

## 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/MP3530HZ

The Operator is: T & L Sugars Limited

The Installation is: T & L Silvertown

This Variation Notice number is: EPR/MP3530HZ/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 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 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 responses to the regulation 60 notices requiring information. This is our decision document, which explains the reasoning for the 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
- “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 variation notice corrects minor mistakes from previous variations that relate to the original permit issue.

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

## 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
Emergency use	<500 operating hours per annum
ELV	emission limit value set out in either IED or LCPD
ESI	electricity supply industries
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
LLD	Limited Life Derogation
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)
WHB	Waste Heat Boiler
LHD	Limited Hours Derogation

## 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 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 Variation Notice contains several 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 31/10/14 requiring the Operator to provide information for each LCP they operate, including:

- The type of plant, size and configuration.
- The proposed compliance routes
- Minimum start up and shut down loads.
- The proposed emission limits and how they accord with the 2014 BAT review paper.
- For higher efficiency gas turbines where they wish to apply for the NO<sub>x</sub> emission derogation, the energy efficiency details of the LCP.
- For gas turbines, proposed emission limits for each unit between the MSUL/MSDL and 70% load, with a justification.
- For gas fired plant, whether they wish to apply for derogation from monitoring when on standby fuels.
- 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 31/03/15.

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 04/06/15. Some additional information was provided clarifying and updating the original Reg 60 responses via emails.

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 Alternative compliance routes**

In their Regulation 60 Notice response the operator applied for Annex V ELVs for the significant majority of the plant (Boilers and CCGT). However the operator initially requested multiple compliance routes to be considered for their LCP when operating in the OCGT mode because at that point they were not aware of applicability or acceptability of the proposed options. The routes requested for the OCGT were: LHD, 500 emergency hours and Annex V ELVs. Subsequently LHD was deemed not applicable and this was withdrawn.

### 3 The legal framework

The 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 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.

### 3.1 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.	ELVs for gas oil included in table 2.2.2. Included condition 2.2.1.6 for more than 10 days
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 Annex V Part 3	2.10.11.6 and 2.10.11.7
40	Multi-fuel firing	Not applicable
41(a)	Determination of start-up and shut-down periods	2.1.5 Table 2.1.13
Annex V Part 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 O <sub>2</sub> 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.	6 Interpretation, and 6.1.3.3 & 6.1.3.4.
Annex V Part 1	Emission limit values	2.2.1.3 Table 2.2.2
Annex V Part 1	For plants operating less than 500 hours per year, record the used operating hours	2.3.7, 2.3.8, 4.2.2e
Annex V Part 1(6(1))	Definition of natural gas	6 Interpretation
Annex V Part 2	Emission limit values	2.2.1.3 Table 2.2.2
Annex V Part 3(1)	Continuous monitoring for >100MWth for specified substances	2.10.11.7

<b>IED Article Reference</b>	<b>IED requirement</b>	<b>Permit condition</b>
Annex V Part 3(2, 3, 5)	Monitoring derogations	2.2.1.3 Table 2.2.2
Annex V Pt3(4)	Measurement of total mercury	Not applicable
Annex V Pt3(6)	EA informed of significant changes in fuel type or in mode of operation	Not applicable
Annex V Pt3(7)	Monitoring requirements	2.10.11.6 and 2.10.11.7
Annex V Part 3(8,9,10)	Monitoring methods	2.10.11.6 and 2.10.11.7
Annex V Pt 4	Monthly, daily, 95%ile hourly emission limit value compliance	2.10.11.6 and 2.10.11.7
Annex V Pt7	Refinery multi-fuel firing SO <sub>2</sub> derogation	Not applicable

## 3.2 Background

The installation is an existing sugar refinery, including on-site power generation and a lime slaking plant in Silvertown, London. Electrical power and steam is generated via a combined heat and power (CHP) facility.

