Environment Agency

Review of an Environmental Permit under the Environmental Permitting (England & Wales) Regulations 2010 (as amended)

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

The Permit number is: EPR/MP3235LY
The Operator is: Centrica SHB Limited
The Installation is: South Humber Bank Power Station
This Variation Notice number is: EPR/MP3235LY/V005

What this document is about

All Environmental permits which permit the operation of large combustion plant (LCP), as defined by articles 28 and 29 of the Industrial Emissions Directive(IED), need to be varied to implement the special provisions for LCP given in the IED, by the 1 January 2016 (Article 82(3)). The IED makes special provisions for LCP under Chapter III, introducing new Emission Limit Values (ELVs) applicable to LCP, referred to in Article 30(2) and set out in Annex V.

The IED provides a period of transition towards the new ELVs via Article 32, the Transitional National Plan (TNP). It also makes provision for plant that wish to be exempted from compliance with the new ELVs in Article 33, the Limited Life Derogation (LLD). Other derogations include limited operating hour regimes for sites using 500 hr or 1500 hr derogations. There are also options for exemption from emission limits based on operating hours.

The operator has submitted responses to our notice requiring information, issued under regulation 60(1) of the Environmental Permitting Regulations (EPR), which has provided us with information on which compliance route they wish to follow for each LCP. The responses also include specific details relating to each LCP, necessary for accurate implementation the IED requirements. A copy of the regulation 60 notice and the operator's response is available on the public register.

We have reviewed the permit for this installation, including all variations since the last permit consolidation, and referred to the operator's responses to the regulation 60 notice requiring information. This is our decision document, which explains the reasoning for the consolidated variation notice that we have issued.

It explains how we have reviewed and considered the compliance routes and, where relevant, the emissions limits proposed by the Operator for each LCP on the installation. This review has been undertaken with reference to the:

- Chapter III and annex V of the IED
- "IED BAT ESI Review Paper, 28 October 2014" produced by the Environment Agency (referred to as the "2014 ESI BAT review paper" in this document)
- "Electricity Supply Industry – IED compliance protocol for Utility Boilers and Gas Turbines", published by the Joint Environmental Programme.

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

As well as implementing the chapter III IED compliance 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 issue. 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 deleted 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 chapter III review.

How this document is structured

Glossary

1. Our decision
2. How we reached our decision
3. The legal framework
4. Key Issues

GLOSSARY

Baseload	means: (i) as a mode of operation, operating for >4000hrs per annum; and (ii) as a load, the maximum load under ISO conditions that can be sustained continuously, i.e. maximum continuous rating
BAT	best available techniques
BREF	best available techniques reference document
CCGT	combined cycle gas turbine
Derogation	as set out in Article 15(4) of the IED
ELV	emission limit value set out in either IED or LCPD
GT	gas turbine
IED	Industrial Emissions Directive 2010/75/EC
LCP	large combustion plant – combustion plant subject to Chapter III of IED
MCR	Maximum Continuous Rating
MSUL/MSDL	Minimum start up load/minimum shut-down load
OCGT	Open Cycle Gas Turbine
Part load operation	operation during a 24 hr period that includes loads between MSUL/MSDL and maximum continuous rating (MCR)
TNP	Transitional National Plan

1 Our decision

We have decided to issue the Variation Notice to the Operator. This will allow it to continue to operate the Installation, subject to the conditions in the Consolidated Variation Notice.

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

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

2 How we reached our decision

2.1 Requesting information relating to the requirements of Chapter III of and Annex V to the IED

We issued a Notice under Regulation 60(1) of the Environmental Permitting (England and Wales) Regulations 2010 (a Regulation 60 Notice) on 31/10/14 requiring the Operator to provide information for each LCP they operate, including:

- The type of plant, size and configuration.
- The proposed compliance route.
- Minimum start up and shut down loads.
- The proposed emission limits and how they accord with the 2014 BAT review paper.
- For gas turbines, proposed emission limits for each unit between the MSUL/MSDL and 70% load, with a justification.

