

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/HP3038LA
The Operator is: Third Energy UK Gas Limited
The Installation is: Knapton Generation Station
This Variation Notice number is: EPR/HP3038LA/V004

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 notices 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 their LCP. The responses also include specific details relating to the 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 notices 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 the 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. 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 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

Annex 1 – ELV calculation methodology.

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
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
LCPD	Large Combustion Plant Directive 2001/80/EC
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)

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 that concern the operation of the non-LCP part of the installation 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 31/10/15 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.
- Any request to move from continuous to 6 monthly monitoring, or to derogate from 6 monthly monitoring, with a justification.

The Regulation 60 Notice response from the Operator was received on 30/3/15.

We considered that the response did not contain sufficient information for us to commence determination of the permit review. We therefore issued a further information requests to the Operator on 15/5/15 and 28/5/15. Suitable further information was provided by the Operator to these requests on 16/6/15.

We considered it was in the correct form and contained sufficient information for us to begin our determination of the permit review.

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.

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.	Not applicable
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	2.3.5 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	Not applicable

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 SO2 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 an updated LCP number in accordance with the most recent DEFRA LCP reference numbers. The LCP references have changed as follows:

- **LCP 418** is changed to **LCP 376**

LCP 376

This LCP consists of 1 x 110 MWth OCGT which vents via a single windshield at emission point A1.

The unit burns sour gas (natural gas containing approx 0.1% by volume of Sulphur compounds, mostly H₂S with some mercaptans) the gas typically contains more than 92% methane and is thus defined as Natural Gas under the description of Natural Gas in the IED although for clarity it is referred to as sour gas in the permit and this document.

The sour gas is recovered from local gas fields and delivered to the installation by a designated pipeline, the rate of gas arrivals is such that the delivery pipe work is allowed to pressurise to store a suitable quantity of gas to allow the OCGT to run for a reasonable period, this results in periodic running of the OCGT and relatively low plant utilisation rates, typical run rates have been in the order of 1200 hours in recent years. The operator hopes to improve the gas supply and is in the process of applying to frack the Gas reserves to increase the flow and supply of gas for the OCGT.

Compliance Route:

The operator has proposed to operate this LCP under the ELV compliance route.

Net Rated Thermal Input:

The Applicant stated in their last response dated 16/6/15 to request for information that the Net Thermal Input was 110 MWth, the operator supplied acceptance test certificates conducted in 1995 on 16/6/15 to support this figure.

The acceptance test certificate conducted on 24/1/95 stated and supplied by the operator in their response for additional information on 16/6/15 stated that the net electrical output was 42.38 mWe, the acceptance test certificate did not contain any data relating to thermal input or plant efficiencies which would have enabled the input to be calculated.

The 2014 annual report submitted by Third Energy on 21/1/15 stated that the total energy input to output ratio was 3.57 i.e. an efficiency of 28.01%, the annual report also contained the total sour gas usage as 355,487 GJ and the total energy output as 28.0271 GWhrs this being equivalent to an efficiency of 28.38%

If an efficiency of 28.2% is taken (the average of the derived efficiencies taken from the 2014 report) then the thermal input based on the acceptance test would be 150.3 MWth.

This casts some doubt on the quoted nett thermal input figure of 110 MWth.

To arrive at a validated thermal input figure, improvement condition IC12 has been set in the permit.

Minimum start up load and Minimum shut-down load:

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 this output load as a percentage of the rated output of the combustion plant (%)

The operator has quoted

Start- up at 16MW and 38.5% load equivalent to a full load of 41.55MW

And

Shutdown at 12MW and 30% load equivalent to a full load of 40.00MW

The operator has supplied trends of emissions which show these MW positions to be appropriate points to define start-up and shutdown, however it can be seen that the load % quoted is inconsistent, to rectify this a full load of 42.38 mWe has been used (taken from the acceptance test certificates supplied by the operator on 16/6/15) to calculate the load % stated in table S1.5 of the permit.

To ensure the data entered in table S1.5 remains accurate after completion of IC12 a further improvement condition IC13 has been set to review the data using validated full load data for the data entered in table S1.5.

