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/FP3031HJ
The Operator is: px Limited
The Installation is: Stallingborough Titanium Dioxide Site
This Variation Notice number is: EPR/FP3031HJ/V002

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 a response 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 response also includes 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 response 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 Non-ESI Review Paper, 28 October 2014" produced by the Environment Agency (referred to as the "2014 Non-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 avalable techniques reference document
CCGT	combined cycle gas turbine
Derogation	as set out in Article 15(4) of the IED
Emergency use	<500 operating hours per annum
ELV	emission limit value set out in either IED or LCPD
FD	forced draught
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)
TEG	turbine exhaust gas
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 17/12/14 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.
- 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 25/03/15.

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 request to the Operator. Suitable further information was provided by the Operator on 17/07/15.

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.

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 17/06/15. A copy of the further information request 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.	3.1.5 Schedule 3, Table S3.3
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.	2.3.6 4.2.5 4.3.1d
38	Monitoring of air emissions in accordance with Annex 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 S1.4
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	Schedule 4, Table S4.1
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	Not applicable
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	Not applicable
AnnV Pt3(7)	Monitoring requirements	Not applicable
AnnV Part 3(8,9,10)	Monitoring methods	3.5, 3.6
AnnV Pt 4	Monthly, daily, 95%ile hourly emission limit value compliance	Not applicable
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(s) in accordance with the most recent Department of Environment Food and Rural Affairs (DEFRA) LCP reference numbers. The LCP references have changed as follows:

- **LCP420** is changed to **LCP221**
- **LCP414 has been added**

LCP221 and LCP414

LCP221 and LCP414 both consist of 1 x 21.2MWth gas turbine (GT) with a 48.8MWth heat recovery steam generator (HRSG) LCP221 vents via 2 x stacks at emission points A1 (19.5m) and A2 (35m). LCP414 vents via 2 x stacks at emission points A3 (19.5m) and A4 (35m). The units burn natural gas only. The plants operate in three modes: OCGT during start-up, CCGT (GT and HRSG) and auxiliary fired force draft (FD) HRSG only. The site does not operate OCGT for any length of time other than during start-up or in the event of an HRSG trip leaving the GT in open cycle mode. Under the latter mode, the GT is shut down if the HRSG cannot be returned to service within 2 hours. Once the exhaust gas from the GT has been introduced to the HRSG the GT load is increased from 46% required for NOx abatement up to 100% base load within 15 minutes. Therefore, loads between 70% and 100% should only be considered as transient. The start-up of the HRSG is completed independently of the GT as per the design of the CHP. A permit condition has been introduced to report the frequency and duration of start-up, see Table S4.1.

Compliance Route:
The operator has proposed to operate these LCPs 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.

Net Rated Thermal Input:
The Applicant has stated that the Net Thermal Input is 21.2MWth for each GT and 48.8MWth for each HRSG. This makes a total of 70MWth for each LCP (140MWth for the site in total). They have justified these figures by referencing a European gas turbines certificate of works acceptance test and OEM tabulated data for the HRSG for various operating conditions both in the CCGTs and boiler only (FD) modes. Utilising these data from the GT performance test and the HRSG data sheets an IPSEpro model for maximum continuous rating in both CCGT and HRSG only mode was constructed. This commercial software reflects the current state of the LCPs following upgrade and optimisations since the original design. This data is traceable to international standards and available for audit by the Environment Agency.

Minimum start up load and Minimum shut-down load: Table S1.4.
The Operator has defined the "minimum start up load" and "minimum shut-down load" for the LCPs in their response to question 6 of the Reg 60, in terms of the output load and percentage of the rated output is based on the rated electrical output from the LCP Units and three criteria that suit the technical characteristics of the plants, which can be met at the end of start-up or start of shut-down. Start-up and shutdown are minimal as the CCGT provides steam and power to a large chemical installation on a continuous basis. The operator states that the GT is out of start-up when the outlet temperature is 990^{o}C with a shaft speed of 11,00rpm. At this point the GT is generating and synchronisation occurs at 3.3MWe.

HRSG in auxiliary mode: the boiler provides steam to the chemical installation at 400^{o}C and 42bar and an export load of 18t/hr. The MCR output is 60t/hr.

Start-up and shutdown procedures have been provided for the CCGT and HRSG. The MSUL/MSDL data is considered as being fit for purpose.

We agree with all of these definitions and have set these thresholds in table S1.4 of the permit accordingly. Standard permit condition 2.3.5 has been set to define the period of start up and shut down, referring to the thresholds in this table.