The Regulation 60 Notice response from the Operator was received on 31/03/15.

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 determination.

The Operator made no claim for commercial confidentiality. We have not received any information in relation to the Regulation 60 Notice response that appears to be confidential in relation to any party.

2.2 Requests for Further Information during determination

Although we were able to consider the Regulation 60 Notice response generally satisfactory at receipt, we did in fact need more information in order to complete our permit review assessment, and issued a further information request on 20/10/15. A copy of the further information requests was placed on our public register.

3 The legal framework

The Consolidated Variation Notice will be issued under Regulations 18 and 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, in issuing the Consolidated Variation Notice, it 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.

Meeting the requirements of the IED

The table below shows how each requirement of the IED has been addressed by the permit conditions.

IED Article Reference	IED requirement	Permit condition
30(6)	If there is an interruption in the supply of gas, an alternative fuel may be used and the permit emission limits deferred for a period of up to 10 days, except where there is an overriding need to maintain energy supplies. The EA shall be notified immediately.	Not applicable
32(4)	For installations that have applied to derogate from the IED Annex V emission limits by means of the transitional national plan, the monitoring and reporting requirements set by UK Government shall be complied with.	3.1.3 Schedule 3, Table S3.4
33(1)b	For installations that have applied to derogate from the IED Annex V emission limits by means of the Limited Life Derogation, the operator shall submit annually a record of the number of operating hours since 1 January 2016;	Not applicable
37	Provisions for malfunction and breakdown of abatement equipment including notifying the EA.	Not applicable
38	Monitoring of air emissions in accordance with Ann V Pt 3	3.5, 3.6
40	Multi-fuel firing	Not applicable
41(a)	Determination of start-up and shut-down periods	2.3.6 Schedule 1 Table S1.5
Ann V Pt 1(1)	All emission limit values shall be calculated at a temperature of 273,15 K, a pressure of 101,3 kPa and after correction for the water vapour content of the waste gases and at a standardised O2 content of 6 % for solid fuels, 3 % for combustion plants, other than gas turbines and gas engines using liquid and gaseous fuels and 15 % for gas turbines and gas engines.	Schedule 6, Interpretation
Ann V Pt 1	Emission limit values	3.1.2 Schedule 3, Table S3.1
Ann V Pt 1	For plants operating less than 500 hours per year, record the used operating hours	Not applicable
Ann V Pt 1(6(1))	Definition of natural gas	Schedule 6, Interpretation
Ann V Pt 2	Emission limit values	3.1.2 Schedule 3, Table S3.1
AnnV Pt 3(1)	Continuous monitoring for >100MWth for specified substances	3.5, 3.6 Schedule 3, Table S3.1
AnnV Pt 3(2, 3, 5)	Monitoring derogations	3.5.1 Schedule 3, Table S3.1

IED Article Reference	IED requirement	Permit condition
AnnV Pt3(4)	Measurement of total mercury	Not applicable
AnnV Pt3(6)	EA informed of significant changes in fuel type or in mode of operation so can check Pt3 (1-4) still apply	2.3.1 Schedule 1, Table S1.2
AnnV Pt3(7)	Monitoring requirements	3.5.1 Schedule 3, Table S3.1
AnnV Part 3(8,9,10)	Monitoring methods	3.5, 3.6
AnnV Pt 4	Monthly, daily, 95%ile hourly emission limit value compliance	3.5.1 Schedule 3, Table S3.1
AnnV Pt7	Refinery multi-fuel firing SO_2 derogation	Not applicable

4. Key Issues

Unless the decision document specifies otherwise we have accepted the applicant's proposals.

Where relevant and appropriate, we have incorporated the techniques described by the Operator in their Regulation 60 Notice response as specific operating techniques required by the permit, through their inclusion in Table S1.2 of the Consolidated Variation Notice.