The sugar production activities fall under the EPR regs, 2010

Section 6.8 Part A (1) d) (ii) - Treating and processing materials intended for the production of food products from vegetable raw materials at a plant with a finished product production capacity of more than 300 tonnes per day (average value on a quarterly basis)

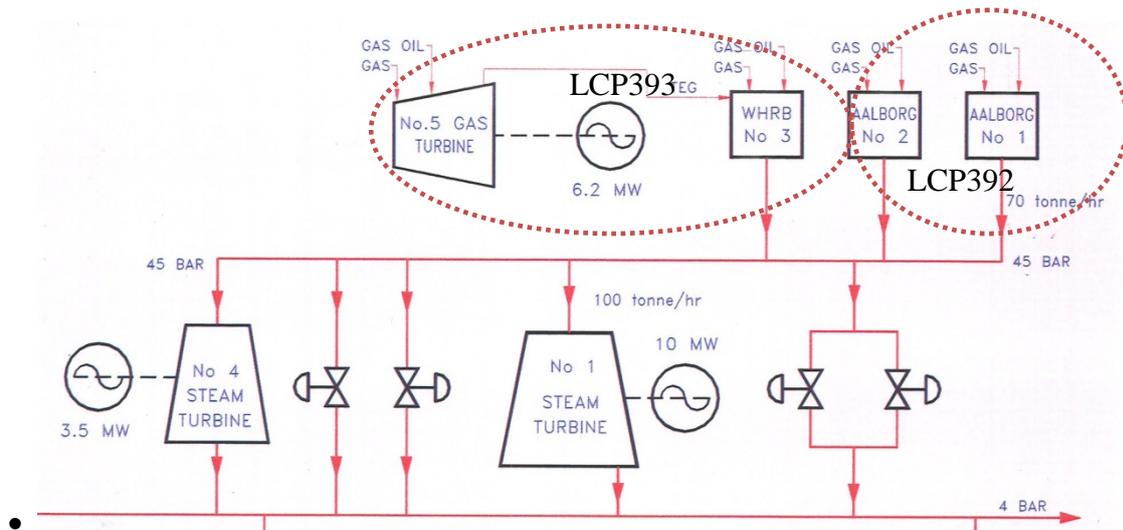
The site also operates as an installation carrying out the activity Section 1.1 Part A (1) (a): "Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more". This activity is the subject of this variation.

The installation is comprised of two large combustion plants (LCP) where the aggregated thermal input of the combustion activity exceeds 50 MWth going into a common stack. The stack, or windshield, may contain several flues from individual combustion plant.

The variation notice uses updated LCP numbers in accordance with the most recent DEFRA LCP reference numbers. It was identified that the original LCP determined for the site is actually two separate LCPs requiring individual reference numbers. The original LCP278 reference, referring to all the plant, has effectively changed as follows:

- **LCP278** reference is now voided
- **LCP392** referring solely to the Aalborg boilers from stack A1.
- **LCP393** referring solely to the gas turbine, waste heat boiler and biomass boilers all releasing from the stack A2 which includes flue A57. The OCGT mode is included under LCP393 but releases from A3 (which is a nearby to stack A2).

The Sugar plant steam and electrical CHP/CCGT arrangement:



As can be seen the site CHP as a whole comprises the two LCPs feeding into the steam turbines and the steam demand for the sugar plant.

**LCP393** (with emissions from flue A2) is for electrical power and steam generation within a CCGT CHP combined heat and power system comprising a gas fired gas turbine (GT), waste heat boiler (WHB) and steam turbines (ST). The gas turbine has been fitted with steam injection as a means to control NOx emissions to air; such steam injection can only operate during CCGT mode when steam is produced within the WHB or Aalborg boilers.

The 6 MWelec GT has a thermal input of 21 MWth and its heat & electrical production is integral to

- the warming cycle for the CHP, WHB and sugar plant steam lines after weekend shut downs.
- electricity production to power the site during the weekends (OCGT)
- balancing electrical load demands of the site during sugar production (i.e. electricity and steam demands tend to rise together as sugar production increases)

The WHB operates to provide the steam generation required for sugar production using

- the supplementary firing mode of up to 43MWth when the GT is running; this is done by adding more heat by burning extra natural gas with the WHB.
- auxiliary firing up to 57MWth, also called forced draft (FD) firing, when the GT is not operating. Thus FD is acting like a standalone boiler; this is usually in an emergency mode when the GT fails at short notice.

