included in the tool the revised damage cost figures produced in 2019 by Defra. To establish a damage cost, all Part A processes should establish the stack height and the population density around the plant. This will provide a category (see table below) upon which the relevant damage cost can be obtained. A small stack height and high population density (Cat 3) would have the highest damage cost whereas the highest stack height (over 100m) and the lowest population density (Cat 7) would produce the lowers damage cost.

Average population density (persons per km^2)	Stack Height <= 50 m and all small points	Stack Height > 50, <= 100 m	Stack Height > 100 m
<= 250	1	4	7
> 250, <= 1000	2	5	8
> 1000	3	6	9

For this site we have used the Category 8 (stack height is 199m i.e. > 100m and population density between 190 and we have assumed the average population density to be > 250, <+ 1000 persons per km^2 based on parish records.

7.1.4 Options assessed:

Only one option to upgrade the SCR plant was assessed as part of the CBA based on an expected annual power generation of 3.5TWh over a five year period, starting in 2020 until closure of the plant in 2025 compared to the Business as usual (BAU), proposed derogation.

The operator also examined as part of the sensitivity upgrading the SCR for a higher power generation of 10TWh, though this operation scenario is not being requested.

Key data input for individual options

Key data input for BAU / proposed derogation	
Parameter	**Environment Agency Assessment of inputs**
Achieving the new SCR plant standards would result in 628 tonnes of NOx being saved.	Valuing the change is acceptable. We are satisfied with this approach BAT AEL / improve SCR plant

Key data input for improving the SCR plant	
Parameter	**Environment Agency Assessment of inputs**
Capital Costs: Of upgrading, re-commissioning and testing/tuning the SCR system to meet the higher performance level	We are satisfied with the detailed calculations used to derive these figures. There are no other coal plants with SCR in the UK. The figures are consistent with plants operating in Europe. .
Operational Costs: • the additional costs with the catalyst management strategy, costs of purchasing, installing and replacing additional catalyst layers over the period 2021 to 2025 • additional maintenance requirements associated with higher levels of air-heater fouling, including increased frequency of air-heater washing (and associated loss of availability), disposal of the associated effluent and increased levels of air-heater basket replacement • additional reagent costs	We are satisfied with the detailed calculations used to derive these figures. There are no other coal plants with SCR in the UK. The figures are consistent with plants operating in Europe.
Environmental Impacts: None	This is zero as the operator has only considered the change in emission. Valuing the change is acceptable. We are satisfied with this approach

The results are summarised in terms of Net Present Value (NPV) in the table below. The costs of meeting the BAT AEL outweigh the monetised benefits in comparison to the proposed derogation (i.e. NPV < 0).

		Proposed derogation	BAT-AEL
Central	£millions	0.00	-0.54
Sensitivity Analysis			
Lowest NPV for BAT-AEL is caused by: Low damage costs	£millions	0.00	-4.62
Highest NPV for BAT-AEL is caused by: High damage costs	£millions	0.00	9.99
Scenario Analysis			
Lowest NPV for each option using highest costs and lowest benefits	£millions	0.00	-5.67
Highest NPV for each option using lowest costs and highest benefits	£millions	0.00	11.05

BAT AEL option: The CBA using central assumptions shows a **negative NPV** for the BAT AEL of 0.54 and therefore the cost of compliance is disproportionate compared to the environmental benefit achieved.

PV costs/benefits: BAT improves the environment by £4.9 m over the time period but costs £5.5. The change is marginal and is significantly changed by sensitivity analysis suggesting uncertainty in the conclusions.

Sensitivity analysis: The lowest NPV for the BAT AEL of £-4.62 is caused by low damage costs supporting the derogation; and the highest NPV for the BAT AEL of £9.99 is caused by high damage costs which swings in favour of upgrading the SCR units.

Manual sensitivity checks: We carried out manual sensitivity checks on specific parameters: of adjusting the weighted average cost of capital (WACC); reducing the plant lifetime and 10TWh power generation. This did not result in any changes to the conclusions. However when we examined the cost and benefits associated when operating at a higher power generation scenario of 10TWh per year up to end of 2025 albeit an unlikely scenario the conclusion changed.

Plant lifetime: The CBA is based on operation until end of 2025 i.e. 5 years and at power generation of 3.5TWh per year. The plant is closing on or before 1st October 2025 in line with government policy that all UK coal-fired power generation must cease by 2025. We explored reducing the lifetime from five years to four years and two months the outcome remained unchanged. We also explored reducing the lifetime in line with their current power generation contract, i.e. until 2022, with the outcome unchanged.

Higher Power Generation Scenario: Based on a high generation case of 10TWh per year representing the upper end of annual generation up to the end of 2025 the central assumption now shows a positive NPV in favour of upgrading the SCR plant. It is only when the lowest damage costs are considered would the reverse apply.

Year that work on derogation application began (Year 0): The Operator started working on the derogation in 2018, but the appraisal period starts in 2020. This makes the tool consider 2018 as the start year of the appraisal period, rather than 2020. This is unusual because the first year would normally not be in the

past. As an additional sensitivity check, we also considered 2020 as the first year instead of 2018. This caused the values to slightly decrease, but the conclusions from the CBA remained unchanged

7.1.5 Summary of the second stage assessment

Based on an expected power generation of 3.5TWh per year the cost benefit analysis, using central assumptions and the revised 2019 NOx damage costs, would appear to show that upgrading the SCR plant is disproportionately costly compared with the environmental benefits. However, there is a significant level of uncertainty in the analysis. Whilst the central assumption shows a negative NPV value of £0.54m for the upgraded SCR (disproportionately costly) this swings to a positive NPV value of £9.99m (proportional in favour of the upgrade) when the high damage cost value is applied. It is the scale and rate of swing that defines the scale of uncertainty. For comparison; the central damage case considered was £1,665/tonne NOx (disproportionate), the high sensitivity range (Table 10: updated full set of damage costs[1],) is £5,277/tonne NOx (favours upgrading the SCR plant). As a result of this level of uncertainty the CBA is considered inconclusive.

7.1.6 Risks of allowing the derogation

Allowing the proposed derogation would not cause any significant pollution or prevent a high level of protection of the environment as a whole to be achieved.

Annual emissions: The annual emissions of NO_x from the activity are currently 4,878 tonnes (in 2018) though as explained earlier higher ELV's are in place until 1st July 2020, these will reduce at the end of June 2020 to 2,589 tonnes when IED Annex V ELV's apply and a further reduction of 628 tones if the BAT AEL was met in accordance with the timeline set by the IED.

National Emissions Ceiling Directive (NECD):
The National Emissions Ceiling Directive for NOx is 1,167 kilo tonnes (to 2019). We agree that the NOx emissions from the proposed derogation will have a limited impact on the UK's overall NOx emissions (0.054%) and the ability to remain below the NOx emission ceiling.