The variation notice uses updated LCP numbers in accordance with the most recent DEFRA LCP reference numbers. The LCP references have changed as follows:

- **LCP 114** is changed to **LCP 49**
- **LCP 115** is changed to **LCP 50**
- **LCP 116** is changed to **LCP 51**

LCP49

This LCP consists of a 491 MWth CCGT which vents via a single windshield at emission point A1. The unit burns natural gas.

LCP50

This LCP consists of two CCGT's of 982MWth which vent via a single windshield at emission point A2. The units burn natural gas.

LCP51

This LCP consists of two CCGT's of 982MWth which vent via a single windshield at emission point A3. The units burn natural gas.

LCP 49/50/51

Compliance Route:

The operator has proposed to operate all of the LCP's under the TNP compliance route.

For plant operating under the TNP, ELVs are set which have been derived for the period 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 operator will apply, at the appropriate time, to vary the permit again to reflect this.

The operator's current proposals to achieve the stricter ELVs by 30 June 2020, are to comply with the Emission Limit Values that apply under Annex V, through the application of the necessary pollution abatement techniques, in particular new burner technology. This information is not in any way binding upon the operator and may change.

Net Rated Thermal Input:

The Applicant has stated that the Net Thermal Input is

LCP49 (GT13)	491MWth
LCP50 (GT11/12)	982MWth
LCP51 (GT/21/22)	982MWth

They have justified this figure based on official performance tests dated 14/05/12/ and 18/06/14 performed by Alstom. The tests were performed to Alstom performance test procedure and ISO 2314 – gas turbine acceptance tests. We accept this justification.

Minimum start up load and Minimum shut-down load:

GT11, GT12 & GT13

The Operator has defined the "minimum start up load" and "minimum shut-down load" for the LCP in their response to question 6 of the Reg 60, in terms of the output load and percentage of the rated output. This is based on the rated electrical output from just the gas turbine.

The operator has justified their stated figures by providing a description of the start up and shut down operation and graph profile for GT13. Similar performance is also achieved for GT11 and GT12.

The proposed minimum load is based on the lowest stable operation limits achievable with the current Gas Turbines. During start up the phase 1 machines follow a start profile designed to minimise thermal shock to the components whilst bringing the GTs up above the minimum load quickly. As the gas control valves (3 off) change over from the pilot mode to premix mode there is a rapid drop in NO_x and CO levels. The profile provided illustrates a typical start up for GT13. This shows that MSUL corresponds to 104 MW load level. Similar performance is also achieved for GT11 and GT12.

GT21 and GT22

The operator has justified their stated figures by providing a description of the start up and shut down operation and graph profile for GT21.

The Phase 2 Gas Turbines now have a low load functionality, once this is activated the Variable Inlet Guide Vanes (VIGVs) switch from one operating concept to another (-45^{o} curve to a -32^{o} curve).While the machine starts up on the -45^{o} curve the NOx levels are elevated. Once the low load release point is reached the VIGVs close and the NO_x /CO levels drop dramatically, as shown in Figure 3 below which illustrates a typical start up for GT21. The low load point corresponds to the MSUL and is similar for both GT21 and GT22. The low load release is automatically achieved using 3 parameters:

- Steam Turbine release is Circuit breaker closed & stress < 60%
- GT release is given with -32 & -45 curve fuel ratio balanced.
- Relative power > 45%

All of these criteria need to be met for automatic release of the VIGVs for low load operation. This equates to a gas turbine load of between 75 and 85 MW depending on the steam turbine and to a lesser extent ambient temperature. Note the ramp rate is typically of the order of 12 MW/minute and hence the selection of 85 MW as the threshold is consistent with the implementing decision requirements for the minimum load compatible with stable generation.

On shutdown, the reverse of the low load release is not applied and instead the MSDL is governed by the steam turbine. As the load is reduced below the MSDL point, combustion instability occurs which results in a rapid transient increase in NO_x and CO levels. Similar performance is also achieved for GT22.