The site installed a set of four biomass boilers each 19 MWth (total 76 MWth) in 2011 as a replacement for the Aalborg boilers. These can only burn wheat husks. The biomass plant has not operated since being installed. The emission from the biomass plant is actually a separate flue notionally within

the LCP393 common windshield (which houses flue A2). Historically and within this variation the biomass emission flue is called A57.

**LCP392** is a pair of Aalborg package boilers each 60MWth (total 120MWth) releasing up stack A1. These have low NOx burners and will be provided with flue gas recirculation (FGR) to control NOx emissions to air in 2016. The Aalborgs boilers are primarily for steam production used within the sugar plant. They also produce steam for use by the steam turbines as part of the CHP.

Both LCP393 and LCP392 exceed an aggregated thermal input of 100 MWth. Under IED this requires that the emissions are monitored continuously using CEMs for NOx and CO.

**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 2.1.1 of the Variation Notice.

Standby Fuel Derogation for all gas fired plant:

The whole site has a back-up supply of gas oil fuel for both LCP392 and LCP393. This is primarily for standby operation and was assessed for acceptable emissions under the original permit determination. The gas oil is selected with low sulphur content to minimise sulphur dioxide emissions.

A derogation IED Article 30(6) allows the operator not to comply with the IED ELVs or to undertake monitoring for gas fuelled plant operating on standby fuels provided it is less than 10 days at a time during periods of gas interruption. The operator in their Reg 60 response does indicate that they would like the permit to include ELVs should the plant operate for more than 10 days at a time during periods of gas interruption.

Backup fuel is used monthly to test the emergency operation of the combustion systems and can be used to fire the GT during initial start-up. Overall standby fuel is not used other than for emergencies, none occurring in recent times.

The current permit has gas oil ELVs for NO<sub>x</sub> and CO and it would backsliding to remove them completely. The operator in their Reg 60 response does propose new gas oil ELVs should the plant need to operate for more than 240 hours/year i.e. 10 days: to quote the operator's Reg 60 response "This derogation gives a period of operation sufficient to iron out any initial problems with emissions upon firing liquid fuels. It is recognised that if interruption or breakdown requires operations beyond the 240 hours, then these must adhere to the liquid fuel ELVs proposed earlier". For this reason gas oil ELVs have been included but a condition added "2.2.1.6 For the release points referenced in table 2.2.2 A1, A2 and A3 those limits which refer to the source firing on gas oil shall not apply providing the LCP is operating on standby gas oil fuel for less than 10 days during periods of gas supply interruption".

Also under a further derogation we have allowed that plant expected to operate <10,000 hours over the life of the plant then continuous emissions monitoring (CEMs) are not required. Hence six-monthly monitoring, under IED Annex V Part 3(3), may be considered on a case by case basis. For this reason we have set only daily ELVs for gas oil fired plant sampled 6-monthly periodically for dust and SO<sub>2</sub> and this would apply if the site needs to operate for more than 10 days on gas oil in a year.

**LCP393** (CCGT, Biomass Boilers and OCGT mode) – Stack A2

This LCP393 is a complex arrangement and is designed to deliver primarily steam to the sugar production plant. A gas turbine (GT) and boilers are linked to steam turbines to generate electricity for on-site use because the National Grid connection is inadequate. The GT can export some electricity to the National Grid to reach stable generation (MSUL), Triad or other occasions when electrical demands don't match steam demands. The LCP combustion modes is split as:

- (a) A gas turbine operating in conjunction with a Waste Heat Recovery Boiler (WHB) firing in a supplementary mode. The residual heat after the stream turbines is then used as part of a CHP (combined heat and power) plant in sugar production.
- (b) The Waste Heat Boiler (WHB) can fire independently of the GT in the auxiliary mode (called Force Draft – FD mode) – thus acting as a boiler; this mode is used only for emergencies only.
- (c) The GT can operate independently of the WHB in the open cycle mode (OCGT) generating up to 6.2 MWelec. This discharges via a separate by-pass stack A3.
- (d) Four biomass boilers, substituting the Aalborgs but not currently operational, use the same common wind shield as flue A2 though via a separate flue A57.