Predicted impact: The Operator has not provided any data on the impact to support their assertion that the impact is not significant. The EA undertook a review in 2015 when we examined the impact of coal fired plant such as Ratcliffe operating in compliance with the Transitional National Plan (TNP) during the period 1 January 2016 until 30 June 2020 and out of compliance with the tighter ELV's set out in Annex V of IED. We concluded at that time that if all other operating parameters remain the same, the proposed changes to the ELV's would not result in any additional impact at receptors. We were satisfied with impacts from the plant operating under the TNP and the impact will now reduce.

From 2001 to 2015 it was a requirement of the permits for coal-fired power stations to carry out ambient air quality monitoring and modelling to demonstrate that compliance with the National Air Quality Strategy (NAQS). The power stations set up six air quality monitoring sites at locations where the maximum ground level

[1] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance

concentrations were calculated to be. Reporting has shown that compliance with all of the National Air Quality Standards has been met at all of the sites in each year since 2001. Based on data collected up to 2015, with the applicable controls on the installation in place in their environmental permits, ongoing monitoring and modelling was no longer necessary. The requirement for Ratcliffe to carry out air quality monitoring in the North Trent Valley ceased at the end of 2015.

Final considerations

There has been no public interest in this site or any historic local dissatisfaction or other complaints about the installation/Operator.

Significant improvements in reducing NOx emissions have already been implemented at the site. The operator has installed SCR on all four boilers in accordance with a variation notice dated 24/04/09, some commissioning work has been carried out but this work is not expected to be completed until June 2020 when Annex V ELV's will apply.

The Operator has recently made their annual return, confirming they fed 1.75TWh of power into the grid during 2019. Whilst they have demonstrated that it will be disproportionately costly to invest in better NOx control when their supply is at 3.5TWh, it is increasingly possible that, based on warmer summers and market forces driving the electricity market towards renewable energy, future years' power outputs from Ratcliffe may also be lower than 3.5TWh.

Whilst there is some uncertainty in the results of the CBA in demonstrating that costs of achieving BAT-AEL ahead of plant closing are disproportionate to the environmental benefits, we are satisfied in our assessment of environmental impact that there would be no significant reduction in NO2 upgrading the SCR plant ahead of closure. In any event, improvements in air quality are marginal. Continuing to meet IED Chapter V ELV's is not causing any significant pollution, nor would it prevent a high level of protection of the environment as a whole being achieved. On this basis we accept the derogation.

7.1.7 Permit conditions:

Whilst we are accepting the derogation, the permit includes conditions requiring:

- The operating techniques for this BAT Conclusion will be incorporated into the permit, table S1.2
- Annex V ELV's shall apply from 1st July 2020.
- The existing permit includes an improvement condition IC19 is to be carried forward requiring confirmation that the SCR unit is performing as expected. Where the performance is better than expected then tighter ELV's will be set.
- Table S1.1 of the permit prohibits the operation of the combustion activity after the 1st October 2025.

7.2 Derogation from BAT 21 – SO2 AELs and BAT 22 Dust AELs

7.2.1 Part 1: First stage assessment

BAT Conclusion 21: In order to prevent or reduce SO_2 emissions to air from the combustion of coal and/or lignite, BAT is to use one or a combination of the technique to achieve the BAT AELs set out in Table 4 of the BAT Conclusion;

BAT Conclusion 22: In order to reduce dust and particulate-bound metal emissions to air from the combustion of coal and/or lignite, BAT is to use one or a combination of the techniques to achieve the BAT AELs set out in Table 6 of the BAT Conclusion.

Description of the derogation request:
BAT Conclusions 21 and 22, to reduce SO_2 and dust emissions apply. There are no valid applicability exclusions. They are considered together as the abatement systems are in line and there is an interaction.

7.2.2 Operator derogation evidence:

BAT Conclusion 21 and 22

The Operator has concluded that they cannot meet the BAT AELs as defined in BAT 21 and 22. To support this conclusion the Operator supplied a number of reports listed below. We have provided a summary of this evidence below:

- Document references 'RAT-UUK-SOxREP-311018 & RAT-UUK-dustREP-311018 which contains redacted CBA information for the public register
- Document reference RAT-UUK-SOxREPCinC-311018 – Full CBA
- Document reference RAT-UUK-DustREPCinC-311018 – Full CBA
- EA Further Information Request 09/04/19
- Document reference RAT-UUK-RFIREPCIC – 271119 – revised CBA for meeting BAT AEL's for SO2 and dust and contains redacted CBA information for the public register.

We have read and considered the evidence and concluded that the Operator cannot meet the BAT-AEL under normal operating conditions.

(a) Primary and secondary techniques

BAT 21 is to use one **OR** a number of techniques. They are already using wet FGD (f) and (j) fuel choice reduced sulphur coal.

Technique	Description	Applicability
(a) Boiler sorbent injection (in-furnace or in-bed)	As per section 10.8.4 of BREF	Generally applicable, however the Operator has already installed Wet flue-gas desulphurisation (wet FGD). Wet FGD is the best- in-class technology for SOx removal.

Technique	Description	Applicability
(b) Duct sorbent injection (DSI)	The technique can be used for HCl/HF removal when no specific FGD end-of-pipe technique is implemented	
(c) Spray dry absorber (SDA)	As per Section 10.8.4	
(d) Circulating fluidised bed (CFB) dry scrubber		
(e) Wet scrubbing	As per Section 10.8.4	
(f) Wet flue-gas desulphurisation (wet FGD)	As per Section 10.8.4	Not applicable to combustion plants operated <500 h/yr. There may be technical and economic restrictions for applying the technique to combustion plants of <300 MWth, and for retrofitting existing combustion plants operated between 500 h/yr and 1500 h/yr. **The plant is > 300 MWth and operates over 1500 hours. Wet flue-gas desulphurisation (wet FGD) is already installed**
(g) Seawater FGD		**Not Applicable (f) Wet FGD already installed**
(h) Combined techniques for NOX and SOX reduction		Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process. **Not appropriate as plant has already installed separate NOx abatement system, SCR.**
(i) Replacement or removal of the gas-gas heater located downstream of the wet FGD	Replacement of the gas-gas heater downstream of the wet FGD by a multi-pipe heat extractor, or removal and discharge of the flue-gas via a cooling tower or a wet stack	Only applicable when the heat exchanger needs to be changed or replaced in combustion plants fitted with wet FGD and a downstream gas-gas heater. **Gas heater already installed.**
(j) Fuel choice	Use of fuel with low sulphur (e.g. down to 0,1 wt-%, dry basis), chlorine or fluorine content	BAT conclusion states that this is 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. The applicability may be limited due to design constraints in the case of combustion plants combusting highly specific indigenous fuels. Lower sulphur fuels are already in use. Ratcliffe have considered using lower sulphur fuel of 0.47%, such fuels have a lower calorific value, more fuel would need to burnt CO_2 emissions would increase, resistivity would increase and reduce the effectiveness of dust control measures, ESP's.