Emission limits:

NOx

The operator initially proposed to operate the LCP under the 1500 hour derogation this would have given the plant a NOx limit of 150 mg/m³ however under the no backsliding position adopted by the Environment Agency the operator would only have been given the existing permit limits (90 mg/m³).

The plant was first permitted on 11/09/07 and annex V of the IED states that the 1500 hour derogation is only available to plants that were permitted before 27/11/02; this option was thus not available for this LCP.

The operator subsequently proposed limits in line with annex V of the IED and the 2014 BAT review paper with ELV's being set for low load running in the periods from start-up to base load and from base load to shutdown that reflected the existing permit limits.

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

A summary of the existing and new permit limits is shown in the following table.

NOx ELV limits >70% load			
Existing mg/m3	Reference Period	Annex V mg/m3	New Permit limit mg/m3
None	95%ile of hourly averages	100	100
90 mg/m3	Daily mean	55	55
None	Monthly averages	50	50
NOx ELV for low load running for the periods from start-up to base load and from base load to shutdown			
Existing mg/m3	Reference Period	Annex V mg/m3	New Permit limit mg/m3
None	95%ile of hourly averages	None	160
90 mg/m3	Daily mean	None	90
None	Monthly averages	None	80

The methodology used to determine the limits is shown in appendix 1, two tables are shown; the first outlines the annex V ELV determination. The second shows the 1500 hour derogation calculation although not directly applicable as stated above this also includes the methodology and calculations to determine equivalent limits for ELVs set for all the reference periods used to set limits when the LCP will be in low load running mode as these are based on the existing permit limits.

Due to restricted gas supplies the plant only runs when the gas is available this results in relatively low running hours and to the plant running load is reduced to further conserve gas supplies.(recent years operation has typically been around 1200 hours / year).

In order to ensure BAT is considered for excessive running at low loads IC 15 has been set in the permit.

In order to ensure low load running at < 70% load is minimised IC 16 has been set in the permit.

CO

The CO limits have been set in line with annex V of the IED and the 2014 BAT review paper. We have also set the same limits for operating the plant from MSUL/MSDL to base load, as the plant will run at low load for significant periods.

SO2

The sulphur in the feed gas varies and is dependent upon the makeup volumes from the supply wells in the gas field and the sulphur removal efficiency of the gas conditioning plant. Sulphur dioxide emissions will

continue to be subject to continuous monitoring and the present permit limits will be retained.

Based on the maximum compressor flow and a typical gas content of 0.01% by volume of sulphur the SO₂ calculation is calculated to be 50mg/m³ and is typically near this level, existing permit levels of 100mg/m³ have been retained in this variation.

Dust

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.

The IED Annex V ELVs for oxides of nitrogen and carbon monoxide apply to OCGT gas turbines when the load is >70%. This has been interpreted as 70% of the rated output load. The rated output load used here is the same as that used for calculating the percentage load when specifying the end of start-up and beginning of shut-down. This is defined in table S1.5 of the permit, improvement conditions IC 12 and IC 13 have been set to validate the LCP maximum Nett load and when this is complete to check the accuracy of the data presented in table S1.5.

Energy efficiency:

The installation does not have CHP.

Reporting efficiency:

In order to ensure the efficiency of plant using fossil fuels 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.

Additional reporting requirements for low load running the environmental equivalent operating hours at 70% load, the operational hours at less than 70% load and the operational run time of the emergency ground flare have been added to aid compliance activities regarding appropriate operations on site.

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 3.1.4 relating to protection of soil, groundwater and groundwater monitoring, has been added in compliance with IED requirements.