Compliance Route (a) – CCGT and WHB (Supplementary):

The operator has proposed to operate this significant part of the LCP393 under the IED Annex V ELV compliance route. The operator requested that the GT be considered for the higher NOx ELVs allowed by the IED Annex V providing the plant can demonstrate better than 75% efficiency as part of a CHP. The operator was able to provide some historical routine test data (but not to an international standard) that indicated the plant net efficiency was ranged between 84.6% to 91.0%. This allowed us to accept the >75% efficiency as part of a CHP. However an improvement condition was added to provide a more adequate and technically justified efficiency report.

The site can and does generate electricity during the weekdays during sugar production as part of a National Grid peak demand reduction scheme (Triad). This mode is acceptable since the plant is operating in the efficient CCGT/CHP mode.

The determined IED Annex V ELVs were accepted by the operator.

Compliance Route (b) - WHB (Aux - FD):

The operator initially proposed to operate this part of the LCP under the IED Annex V ELV compliance route. However it was later requested that this be considered as emergency plant. The WHB (Aux - FD) will only be used in an emergency mode when for example the GT fails at short notice. Under our FAQv14 we allow WHB(Aux) mode “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 Regulator will permit the operation of the WHB in auxiliary mode at 15% Oxygen reference conditions”.

To restrict the WHB(Aux – FD) to the emergency mode, the activity will be limited to 500 hours with table 1.1.1.

The WHB(Aux) will have the IED Annex V limits as if a normal boiler but at 15% Oxygen reference conditions (normally this would be at 3%).

It is not BAT to operate a WHB in auxiliary mode other than in an emergency. A BAT justification should be sought for operators running a WHB in auxiliary mode for situations other than to deal with an emergency. For these situations the Oxygen reference conditions would be 3%.

#### Compliance Route (c) - OCGT:

The operator has proposed to operate this part of the LCP under the IED LHD compliance route except that they considered 500 emergency hours or may be appropriate for the OCGT. The OCGT utilises a separate by-pass stack A3.

The operation of the OCGT is already a permitted activity as being integral to the CHP/sugar plant. It had been assessed as having acceptable impacts for the required hours needed for the sugar plant under the original permit application. The operator is not asking for a new OCGT activity within the permit and specifically not for the export of electricity as part of the ESI balancing mechanism for which we would require detailed additional BAT assessment.

The GT can fire at less than 70% baseload and goes to the bypass stack for 10-15 minutes maximum before being diverted to the WHB as part of the warm-up process of the CCGT/WHB. This OCGT mode is considered as a CCGT start-up criteria covered by the CCGT MSUL/MSDL.

The operator confirmed that the OCGT was for operation at weekends for their own on-site electricity demands and to provide additional electricity above the limited grid connection. This OCGT mode because of its poor energy efficiency, unlike CCGT, may be unacceptable under BAT as part of a National Grid peak demand reduction scheme (such as Triad) so it was determined that OCGT activity should expressly excluded this mode of operation for off-site electrical generation.

Weekend GT load demands were always practically near 50% only (about 3MWelec). Plant operations are being managed to reduce electricity load demands further and certainly would not go above 70% baseload into the future. This load level is important because IED ELVs within Annex V would thus not be routinely applicable. It is also reasonable to determine that as the OCGT has a separate by-pass stack A3 it is effectively operating standalone and not as a greater than 50 MW LCP needing the application of Annex V ELVs above 70% baseload as well.

The OCGT already has permit ELVs so accepting the maintenance of current limits or better these have been accepted for the OCGT. However it is likely that the site can do better and so an Improvement condition has been added to assess the emission and propose new ELVs.