BAT Conclusion 22

BAT22 is to use one or a combination of the techniques given below to reduce dust emissions. Ratcliffe are already using advanced ESP's and wet FGD.

Review of all possible techniques to achieve BAT AEL for Dust		
Technique	Description	Applicability
Electrostatic precipitator (ESP)	Description as per section per Section 10.8.4 of BREF	Generally Applicable - Ratcliffe Power Station was one of the first UK coal stations to fit Flue Gas Desulphurisation (FGD) with the units commissioned between 1994 and 1996. To facilitate successful, reliable operation of the new FGD plant, the Electrostatic Precipitator (ESP) on each unit were also comprehensively upgraded with the addition of two new "piggy-back" ESPs per boiler. The ESP's are able to meet the IED Annex ELV's but based on the current and anticipated future fuel basket, ESP units in combination with the FGD units are not capable of delivering the 8 mg/Nm^3 annual mean BAT AEL and daily average BAT AEL of 14mg/Nm^3 without major modification and additional ESP fields. Whilst a bag filter per unit is more efficient this would involve capital investment being made ahead of closure and could not be completed in time.
Bag filter		
Boiler sorbent injection (in-furnace or in- bed)	Description as per section per Section 10.8.4 of BREF. The techniques are mainly used for SOx, HCl and/or HF control.	
Dry or semi-dry FGD system		

Review of all possible techniques to achieve BAT AEL for Dust		
Technique	Description	Applicability
Wet flue-gas Desulphurisation (wet FGD)		See applicability in BAT 21 above As stated above using lower sulphur fuel of 0.47%, fuels have a lower calorific value and CO_2 emissions would increase, dust has higher resistivity and effectiveness of ESP's would be reduced. ESP are already not capable of meeting the BAT AEL.

(b) Emission Limit Values (ELV's):

The Operator has proposed ELV's that align with Annex V of IED compared to the BAT AEL value as set out in the Table below. The Operator is proposing to close the plant by the 1st October 2025 or earlier. The derogation will not extend beyond 2025 at the latest.

Emission Limit Value (ELV) in mg/Nm^3 comparison table					
Parameter	**Averaging period**	**Current until 30 June 2020 (TNP)**	**Limit from 1 July 2020 (Annex V)**	**BAT AELs**	**Proposed applies until plant closure on/before 1 Oct 2025**
SO_2	**Annual**	None	None	130 Footnotes (4)(5)	200
	Monthly	350	220	None	200
	Daily Average	440 (95% daily means)	440 (95% daily means)	205	220
	95% of validated hourly average in a calendar year	None	400	None-	400
Dust	**Annual**	None	None	8	20
	Monthly	20	20	None	20
	Daily Average	35 (95% daily means)	22	14	22
	Monthly	None	40	None	40

Notes In all cases correction factors O_2 ref conditions is 6% and continuous monitoring apply

Footnotes 4 & 5 of table 4 – BAT21

(4) The lower end of the range can be achieved with the use of low sulphur fuels in combination with the most advanced wet abatement system designs.

(5) For other existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 205 mg/Nm^3.

(c) Criteria:

The derogation request is required for all four generating units based on the technical characteristics of the combustion plant.

Their primary criteria is that the whole plant is closing on or before the 1st October 2025 making further investment in improving the now outdated abatement technology is not cost effective and in any case outweigh any environmental improvement achieved. This is supported in para 4.41 of the DEFRA IED EPR Guidance for Part A installations1: the intended remaining operational lifetime of the installation as a whole or of the part of it giving rise to the emission of the pollutant(s), where the Operator is prepared to commit to a timetable for closure.

[1] https://www.gov.uk/government/publications/environmental-permitting-regulations-guidance-on-part-a-installations)

Derogation criteria assessment		
Criteria detail	**Operator proposal – linked to DEFRA IED EPR guidance**	**Environment Agency view**
Technical –the intended remaining operational lifetime of the installation as a whole or of the part of it giving rise to the emission of the pollutant(s), where the operator is prepared to commit to a timetable for closure. The whole site is closing in or before 1st October 2025	Lower sulphur fuels are already in use and Electrostatic Precipitator (ESP) on each boiler unit ensure that over 99% of the particulate emissions are removed from the exhaust gases before they enter the wet FGD plant that captures 90% SO2 emissions to achieve compliance with Annex V ELV's for SO_2 and dust. The BAT AEL's for SO_2 and dust are tighter. The abatement systems require major modification and capital expenditure to achieve the tighter standards. To compound any investment decision Government's BEIS Department announced in January 2018 its intention to bring forward legislation to apply a concentration-based limit on carbon dioxide emissions to coal units, at 450g CO2/kWh from 1st October 2025. Ratcliffe can't meet this standard, mandating the closure of units fired primarily on coal from that date. This undermines any investment decision both practically in the	There is a clear link with para 4.41 of the DEFRA IED EPR Guidance for Part A installations. We accept that market uncertainty in future coal generation levels in the intervening years before closure will influence further investment being made. We are aware that investment decisions are complex and are not made in isolation. They are influenced by combination of national and international policies such as the introduction of concentration based limit on carbon dioxide emissions to coal units from 1st October 2025 referred to. We acknowledge that the wider issues have prevented any firm investment decision being made. We accept that the closure of the plant on or even before 1st October would prevent significant capital investment being realistic. We are aware that investing in new technology when the whole

Derogation criteria assessment		
Criteria detail	**Operator proposal – linked to DEFRA IED EPR guidance**	**Environment Agency view**
	development of abatement projects to assess, design, manufacture, install and commission any solutions to meet the new BAT AEL's The reasoning for seeking a derogation is supported in para 4.41 of the DEFRA IED EPR Guidance for Part A installations. "The intended remaining operational lifetime of the installation as a whole or of the part of it giving rise to the emission of the pollutant(s), where the operator is prepared to commit to a timetable for closure" The forth coming carbon reduction measures will reduce carbon support making coal generation more expensive. Though the intention is to reduce CO2 emissions it will also reduce the coal generation and the true extent of this for Ratcliffe remains uncertain. While the scenarios modelled have been considered based upon the longest expected remaining life of the plant (to 2025), current power generation contract is up to end of September 2022 with no guarantee that the contract would be extended closure by the end of September 2022 remains a credible scenario given the current market conditions, creating a significant uncertainty around further investment requirements.	plant has a very limited life may in advertently cause more pollution when operating outside of previous designed parameters increasing raw materials use; noise; energy requirements; CO2 emissions, dust, NOx and SO2 and we would not wish to encourage this. However, where there is an overriding environmental benefit we would expect investment to be made. We have therefore scrutinised the CBA.
Technical investment cycle to improve existing SO2 & dust pollution control systems	Reduced generation means that any investments made in order to reduce emissions further will have a lower impact that might otherwise be made from the investment. The timescales associated with completing any major engineering upgrade	We acknowledge that the wider issues have prevented any firm investment decision being made. We accept that the closure of the plant on or even before 1st October 2025 would prevent significant capital investment being realistic though where there is an

Derogation criteria assessment		
Criteria detail	**Operator proposal – linked to DEFRA IED EPR guidance**	**Environment Agency view**
	involve significant lead times for project planning and significant outage time for the installation whilst also incurring associated lost generation costs. Any engineering upgrade would need to be completed by the end of 2020. Achievement of the BREF limits by Aug 2021 with only 13 months remaining until the end of 2020 is now not deliverable. Abatement solutions are unique to Ratcliffe and would become immediately redundant. The timings of the unit installation consequently mean that the agreed unit outage period in 2020 is missed, which has an impact both on the unit availability and Capacity Market obligations/penalties.	environmental benefit we would expect investment. We have therefore scrutinised the CBA.