We agree with all of these definitions and have set these thresholds in table S1.5 of the permit accordingly. Standard permit condition 2.3.6 has been set to define the period of start up and shut down, referring to the thresholds in this table.

Emission limits:

The operator has reviewed the current emission performance for the site and has concluded that separate ELV's for operation between MSUL/MSDL are not required. The ELV's are considered to be suitable to encompass the variation in emissions at lower loads.

The operator has proposed limits in line with annex V of the IED and the 2014 BAT review paper.

Parameter	Existing mg/m3	Reference Period	Annex V mg/m3	New Permit limit mg/m3
NO_x	None	95%ile of hourly averages	100	140
	80	24 hourly averages	55	75
	None	Monthly averages	50	70

NOx – all LCPs
Only the daily average period was reflected in the previous permit . The emission data for 2014 has been reviewed with the new definitions of start up and shut down incorporated. The maximum and 95th percentile data have been calculated and are shown in the table below. This data has been used as the basis of the proposals shown above which represents a tightening from the existing daily average limit (80 mg/m3). The ELVs are consistent for all the units for management and control purposes. All remaining ELVs have been set in line with Annex V ratios and in accordance with the methodology set out on page 11 of the IED BAT ESI Review paper.

NO_x Maximum daily average in 2014				
GT11	GT12	GT13	GT21	GT22
52	54	56	55	79
NO_x 95th Percentile Daily Average in 2014				
GT11	GT12	GT13	GT21	GT22
43	36	44	46	55

Note: the above data is based on validated hourly average data in line with IED Annex V requirements and at standard reference conditions.

CO all LCP's

Only the daily average was reflected in the previous permit. This ELV (100mg/m^3) remains unchanged from the previous permit in accordance with the "no backsliding" requirement. All remaining ELV's have been set in line

with Annex V in accordance with the methodology of the IED BAT ESI Review Paper.

Consequently we have accepted the proposed limits and incorporated them into table 3.1 of the permit.

Auxiliary boiler

A gas oil fired auxiliary boiler(42MWth) provides steam during start-up of the first module following a complete shutdown. The operation is limited to 500 hours per year operation. The previous monitoring requirements and emission limits have been retained as per “no backsliding “ requirement.

Gas fired plant:

Sulphur dioxide emissions from natural gas firing of gas turbines and boilers will be reported as six monthly concentrations on the basis of the fuel sulphur content without continuous or periodic monitoring since only trace quantities of sulphur are present in UK natural gas. Dust emissions for natural gas fired boilers will, likewise, be reported on the basis of emission factors without continuous or periodic monitoring. For gas turbines we have not required any reporting as the dust emissions will always be reported as zero. This is because natural gas is an ash-free fuel and high efficiency combustion in the gas turbine does not generate additional particulate matter. The fuel gas is always filtered and, in the case of gas turbines, the inlet air is also filtered resulting in a lower dust concentration in the flue than in the surrounding air.

Reporting efficiency:

In order to ensure the efficiency of plant using fossil fuels or biomass is maximised and regularly recorded, condition 1.2.1(c), condition 4.2.2(b) and table S4.2 have been added to the permit.

Monitoring & standards:

Standards for assessment of the monitoring location and for measurement of oxygen, water vapour, temperature and pressure have been added to the permit template for clarity.

A row has been included in table S3.1 which requires the operator to confirm compliance with BS EN 15259 in respect of monitoring location and stack gas velocity profile in the event there is a significant operational change (such as a change of fuel type) to the LCP.

Resource efficiency metrics:

A more comprehensive suite of reporting metrics has been added to the permit template for ESI plant. Table S4.2 “Resource Efficiency Metrics” has

been added requiring the reporting of various resource parameters, as this is an Electrical Supply Industry (ESI) power plant. This table is being used for all ESI plant.

Additional IED Chapter II requirements:

Condition 3.1.6 relating to protection of soil, groundwater and groundwater monitoring, has been added in compliance with IED requirements. Conditions 4.3.1 and 4.3.2 relating to notifications have been amended in compliance with IED requirements.