#### Compliance Route (d) – Biomass boilers:

The operator has proposed to operate this part of LCP393 under the IED Annex V ELV compliance route based on the operation of the biomass boilers separately to the CCGT. The IED does require ELVs to be evaluated as figures for the 'whole stack' based on mixed fuel and mixed loads as required by the various combustion plants. The biomass discharges from A57, a separate flue within A2.

However we have developed guidance based on practicality. A quote from permitting FAQ v14 states: "for multiple units discharging via separate flues within a common windshield with mixed 'types' of combustion units or fuels where ELVs may differ", the guidance states that "the preferred option is for the Operator to demonstrate compliance with a 'dynamic' ELV across the windshield ... OR if this is not possible", it states that "The relevant ELV is set on each combustion plant flue. The regulator will decide on which option is most suited based on site specific circumstances."

We have decided to determine biomass ELVs for A3 separately for the following reasons:

- (a) our FAQ referred to above
- (b) the plant is very complex and it is extremely unlikely we could set dynamic ELVs based on fuel load ratios for the mixed plant since it is difficult to measure instantaneous fuel inputs for biomass and also the different oxygen references for GTs and biomass.
- (c) MSUL/MSDL across the whole stack would be extremely difficult to specify. This is because any of 4 biomass units may need to operate in combination with the already complex CCGT/CHP MSUL/MSDL. Biomass is notorious for abnormal modes for which ELVs do not apply.
- (d) it has not operated since permitting in 2011 and is not expected to do so in the future.

Biomass ELVs are taken from the IED Annex V or the current permitted ELVs as applicable.

**Net Rated Thermal Input:**

The applicant has stated that the Net Thermal Input is

- (a) CCGT at 64 MW.
- (b) The Waste Heat Boiler (WHB) auxiliary mode at 57 MW
- (c) OCGT at 21 MW
- (d) Four biomass boilers total at 76 MW (4x19 MWth).

They have justified these figures by confirming the original net thermal input used in the initial permitting determination is correct without any clear justification. However it was felt that this was not sufficient and was inconsistent even within their submission itself; so an improvement condition IC13 was added requiring them to report the net rated thermal input for LCP392 and LCP393. Lack of clarity in the net rated thermal input means that the MSUL defined as percentage of this figure also supplied by the operator needs to be reconfirmed.

## **MSUL/MSDL**

### Minimum start up load and Minimum shut-down load (c) - OCGT:

The Operator has defined the “minimum start up load” and “minimum shut-down load” for the OCGT part of the LCP in their response to question 6 of the Reg 60, in terms of the output load (i.e. electricity MW). This was accepted. The response included plots highlighting the interaction of emissions and electrical output. MSUL will be around 5 minutes.

### Minimum start up load and Minimum shut-down load (a) - WHB & CCGT:

The Operator has defined the “minimum start up load” and “minimum shut-down load” for the WHB of the CCGT part of the LCP in their responses to question 6 of the Reg 60, in terms of the output load (i.e. heat MW converted from steam demand); and this output load as a percentage of the rated output of the combustion plant (%). This was accepted after further information was provided detailing the very complex warming cycles for the CCGT/CHP. The response included plots highlighting the complex interaction of emissions, steam demand and plant warming cycles. The MSUL could take up to 12 hours and was required after weekend shut downs; this only represents about 7% of plant combustion running times. It was also noted that though taking up to 12 hours to reach MSUL this was actually an extended period of very low load prior to a rapid steam demand take up; low fuel usage and hence low quantities of combustion gas emissions.

### Minimum start up load and Minimum shut-down load (b) – WHB (Aux mode):

The Operator has defined the “minimum start up load” and “minimum shut-down load” for the WHB in FD mode part of the LCP in their response to question 6 of the Reg 60, in terms of the output load (i.e. heat MW converted from steam demand); and this output load as a percentage of the rated output of the combustion plant (%).