Options review: The Operator has referred to the BAT Conclusions and addressed all reasonable techniques for achieving the BAT AEL. Where an option is considered appropriate for cost benefit analysis (CBA) it has been identified as such and considered further.

Techniques not progressing to the CBA	
Technique	**Reasons not progressed to the CBA**
Fuel Choice	Fuel choices alone. The implications of changing fuel has already been discussed above. In addition the sales of gypsum, a by-product of FGD, would be lost as a result of the change in fuel, leading to a reduction in income. Lower sulphur fuel of 0.47%, fuels have a lower calorific value and CO2 emissions would increase. This has been carried forward in the CBA to achieve compliance with BAT AEL for SO2 by August 2021, but given that additional flue gas conditioning equipment to improve dust capture within the ESPs would be required in our view we do not consider this as a viable option. Viable options are those that would meet both dust and SO2 BAT AEL's in the CBA.

Replace the ESP's with bag plant	BAT conclusion allows either technique. Significant capital expenditure would be required. Further upgrades to the draught plant, and ducting would be required to overcome the increased pressure drop across the filter and associated increased implosion risks associated with more powerful fans. The time to install this equipment would be around two years from contract award for the first unit, with potentially lengthy periods of lost generation for equipment demolition, removal, rebuild and tie-in/commissioning. The Operator also maintain that the current system removes more of the final particulates. As ESP's with wet FGD is already in use this option was dismissed.
Closure of plant in 2021	Contracts (for UK capacity market) are in place until the end of September 2022. Huge penalties would be incurred. Whilst they have not said what this would be, we do accept that it would be substantial.

CBA Options:

Two options for achieving the BAT AEL's for both SO_2 and dust using available techniques are considered as viable based on an expected power generation of 3.75TWh and a high power generation of 10TWh. They were taken forward for the disproportionality assessment. They are summarised in the table below. The Operator has conducted a cost benefit assessment of a number of options for achieving the BAT AEL and has adequately justified this decision.

Options considered as viable and taken forward for disproportionality assessment		
Option	**Description**	**Timescale for completion**
(1) Business as usual (BAU) and	Use of current fuel basket and abatement systems , FGD and ESP based on expected power generation of 3.5TWth	No change – operations as of 1st July 2020 when TNP ends and mandatory IED Annex V limits apply until plant closure on or before 1st October 2025
(2) Meet BAT-AEL's for SO_2 and dust with SO_3 injection	Use of lower sulphur fuel & SO3 injection. Includes use of remaining current coal stock during 2020, BAT AEL compliance SO_2 130mg/m^3, dust 8 mg/Nm^3. Emissions of SO_2 and dust would reduce by 880 and 136 tonnes per annum.	BAT achieved in 2021.
(3) Meet BAT-AEL for SO_2 and Dust by lower sulphur fuel and major upgrade of ESP operation	Use of lower sulphur fuel relative to current fuel basket & Major upgrade of ESP. Includes use of remaining current coal stock in 2020. BAT AEL compliance SO_2 130mg/m^3, dust 8 mg/Nm^3. Emissions of SO_2 and dust would reduce by 880 & 136 tonnes per annum.	BAT achieved in 2021

Options considered as viable and taken forward for disproportionality assessment		
Option	**Description**	**Timescale for completion**
(4) Option (2) and (3) based on higher power generation alternate	Cost data and emissions reduction based on high generation 10 TWth for options 2 and 3 described above. BAT AEL compliance SO_2 130mg/Nm^3, Dust 8 mg/Nm^3. Emissions of SO_2 and dust would reduce by 2,513 and 388 tonnes per annum.	BAT achieved in 2021 Generation of this scale is unlikely and not proposed. There has been a steady decrease in the preceding years and is therefore considered unrealistic. The CBA has been examined in the sensitivity assessment

Significance:
If compliant with the BAT-AEL's then the mass of emission of SO_2 and dust respectively released would be reduced by 880 and 136 tonnes per annum compared to operating to Annex V ELV's.

Summary of the first stage assessment
The Operator has supplied a valid derogation request against BATC 21 & 22 of the BAT conclusions. The derogation request is based on technical characteristics. The Operator has looked at the viability of using low sulphur coal as an option though this would only achieve compliance with the BAT AEL for SO_2 and would reduce the effectiveness of the ESP's, the performance of which already falls short of that required by BATC. Changes to the FGD and sulphur content of the fuels have a direct linkage to the investment needed on the ESP to achieve compliance with both BATC. Given the interaction with the abatement of SO_2 (BAT21) and abatement of dust emissions (BAT22) options, achieving both are most relevant for consideration and taken forward in the CBA. We accept that as the site is closing on or before 1st October 2025, replacing ESP's with bag filters is not viable especially as the current ESP's are capable of being upgraded to meet the tighter BAT AEL's.

7.2.3 Second Stage Assessment - Demonstrating disproportionality of costs and benefits

The Operator has provided information that satisfactorily demonstrated that the stated criterion would result in disproportionate costs for achieving the BAT AEL compared to the environmental impacts.

Cost Benefit Analysis (CBA): The CBA was reviewed and considered to be applicable and correct and should be considered as part of the derogation. Key points of the evidence provided are:

The Operator did not provide a copy of the tool but step by step screen shots from the tool were included within the CBA report. The CBA report was in three sections and considers options for achieving compliance for SO_2 only through adjusting fuel basket; implementing both SO_2 and dust by adjusting the fuel basket & flue gas conditioning for dust abatement and finally implementing both by adjusting the fuel basket and undertaking a major ESP upgrade of dust abatement.

In our assessment we took the figures presented in the report and remodelled using our draft CBA tool v6.20 and applied the PM2.5 Part A Category 8 and SO2 National (SOx) DEFRA 2019 damage cost figures to determine if we could replicate the outputs. Presented below are our numbers and so they may be very slightly different to those shown in the document RAT-UUK-RFIREPCIC – 271119. Any discrepancies are minor and do not materially impact on our conclusions.