Annex 1: Methodology used to calculate the ELVs

method

- 1 no backsliding so do not set limits > present permit unless justified by operator.
- 2 back calculate using present permit limits and annex v ELV ratios
- 3 do not set tighter than annex v limits unless site specific requirement
- 4 if present permit tighter than annex v set to annex v unless option 3 applies
- 5 under TNP or < 1500 hrs set to permit limit calcn , round down to sensible number

SOUR GAS APPROX 93% METHANE (data specified in application)
 THEREFORE COUNTS AS FIRED AS ON
 NATURAL GAS
 NATURAL GAS DEFINITION IN ANNEX V = > 80% METHANE
 thermal input
 110MW

OCGT	NOx Natural Gas				CO Natural Gas			
annex v limits	hourly	daily	yearly limit for all hourly averages as 95% ile	monthly	hourly	daily	yearly limit for all hourly averages as 95% ile	monthly
Annex V	100	55		50	200	110		100
% of annex v monthly	200%	110%		100%	200%	110%		100%
in present permit permit values by calc	not set	90	not set	not set	not set	not set	not set	not set
	163.6363636			81.8181818				
% of annex V	164%	164%		164%				
	annex V tighter than permit limits				no CO limits in present permit set to ANNEX V LIMITS			
	set to ANNEX V LIMITS				set to ANNEX V LIMITS			
proposed limits	100	55		50	200	110		100

NOTE

Operator requested Annex v limits at > 70% load and present permit limits from SU to 70% load and present permit limits for 70% to SD
 2014 annual submission states daily mean NOx at 71

i.e. plant is not capable of achieving annex v limits

operational hours approx 1200 hrs /year

request from operator is not acceptable as this would allow them to operate without time restrictions at < 70% load at the higher ELV

Clearly not the intention of the IED . So propose

a pre operational condition for operations in excess of 1500 hrs to demonstrate compliance with ELV annex v limits

This gives them the same limits as if they had applied for the < 1500 hr derogation and ensures the level playing field would be maintained as operations > 1500 hrs would have to meet annex v limits.

retain present permit SO2 limits

application S in gas feed calcs gives a calculated SO2 of 50 mg/m3

2014 annual returns reports SO2 average as 45 mg/m3 , max hourly recorded as 64mg/m3

IC3 was set to investigate Sulphur removal from gas feed and note made on permit that SO2 limit could potentially be reduced if S removal was instigated completed in 2009 but no progress since so retain SO2 limit as set in permit

For comparison the < 1500 hr derogation ELV calculation originally requested

method

- 1 No backsliding so do not set limits > present permit unless justified by operator.
- 2 back calculate using present permit limits and annex v ELV ratios
- 3 do not set tighter than annex v limits unless site specific requirement
- 4 if present permit tighter than annex v set to annex v unless option 3 applies
- 5 under TNP or < 1500 hrs set to permit limit calcn , round down to sensible number

SOUR GAS APPROX 93% METHANE (data specified in application)
 THEREFORE COUNTS AS FIRED AS ON NATURAL GAS
 NATURAL GAS DEFINITION IN ANNEX V = > 80% METHANE
 thermal input 110MW

OCGT	NOx Natural Gas				CO Natural Gas		
< 1500 HRS	hourly	daily	yearly limit for all hourly averages as 95% ile	monthly	hourly	daily	yearly limit for all hourly averages as ile
Annex V	300	165		150	not set	not set	not set
% of annex v monthly	200%	110%		100%	200%	110%	
in present permit permit values by calc	not set	90	not set	not set	not set	not set	not set
	163.636364			81.818182			
% of annex V	55%	55%		55%			
	Tighter than annex V set to permit limits						
proposed limits	160	90		80	DO NOT SET LIMITS AS PRESENT PERMIT AND ANNEX V		
	hourly at permit calc level rounded down to a sensible Number						
	daily at permit limits						
	monthly at permit calc level rounded down to a sensible Number						

NOTE

Operator requested Annex v limits at > 70% load
 and present permit limits from SU to 70% load
 and present permit limits for 70% to SD
 as permit limits are tighter than annex v in all periods set one ELV at permit limits to cover all valid periods

retain present permit SO2 limits

application S in gas feed calcs gives a calculated SO2 of 50 mg/m3

2014 annual returns reports SO2 average as 45 mg/m3 , max hourly recorded as 64mg/m3

IC3 was set to investigate Sulphur removal from gas feed and note made on permit that SO² limit could potentially be reduced if S removal was instigated completes in 2009 but no progress since so retain SO2 limit as set in permit