### Minimum start up load and Minimum shut-down load (d) - Biomass:

The Operator has defined the “minimum start up load” and “minimum shut-down load” for the biomass part of the LCP in their response to question 6 of the Reg 60, in terms of the 3 criteria. These were accepted however because the plant has not been operational since commissioning it was felt these criteria should be re-evaluated once operational and so improvement Condition IC14 is added to provide a more detailed justification after 6 months of restarting the plant.

Overall we have provisionally agreed with the practical definitions related to the CHP operation and have set the thresholds in table 2.1.13 of the permit accordingly. Standard permit condition 2.1.4 has been added to define the period of start up and shut down, referring to the thresholds in this table.

## **LCP392** (Aalborg Boilers) – Stack A1

This LCP consists of two 60 MWth Aalborg Boilers which vent via multiple flues within a single windshield at emission point A1. The units burn natural gas and gas oil as a standby fuel.

### Compliance Route:

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

### **Net Rated Thermal Input**

The Applicant has stated that the Net Thermal Input is 2 x 60 MWth = 120 MWth. They have justified this figure by confirming the original net thermal input used in the initial permitting determination is correct. However it was felt that this was not sufficient so an improvement condition Table 1.4.1 item 13 was added to provide adequate reports.

### 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 steam load. It is based on the rated thermal output from the boiler in a conversion from steam generation rates in tonnes/hr.

We agree with this practical definition and have set the thresholds in table 2.1.13 of the permit accordingly. Standard permit condition 2.1.4 has been added to define the period of start up and shut down, referring to the thresholds in this table.

## **LCP392 and LCP393 Emission limits Values:**

The operator generally accepted that Annex V ELVs was the compliance route but in their Reg 60 response the operator based their request on comparison to their current ELVs applied to the wrong IED time averaging period. Specifically the permit's current ELVs are daily averages and the operator used these as if applying to monthly averages under the IED Annex V. Also the operator did not formally propose ELVs for all three of the required IED averaging intervals (daily, monthly and 95%ile hourly averages for full year).

The operator stated they expected the CCGT and Aalborg boilers to be compliant with ELVs across the load range from MSUL/MSDL

After the correct monthly IED ELVs were confirmed in line with Annex V of the IED and the ESI 2014 BAT review paper, we worked through the current ELVs to check for IED ELVs appearing to be looser than already allowed within the current permit (termed 'backsliding').

### **ELV and Monitoring Derogations**

We have said within our JEP (Joint Environmental Programme) monitoring protocol that dust and SO<sub>2</sub> emissions from natural gas firing boilers and GTs shall be reported on the basis of emission factors without continuous or periodic monitoring. This is because natural gas is an ash-free fuel and high efficiency combustion does not generate additional dust. Natural gas is almost sulphur free; the residual sulphur in natural gas supplied through the high pressure grid equates to a flue gas SO<sub>2</sub> concentration of about 0.09 mg/Nm<sup>3</sup>, at 15% O<sub>2</sub> in the dry flue gas, and this rises to about 0.24 mg/Nm<sup>3</sup> for odorised gas.

ELVs are summarised in the following tables which detail the current ELVs, the IED Annex V ELVs, operator proposed ELVs and what has be determined.

In all cases IED Annex V specifies the monthly average ELV. The daily average ELV is 110% of this monthly average ELV figure; and the 95%ile of the year's hourly averages is 200% of this monthly figure.

We believe that the most applicable short term emission limit value applicable when only periodic monitoring is required is the daily average value (i.e. 110% of the headline IED Annex V emission limit value)





This is the clarification for the ELVs for LCP392 (Aalborg Boilers) – Stack A1

Parameter	Current ELVs			Annex V – ELV			ELV route proposed			ELV route determined		
	Monthly average (mg/m3)	Daily mean (mg/m3)	maximum of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means
NOx (MSUL/MSDL to baseload) - gas		200		100	110	200		100		100	110	200
CO (MSUL/MSDL to baseload) - gas		200		100	110	200		100		100	110	200
SOx (MSUL/MSDL to baseload) - gas				35	38.5	70		35		35		
Dust (MSUL/MSDL to baseload) - gas				5	5.5	10		5		5		
NOx (MSUL/MSDL to baseload) - oil		250		200	220	400		250		200	220	400
CO (MSUL/MSDL to baseload) - oil		125						125		125.0	125.0	250.0
SOx (MSUL/MSDL to baseload) - oil				250	275	500		350			275	
Dust (MSUL/MSDL to baseload) - oil				25	27.5	50		30			27.5	