7.2.4 Options assessed:

The Operator assessed two options as part of the CBA based on an expected annual power generation of 3.5TWh operating from 2020 up to the end of 2025 providing a reduction of SO_2 and dust of 880 and 136 tonnes per annum and examined a higher power generation of 10TWh as a sensitivity check where emissions of SO_2 and dust would reduce by 2,513 and 388 tonnes per annum for the same time period.

Option 1 Costs of using 0.47% lower sulphur content relative to current fuel basket is used with ESPs, and sulphur trioxide injection (SO_3) to improve particulate control (BAT-AEL-SO3) and

Option 2 Costs associated with the use of lower sulphur fuel 0.47% lower sulphur content relative to current fuel basket and major modification to ESP's, (BAT-AEL-ESP).

Data input – options

The tables below provide a summary of emissions and key costs of the proposed options.

Key data input BAU/proposed derogation based on Power generation 3.5TWh per year.		
Parameter	**Operator inputs**	**Environment Agency Assessment of inputs**
Capital/operating costs Operating in compliance with Annex V ELV's as of 1st July 2021	No Capital Expenditure incurred – based on operation current fuel basket and the existing abatement systems, ESP's and FGD	We accept that there would be no additional costs

Key data input BAU/proposed derogation based on Power generation 3.5TWh per year.		
Parameter	**Operator inputs**	**Environment Agency Assessment of inputs**
Environmental impacts SO_2 National (SOX) PM10 ESI	Based on meeting ELV- SO2 – 200 mg/$m^3$880 tonnes of SO2 released annually starting 2021 until 2025 Based on meeting ELV dust 20 mg/m3136 tonnes of PM10 released annually starting 2021 until 2025	Valuing the change in emissions is accepted

Key data input BAT-AEL-SO3		
Parameter	**Operator inputs**	**Environment Agency Assessment of inputs**
Capital Costs	Cost associated with the installation of an additional spray level within the absorber tower and recirculation pumps, repositioning of demisters, and upgrading of the electrical infrastructure to meet the extra electrical load demands. Incurred in 2020	Costs align with other European plants described in the BREF and are accepted. Its noted that they allowed a 20% uncertainty which is reasonable and accepted
Total operating and maintenance costs by year	Reduced sulphur fuel, carbon price support changes to limestone, gypsum, ash other feedstock incurred from 2021 until 2025	
Total cost of energy	Additional CO_2 associated with NCV of lower sulphur fuels emission type each year from 2021 to 2025	We accept that more fuel would be used to deliver same power generation,
Emissions	use of old higher sulphur coal in 2020	Use of fuel stocks prior to 2021 is accepted

BAT-AEL-Major ESP		
Parameter	**Operator inputs**	**Environment Agency Assessment of inputs**
Equipment, Total upfront investment costs for all years (non-discounted)	Additional ESP units and associated infrastructure, cost incurred in 2020	Cost were based on rebuilding of ESPs at Charbon, in France and are accepted. As above they allowed a 20% uncertainty which is reasonable and accepted

BAT-AEL-Major ESP		
Parameter	**Operator inputs**	**Environment Agency Assessment of inputs**
Total operating and maintenance costs by year (non-discounted) £000's	Additional fuel cost and other costs of feedstock to limestone, gypsum, ash incurred from 2021 until 2025	
Total cost of energy	Additional CO2 associated with NCV of lower sulphur fuels and more fuel being burnt incurred from 2021 to 2025	We accept that more fuel would be used to deliver same power generation
Emissions	Use of higher sulphur coal in 2020	Use of fuel stocks prior to 2021 is accepted

The results are summarised in terms of Net Present Value (NPV) in the table below for both options to meet BAT AEL. The costs of meeting the BAT AEL outweigh the monetised benefits in comparison to the proposed derogation (i.e. NPV < 0).

Summary of NPV analysis			
Option		**BAT-AEL-SO3**	**BAT-AEL-ESP**
Central	**£m**	-18.06	-60.45
Lowest NPV for BAT-AEL is caused by: Low damage costs	**£m**	-33.99	-76.38
Highest NPV for BAT-AEL is caused by: High damage costs	**£m**	+27.89	-14.50
Lowest NPV for each option using highest costs and lowest benefits	**£m**	-41.05	-93.56
Highest NPV for each option using lowest costs and highest benefits	**£m**	+34.36	+1.52

BAT AEL options:

BAT-AEL-SO_3: The CBA using central assumptions shows a negative NPV for the BAT AEL of £-18 and therefore the cost of compliance is disproportionate compared to the environmental benefit achieved.

BAT-AEL-ESP: The costs of this option were disproportionate compared to the environmental benefit achieved, with a negative NPV £-60m using central case assumptions.

Sensitivity analysis:
The lowest negative NPV for the BAT AEL of £-41m for SO_3 injection or £-93m when considering major rebuild of ESP is caused by low damage costs; and the highest negative NPV for the BAT AEL of £34m or £1.52m is caused by high damage costs.

Manual sensitivity checks
We carried out manual sensitivity checks on specific parameters: Weighted average cost of capital (WACC) and plant lifetime. This did not result in any changes to the conclusions. When we examined the higher power generation the results did change, see below.

Plant lifetime: The CBA is based on operation until 2025 when the plant will close on or before 1st October 2025 in line with Government Policy. The power station only has a contract until the end of September 2022 (UK Capacity Market). We explored reducing the lifetime from 5 years to 2 years the outcome is unchanged. The central assumption becomes more negative. Similarly if the plant lifetime is reduced to two years in line with contract with national grid the central assumption becomes more negative.

Higher Power Generation Scenario: The central assumption results from CBA based on a high generation case of 10TWh per year representing the upper end of annual generation up to the end of 2025 now shows a positive NPV of £+0.8m in favour of reducing S content of the coal and using SO_3 injection. It is only when the lowest damage costs are considered would the reverse apply. The central assumption remains negative of not undertaking major upgrading of the ESP's. They do assert that shifting from 3.5TWh to 10TWh would involve a fuel volume handling an absolutely unprecedented volume of coal which could not be achieved within a single year. They maintain that generation levels of sub-2TW is a more credible variation year-on-year. The practicalities of handling variations in fuel volume such as ships, port access, port storage, trains, delivery routes, drivers etc. was not monetised.

Year that work on derogation application began (Year 0): The operator started working on the derogation in 2018, but the appraisal period starts in 2020. This makes the tool consider 2018 as the start year of the appraisal period, rather than 2020. This is unusual because the first year would normally not be in the past. As an additional sensitivity check, we also considered 2020 as the first year instead of 2018. This caused the values to slightly decrease, but the conclusions from the CBA remained unchanged.

Combined CBA for all three Derogations NOx, SO2 and dust: The results of the CBA using central assumption still shows negative NPV compared to the environmental benefit achieved. The value has slightly more negative. This is to be expected as no capital investment is needed in improving NOx abatement, SCR.