Table S1.4 Start-up and Shut-down thresholds		
Emission Point and Unit Reference	"Minimum Start-Up Load" Load in MW and as percent of rated power output (%) or steam flow rate in t/hr and as percent of rated thermal output (%) and when two of the criteria listed below for the LCP or unit have been met.	"Minimum Shut-Down Load" Load in MW and as percent of rated power output (%) or steam flow rate in t/hr and as percent of rated thermal output (%) and when two of the criteria listed below for the LCP or unit have been met.
A1:OCGT(No.1) A3:OCGT(No.2)	At 3.3MWe; 50% load at GT outlet temperature 990^{o}C and GT shaft speed 11,000rpm or above	Less than 3.3MWe, 50% load at GT outlet temperature 990^{o}C and GT shaft speed 11,000rpm

Table S1.4 Start-up and Shut-down thresholds		
Emission Point and Unit Reference	"Minimum Start-Up Load" Load in MW and as percent of rated power output (%) or steam flow rate in t/hr and as percent of rated thermal output (%) and when two of the criteria listed below for the LCP or unit have been met.	"Minimum Shut-Down Load" Load in MW and as percent of rated power output (%) or steam flow rate in t/hr and as percent of rated thermal output (%) and when two of the criteria listed below for the LCP or unit have been met.
A2: LCP221 (GT/HRSG No.1) in supplementary mode A4:LCP414 (GT/HRSG No.2) in supplementary mode	At 6.6MWe; 100% load at GT outlet temperature 1059^{o}C and GT shaft speed 11,000rpm or above	Below 3.3MWe; 50% load at GT outlet temperature 990^{o}C and GT shaft speed 11,000rpm
A2: LCP221 (HRSG No.1) in auxiliary mode A4:LCP414 (HRSG No.2) in auxiliary mode)	At 18t/hr steam; 30% load at 42bar and temperature 400^{o}C or above	Below 18t/hr steam; 30% load at 42bar and 400^{o}C flame switched off

Emission limits:

The operator proposed limits in line with Annex V of the IED and the 2014 BAT review paper for the TNP compliance route.

The IED in Annex V Part 4 section 1 requires that each series of periodic measurements shall comply with the ELVs set out in the relevant section of Annex V. Three different ELVs are detailed, each with a different time basis (hourly, daily and monthly). Periodic monitoring is undertaken over a limited time period which may range from 30 minutes to a number of hours depending on the applicable monitoring standard. We believe the most appropriate short term ELV is the daily average value because periodic monitoring is used to demonstrate compliance.

The sampling period will reflect that specified in the relevant CEN standard or that in relevant guidance. The monitoring results should be expressed as an average over the sampling period corrected to the relevant reference conditions.

There shall be no subtraction of any sampling uncertainty from the reported result. However, the sampling uncertainty of the reference monitoring method will be taken into account when assessing compliance. The limit value is set

as an absolute ELV with no percentile allowances (100% compliance basis over the sampling period).

In general the principle is the ELV applies across the windshield. However, it is acknowledged where a windshield contains combustion gases from different combustion units (GT alone, GT/HRSG CCGT, HRSG FD fired) setting a dynamic ELV (one that changes according to which units are in operation at any one time) across the windshield to account for different modes of operation is not always practical. It is therefore considered BAT to set the ELV relevant to each type of operating mode. By definition, as each mode is compliant with its own ELV, the windshield will be compliant with any ELV calculated across it.

The operator has not applied for site specific ELVs to cover the load range from MSUL/MSDL to 70% ISO base load. Once the exhaust from the GT has been introduced to the HRSG the GT turbine load is increased from 46% required for NOx abatement up to 100% full load within 15 minutes and as such, loads between 70% and 100% are regarded as transient. Therefore, the ELVs apply over all load ranges from MSUL/MSDL to 100% ISO base load.

OCGT mode of operation:

The operator is currently limited to operating the GT in open mode during start-up only (applicable to release points A1 and A3 GT bypass stacks).

However, there are occasions when the GT needs to operate open cycle outside of start-up. These operations are limited in Table S3.1 to less than 500 hours per annum. IED Annex V Part 1 (6) general condition GT's for emergency use. (Note. GT thermal input is 21.2MWth). There are no ELVs associated with emission points A1 and A3. However, 6 monthly reporting of NOx, SO_2 and CO concentration values are required.

CCGT mode of operation:

The operator requested the ELV for NOx be increased to 150mg/m^3 but failed to provide any BAT justification. Therefore, the current limit of 125mg/m^3 has been retained. In their response to the Regulation 60 Notice, they also proposed an ELV of 500mg/m^3 for CO, referenced to 15% oxygen. Again, they failed to provide any BAT justification. The current permit does not have a limit for CO. As the operator has opted for the TNP compliance route, we have set a limit in compliance with Annex V IED of 100mg/m^3 referenced to 15% oxygen.

HRSG FD mode of operation:

The operator requested the ELV for NOx to be set at 150mg/m^3, this is a significant improvement of the existing ELV at 350mg/m^3. However, it is not clear at what oxygen reference this was set. Therefore, the limit of 150mg/m^3 at 3% oxygen has been set in line with the 2014 BAT review paper (frequently

asked questions). In their response to the Regulation 60 Notice, they also proposed an ELV of 1000mg/m^3 for CO, referenced to 15% oxygen. Again, they failed to provide any BAT justification. The current permit does not have a limit for CO. As the operator has opted for the TNP compliance route, we have set a limit in compliance with Annex V IED of 100mg/m^3 referenced to 3% oxygen.

LCP221 and LCP414
Release point A1 and A3 GT open cycle:

Parameter mg/m^3	Current limit	Annex V IED	Regulation 60 response	New Permit limit mg/m^3
NO_x	None	<500 hrs	None	<500 hrs
CO	None	<500 hrs	None	<500 hrs

LCP221 and LCP414
Release point A2 and A4 GT/HRSG combined cycle:

Parameter mg/m^3	Current limit	Annex V IED	Regulation 60 response	New Permit limit mg/m^3
NO_x	125mg/m^3	TNP	150mgm^3	125mg/m^3
CO	None	100mg/m^3	500mg/m^3	100mg/m^3

LCP221 and LCP414
Release point A2 and A4 HRSG FD mode:

Parameter mg/m3	Current limit	Annex V IED	Regulation 60 response	New Permit limit mg/m^3
NO_x	350mg/m^3	TNP	150mgm^3	150mg/m^3
CO	None	100mg/m^3	1000mg/m^3	100mg/m^3

Sulphur dioxide emissions from natural gas firing will be reported 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. Likewise, dust emissions from natural gas firing will be reported on the basis of emission factors without continuous or periodic monitoring. Natural gas is an ash-free fuel and high efficiency combustion does not generate additional dust. 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.

Note: For a GT with a supplementary fired (SF) heat recovery steam generator (HRSG), ELVs apply to the different modes of firing as follows:

a) GT only;

- Gas turbines for emergency use operating for less than 500 hours per year are not covered by ELVs. The operating hours shall be recorded as detailed in the revised permit.

- For operation greater than 500hrs/year, the GT ELVs apply at 15% Oxygen reference conditions.

b) HRSG only (forced draught)

- Under emergency (abnormal) conditions, where the GT is taken off-line and where the Operator has a credible plan to recover operation of the GT, the Oxygen reference condition is 15%. A permit condition has been included to monitor performance of this mode of operation, see Table S4.1.

- It is not BAT to operate the HRSG in auxiliary mode other than in an emergency. For these situations the Oxygen reference condition is 3%.

Energy efficiency:

The installation operates as a CHP. In line with the DEFRA Part A guidance, to report on the scope for further improvement, a condition has been included for the operator to carry out a 4-yearly efficiency review.

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.

Notifications:
Schedule 5, Part C, takes account of the malfunction and breakdown requirements. A breach of permit condition is NOT implicit in notification under Part C.

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.

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

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.

Annex 1: Review and assessment of changes that are not part of the Chapter III IED derived permit review.

The pH limit (5 – 10) in the current permit, was removed following a request by the operator. This decision was recorded in CAR form A/091127/PP3132SQ which is available on our public register. The operator is required to maintain records of the quality of effluent transferred from his process to the Cristal Pigment UK Limited effluent system. These records shall be made available for inspection on request. The opportunity was taken in this review to remove the limit from the emission to water table as follows:

Table S3.2 Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Emission point ref. & location	Parameter	Source	Limit (incl. unit)	Reference period	Monitoring frequency	Monitoring standard or method
W1 discharge from 8 tonne drain sump tank (reference W2 in application) to Cristal Pigment UK Limited effluent flume.	pH	Boiler feed-water treatment effluent, boiler blow-down waters, condensate drainage and washings from turbine blade cleaning	Note 1.	Continuous	Weekly	BS EN 6068-2.50
W1 discharge from 8 tonne drain sump tank (reference W2 in application) to Cristal Pigment UK Limited effluent flume.	Oil or grease	Boiler feed-water treatment effluent, boiler blow-down waters, condensate drainage and washings from turbine blade cleaning	No visible emission	24 hour period beginning 00.01	Daily	-

Note 1: Records of effluent pH sent to Cristal Pigment UK Limited shall be retained and available for inspection.