7.2.5 Summary of the CBA

The Operator has provided a credible argument that the increased costs linked to the technical characteristics are disproportionate for achieving the BAT AEL's for both SO_2 and dust. An appropriate range of options were reviewed and those identified as technically viable were considered further. Viable options were taken forward for Cost Benefit Analysis (CBA), were adequately described in the CBA and the cost of the BAT AEL option and other options was confirmed as disproportionate compared to the environmental benefits.

Based on an expected power generation of 3.5TWh per year the cost benefit analysis, using central assumptions and the revised 2019 damage costs, the CBA would appear to show that reducing the sulphur content of fuel and SO_3 flue gas conditioning for dust abatement plant is disproportionately costly compared with the environmental benefits.

However, there is a level of uncertainty in the analysis. Whilst the central assumption shows a negative NPV value of £-18m for changing the fuel basket to use lower S coal and injection of SO3 is (disproportionately costly) this swings to a positive NPV value of £28m (proportional in favour of the upgrade) when the high damage cost value is applied. It is the scale and rate of swing that defines the scale of uncertainty. For comparison; the central damage case considered was £6,274 tonne SO2 National (SOX) (disproportionate), the high sensitivity range (Defra figure) is £17,861/tonne (favours changing the fuel basket to use lower S coal and using injection of SO_3). When all three derogations NOx, SO2 and dust are considered together NPV is slightly more negative and swings to positive when higher damage costs are considered. As a result of this level of uncertainty the CBA is considered inconclusive.

7.2.6 Risks of allowing the derogation

Allowing the proposed derogation would not cause any significant pollution or prevent a high level of protection of the environment as a whole to be achieved based on our assessment below.

Annual emissions: The current allowable annual emissions of SO_2 and dust under TNP from the activity are 7104 and 710 tonnes these will reduce by 880 and 136 tonnes respectively if the BAT AELs were met in accordance with the timeline set by the IED.

National Emissions Ceiling Directive (NECD): The Operator presented two tables, Tables 15 & 16 of the CBA report of the impact on NECD were the derogation to be granted and if BAT AEL's were met. They show that the UK national SO_2 emissions are projected to meet both the 2020 and 2025 targets by a substantial margin with Ratcliffe Power Station contributing less than 1.5% of the of the 2025 interim ceiling and not implementing the derogation would be an additional reduction in emissions of less than 1.3% of the 2025 interim ceiling. We agree that the SO_2 emissions from the proposed derogation will have no impact on the UK's overall SO_2 emissions and the ability to remain below the SOx emission ceiling.

In the case of PM2.5 emissions, the UK is not expected to meet the targets. Ratcliffe Power station contributes only 0.26% of the 2025 interim ceiling. The impact of not implementing the dust derogation would be an additional reduction emission of less than 0.2%. The changes are so small that we agree that dust emissions from the proposed derogation will have an insignificant impact on the UK's overall PM2.5 emissions and the ability to meet the NECD.

Predicted impact: A summary of the maximum predicted impact at the closest receptor of derogating from the BAT AEL on any long or short term Environmental Quality Standard (EQS) / Environmental Assessment Level (EAL) is presented in the table below.

Summary of predicted impacts – maximum at a receptor					
Option	**Parameter**	**EQS µgm^{-3}**	**PC µgm^{-3}**	**PC as % of the EQS**	**Assessment of inputs**
Derogation	SO_2 99.9th %ile 15 min mean	266	38.79	14.6	Not significant below 70% of EQS
	SO_2 99.73rd %ile 1 hour mean	350	30.98	8.9	Insignificant for proposed derogation
	SO_2 99.18th %ile of 24-hour mean	125	13.66	10.9	Not significant below 70% of EQS
	PM10 annual mean	40	0.05	0.1	Insignificant for proposed derogation
	PM10 90.41th %ile of 24- hourly mean	50	0.33	0.7	
	PM2.5 annual mean	25	0.04	0.2	
Meeting BAT AEL	SO_2 99.9th %ile of 15 min mean	266	36.15	13.6	Marginal improvement in PC - Not significant below 70% of EQS
	SO_2 99.73rd %ile of hourly mean	350	28.86	8.2	Insignificant
	SO_2 99.18th %ile of 24- hourly mean	125	12.73	10.2	Marginal improvement in PC - Insignificant for BAT AEL

Summary of predicted impacts – maximum at a receptor					
Option	**Parameter**	**EQS µgm^{-3}**	**PC µgm^{-3}**	**PC as % of the EQS**	**Assessment of inputs**
	PM10 annual mean	40	0.02	0.0	Insignificant
	PM10 90.41th %ile of 24- hourly mean	50	0.21	0.4	
	PM2.5 annual mean	25	0.02	0.1	

It can be seen from the table above that emissions of PM10 and PM2.5 already screened out as insignificant as the process contribution is < 1% of the long term EQS and <10% of the short term EQS. For SO_2, emissions either screen out as insignificant or where they do not screen out as insignificant, emissions are marginal and would not give rise to significant pollution. In all cases there is no risk of causing an exceedence of the EQS. The change in impact is only marginal (0.99%) and considered inconsequential. There is no history of odour complaints.

From 2001 to 2015 it was a requirement of the permits for coal-fired power stations to carry out ambient air quality monitoring and modelling to demonstrate that compliance with the National Air Quality Strategy (NAQS). The power stations set up six air quality monitoring sites at locations where the maximum ground level concentrations were calculated to be. Reporting has shown that compliance with all of the National Air Quality Standards has been met at all of the sites in each year since 2001. Based on data collected up to 2015 that with the applicable controls on the installation in place in their environmental permits, ongoing monitoring and modelling was no longer necessary. The requirement for Ratcliffe to carry out air quality monitoring in the North Trent Valley ceased at the end of 2015.

Based on our review undertaken in 2015 when we examined the impact of coal fired plant such as Ratcliffe operating in compliance with the Transitional National Plan (TNP) – during the period 1 January 2016 until 30 June 2020 and not being compliant with the ELV's set out in Annex V of IED. We concluded at that time that if all other operating parameters remain the same, the proposed changes to the ELV's would not result in any additional impact at receptors. We agree that the NOx emissions from the proposed derogation will have a limited impact.

The habitats assessment conservatively assumes that the most sensitive habitat is present at the maximum impact location. The assessment of the proposed derogation and BAT AEL scenarios does not identify either scenario to have a lesser impact than the other.

Summary of risks of allowing the derogation

The Operator has demonstrated that the costs of achieving the BAT AEL's in 2021 for both SO_2 and dust ahead of the plant closing in 2025 are disproportionate to the environmental benefits.

There is no significant reduction in SO_2 or dust emissions from the installation through the adoption of reduced sulphur coal and making further improvements to secondary dust abatement system by either by flue gas injection or additional ESP plates and in any event, the impacts are not significant for the proposed derogation and the BAT AEL options.

Final considerations

There has been no public interest in this site or any historic local dissatisfaction or other complaints about the installation/Operator. The Operator has recently made their annual return, confirming they fed 1.75TWh of power into the grid during 2019. Whilst they have demonstrated that it will be disproportionately costly to invest in better SO_2 and dust control when their supply is at of 3.5TWh, it is increasingly possible that, based on warmer summers and market forces driving the electricity market towards renewable energy, future years' power outputs from Ratcliffe may also be lower than 3.5TWh.

Whilst there is some uncertainty in the results of the CBA in demonstrating that costs of achieving BAT-AEL ahead of plant closing are disproportionate to the environmental benefits, the operator has demonstrated that improvements in Air Quality are marginal, meeting the IED Chapter V ELV's is not causing any significant pollution or would prevent a high level of protection of the environment as a whole to being achieved. On this basis we accept the derogation.

There are only 5 coal plants in the UK of which three are in England, Ratcliffe-on-Soar being considered here; West Burton A which is to reduce to 1500 hours of operation per year from August 2021 and Drax in Yorkshire is to cease burning coal in 2021. Our decision would not set any precedent.

7.2.7 Permit conditions:

Whilst we are accepting the derogation, the permit includes conditions requiring:

- The operating techniques for this BAT Conclusion will be incorporated into the permit table S1.2
- Annex V ELV's shall apply from 1st July 2020 and would continue until closure of the plant.
- Table S1.1 of the permit prohibits the operation of the combustion activity after the 1st October 2025.

8 Emissions to Water

The consolidated permit incorporates the 4 current discharges to controlled waters identified as W1, W3, W4 and WS7 into the River Trent.

8.1 BAT Conclusion 15 for direct discharges to a receiving water body from flue-gas treatment

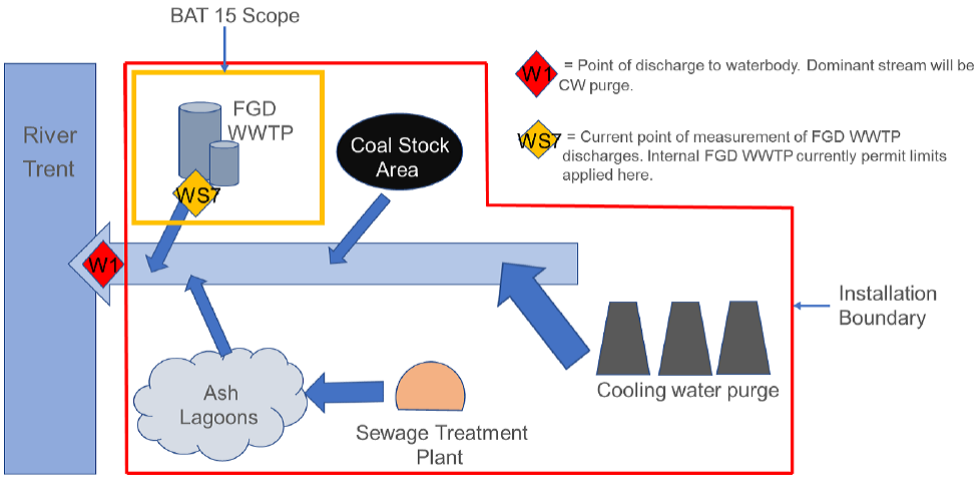
The UK Regulators' Large Combustion Plant Best Available Techniques Interpretation Document identifies that the FGD WWTP should be monitored for BAT AEL compliance at an appropriate point. The exact location is to be justified on a site specific basis, taking into account current performance compared to the BAT AELs. There should also be no backsliding from current ELVs without appropriate justification.

Furthermore, where monitoring for BAT AEL compliance purposes takes place upstream of the final discharge point the monitoring value corresponding to the BAT AEL compliance may differ from the numeric value in the BREF and will need to be set reflecting the specific installation arrangements.

For this installation, the Operator has confirmed that releases to surface water from the site arise from many sources including ash lagoons, coal stockyard run-off, surface water drains, FGD waste water treatment plant, sewage treatment plant and cooling water purge. Where required, these individual releases are treated separately before being combined into a single waste water stream prior to release at the site boundary as shown in Figure 1 below.

The BAT-AELs stated in the LCP BREF BAT Conclusion 15 are applicable at the point of release to water body i.e. at W1 in Figure 1 the installation boundary, with FGD WWTP emissions only falling in scope.

Figure 1. Schematic of UK freshwater plant and the flows of discharge streams to water



Currently the permit sets a minimum flow of 700l/s at W1 before discharge at WS7 is permitted. On this basis with exception of Total Suspended Solids of the Operator proposes compliance with BAT-AELs be demonstrated at the point of discharge by application of relative flow balances measured at W1 (final site discharge) and WS7 (FGD WWTP) and is accepted.

Proposed limits

Monitoring results demonstrate that the current emissions of all parameters (except Total organic carbon (TOC) / Chemical oxygen demand (COD), sulphides, sulphate (SO_4^{-2}) and sulphite (SO_3^{-2} as these parameters are not currently monitored) are below the BAT-AELs. We have set limits in Table S3.2a of the permit based on the Operator's proposal as set out in response to BAT15 – BAT conclusions Ratcliffe final spreadsheet.

Substance/Parameter	Current Limits(mg/l)	BREF BAT15 Table1	Permit Limits from 17/08/21	Basis of Limits
Total organic carbon / Chemical oxygen demand (COD)	None	50 mg/l /150 mg/l	None	BREF
Total suspended solids (TSS)	75 Note 1	30 mg/l	30 mg/l	BREF
Sulphate (SO_4^{-2})	None	2 g/l	2 g/l	BREF
Sulphide (S^{-2}), easily released	None	0.2 mg/l	0.2 mg/l	BREF
Sulphite (SO_3^{-2})	None	20 mg/l	20 mg/l	BREF
Fluoride	20	20 mg/l	20 mg/l	No Backsliding
Total nitrogen	None	None	None	BREF
Mercury*	0.025	3 µg/l	3 µg/l	No Backsliding
Cadmium*	0.05	5 µg/l	5 µg/l	BREF
Arsenic*	0.5	50 µg/l	50 µg/l	BREF
Chromium	1	50 µg/l	50 µg/l	BREF
Copper*	0.5	50 µg/l	50 µg/l	BREF
Lead*	0.5	20 µg/l	20 µg/l	BREF
Nickel*	0.04	50 µg/l	50 µg/l	BREF
Zinc*	1	200 µg/l	200 µg/l	BREF
Chlorides	40 000	None	40 000 mg/l	No backsliding

* Reg61 Response BAT15 - Operator had requested retention of current limit on the basis being tighter. This is not correct as the BATAELs are in µg/l.

Note 1 permit variation EPR/AP3330LB/V005 set a single TSS permit limit at W1 accounting for all contributing emission streams (CW purge, FGD-WWTP, ash lagoons and coal stock area).

8.2 BAT 5 – monitoring of emissions to water from flue-gas treatment

BAT Conclusions 5 and 15 introduce a number of new parameters to be monitored namely Total Nitrogen, Total organic carbon (TOC) / chemical oxygen demand (COD), sulphate, sulphide and sulphite. The Operator does not propose to monitor these parameters, maintaining that due to chemical analysis it is not practical.

BAT Conclusion 5 states that either the BAT AEL for TOC or COD applies. Footnote (6) of Table 1 of BAT Conclusion 15 states that the BAT-AEL does not apply to discharges to the sea or to brackish water bodies. We accept that waters from the waste water treatment plant are “brackish” having high chloride content. On this basis we have not set any BAT AEL or monitoring requirements for this parameter.

In the case of sulphate, sulphide and sulphite we do not accept that monitoring is not practicable and have set monitoring as specified under BAT Conclusion 5 in table S3.2a of the permit. We have included Note 4 in table S3.2a stating that the monitoring standard for Sulphide is to be agreed in writing with the Environment Agency.

8.3 Water Framework Directive (WFD)

In addition to the review of compliance against the relevant BAT Conclusions for emissions to water, this permit review also provides an opportunity to consider whether the discharge to surface water will maintain River Quality Objectives (RQOs) in the receiving watercourse to ensure the water quality objectives under the WFD will be met.

This permit review sets new limits for a range of parameters at the flue gas desulphurisation plant, as described above. The power station is set to close in or before 1st October 2025. It is considered that these measures and factors are sufficient to ensure that the discharge to surface water will maintain RQOs. The introduction of tighter BAT AELS is not necessary to implement further limits based on the river needs.

9 Additional IED Chapter II requirements:

Condition/table	Justification
Condition 2.3.8 and improvement condition IC23, Table S1.3 added	In the event of a black out National Grid would call on combustion plant to operate and may require them to do so outside their permitted conditions. We have dedicated black start plant and they are permitted to run as such but this scenario is relevant to the rest of the LCP which could be called depending on the circumstances. A risk assessment will be carried out by Energy UK/Joint Environmental Programme on behalf of LCP connected to the National Transmission System. Air emissions modelling will be based on generic black start scenarios to establish whether they have the potential to have a local impact on the environment or not (on a national basis). If the modelling demonstrates that no significant impacts are likely, the plant can operate under condition 2.3.8. This condition allows the hourly ELVs for plants operating under a black start instruction to be discounted for the purpose of reporting. We would also require there to be a procedure in place for minimisation of emissions in the case of a black start event and for reporting in the event of a black start. This modelling and the procedures have not been agreed in advance of the issue of the permit review and therefore a condition linking back to an improvement condition has been included in the permit.
Tables S1.1 and S1.2	Removed reference to petcoke and PFO as they are no longer used.
Table S2.2	Updated to refer to Industrial Emissions Directive which supersedes the Large Combustion Plant and Waste Incineration Directives.

10 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 been made. We have accepted the claim for confidentiality. See Section 2 of this document. The decision was taken in accordance with our guidance on confidentiality.
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential. The decision was taken in accordance with our guidance on confidentiality.
Consultation/Engagement	
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.

Aspect considered	Decision
Changes to the permit conditions due to an Environment Agency initiated variation	We have varied the permit as stated in the variation notice.
Improvement programme	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 compliance with the relevant BAT Conclusions. This is described in the relevant sections of this document. We have also removed the completed improvement conditions from the permit.
Emission limits	We have decided that emission limits should be set for the parameters listed in the permit. These are described in the relevant BAT Conclusions in Sections 5.1, 6, 7 and 8 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 Sections 6 and 8 of this document. Table S3.4 Process monitoring requirements was amended to include the requirement to monitor energy efficiency after overhauls on site in line with BAT Conclusion 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 monitored parameters. These are described in the relevant BAT Conclusions in Section 6 of this document.
Operator competence	
Management system	There is no known reason to consider that the Operator will not have the management system to enable it to comply with the permit conditions.
Growth Duty	
Section 108 Deregulation Act 2015 – Growth duty	We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit. Paragraph 1.3 of the guidance says: "The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number

Aspect considered	Decision
	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.

Annex 1: Improvement Conditions

Based on the information in the Operators Regulation 61 Notice responses and our own records of the capability and performance of the installation at this site, we consider that we need to set improvement conditions so that the outcome of the techniques detailed in the BAT Conclusions are achieved by the installation. These additional improvement conditions are set out below - justifications for them are provided at the relevant section of the decision document.

Table S1.3 Improvement programme requirements		
Reference Note 1	**Requirement**	**Date**
IC19	The operator shall provide a written report on operation of the SCR systems on each boiler. In particular, the report shall quantify: a. the NOx abatement performance of the SCR plant in mg/Nm^3 of NO_2; b. the extent of any ammonia slippage in mg/Nm_3 of NH_3 c. any impact of the operation of the SCR system on overall station energy efficiency.	31/07/2021
IC21	Following completion of IC19 the Operator shall submit a report in writing to the Environment Agency for acceptance. The report shall define and provide a written justification of the “minimum start up load” and “minimum shut-down load”, for each unit within the LCP as required by the Implementing Decision 2012/249/EU in terms of: i. The output load (i.e. electricity, heat or power generated) (MW); and ii. This output load as a percentage of the rated thermal output of the combustion plant (%). And / Or iii. At least three criteria (operational parameters and / or discrete processes as detailed in the Annex) or equivalent operational parameters that suit the technical characteristics of the plant, which can be met at the end of start-up or start of shut-down as detailed in Article (9) 2012/249/EU.	31/07/2021

IC22	BAT Conclusion 4 The operator shall submit a report demonstrating sufficient stability of emissions of mercury and halogen compounds (chlorine and fluorine compounds) in accordance with the latest agreed version of the Protocol for LCP BREF Compliance with trace species monitoring requirements at coal fired power plant.	31/03/2021
IC23	Black start operations A written report shall be submitted to the Environment Agency for approval. The report shall contain an impact assessment demonstrating that there is no significant environmental risk associated with black start operations and propose a methodology for minimisation of environmental impact during such a period of operation and for reporting instances of black start operation. The plant shall be operated as set out in condition 2.3.8 of the permit once the report has been approved by the Environment Agency. The methodology for operation and reporting set out in the report shall be implemented by the Operator from the date of approval by the Environment Agency.	12 months from variation issue
Note 1: All completed ICs 1 to 18 and 20 have been removed with numbering retained for ease of future reference.		

Annex 2: Advertising and Consultation on the draft decision

This section reports on the outcome of the public consultation on our draft decision carried out between 03 June 2020 and 01 July 2020.

We did not receive any comments from statutory/non-statutory bodies, other organisations or members of the public during our draft consultation.

At the request of the Operator, we made the following minor amendments:

- Table S1.2 Refers to additional information on monitoring of total suspended solid emissions to water from flue-gas treatment compliance and operating techniques in response to BAT5 & BAT15.
- Note 5 to Table S3.2b removed following confirmation that monitoring method aligns with EN 872
- Table S3.2 Monitoring method for Sulphite is to be agreed (Note 4)