Some key points:

- 1) The ELVs for boilers applies from MSUL/MSDL as per the current permit
- 2) Annex V requires the size of the whole LCP to determine the appropriate ELV and not the size of the individual boiler. Hence the LCP is 120 MW so the 100-300 MW range for ELV is used.
- 3) CO using oil does not have an ELV in IED Annex V. Because the permit already has an ELV, under no backsliding, it is retained for the daily mean and recalculated for the other periods
- 4) Our non-ESI guide states "Where a shorter term ELV is tighter than Annex V, the longer term limit will usually be set at the same level" - this means that the CO on oil monthly ELV is set not by the ratio based on 125 being 110% (i.e. not 113.63).
- 5) The gas oil ELVs will only apply when an LCP has operated on standby gas oil fuel for more than 10 days during periods of gas supply interruption and will be carried out using periodic sampling 6 monthly.
- 6) SO<sub>2</sub> and dust on natural gas can be by calculation so the ELV effectively applies across all averaging periods

This is the clarification for the ELVs for LCP393 (a) - WHB & CCGT – A2

Parameter	Current ELVs			Annex V – ELV			ELV route proposed			ELV route determined		
	Monthly average (mg/m3)	Daily mean (mg/m3)	maximum of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means
A2 GT/WHB CHP Supplementary firing (MSUL/MSDL to baseload)												
NOx (MSUL/MSDL to baseload) - gas		220		50 (75 for >75% efficiency)	55 (82.5 for >75% efficiency)	100 (150 for >75% efficiency)		75		75	82.5	100
CO (MSUL/MSDL to baseload) - gas		100		100	110	200		100		100	100	200
SOx (MSUL/MSDL to baseload) - gas												
Dust (MSUL/MSDL to baseload) - gas												
NOx (MSUL/MSDL to baseload) - oil		380		90	99	180		90		90	99	180
CO (MSUL/MSDL to baseload) - oil		125		100	110	200		100		100	110	200
SOx (MSUL/MSDL to baseload) - oil												
Dust (MSUL/MSDL to baseload) - oil												

Some key points:

- 1) The ELVs for the CCGT applies from MSUL/MSDL to baseload: IED Annex V limits apply above 70% load for the GT and the EA separately determines ELVs which apply MSUL to 70% load ('part load'); the operator stated they expected the CCGT to be compliant with ELVs across the load range.
- 2) The current permit has a tighter CO limit than the IED for daily averages – this is retained therefore to prevent backsliding.
- 3) Our non-ESI guide states "Where a shorter term ELV is tighter than Annex V, the longer term limit will usually be set at the same level" - this means that the CO monthly ELV is set not by the ratio based on 100 being 110% (i.e. not 90.9).
- 4) The EA is not requiring the monitoring of SO<sub>2</sub> and dust in GT CCGT firing on gas but substitutes a mass calculation based on standard parameters defines by the EU. IED does not require ELVs for dust and SO<sub>2</sub> for oil fired GTs.
- 5) The option for a larger NOx ELV on gas is allowed by the IED providing the CCGT operates as a CHP with better than 75% efficiency.

This is the clarification for the ELVs for LCP393 (b) – WHB Auxiliary firing – A2

Parameter	Current ELVs			Annex V – ELV (same as Aalborgs i.e. Assume as 'normal' gas boilers)			ELV route proposed			ELV route determined		
	Monthly average (mg/m3)	Daily mean (mg/m3)	maximum of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means
A2 WHB Auxiliary firing (FD)												
NOx (MSUL/MSDL to baseload) - gas		220		100	110	200		100		100	110	200
CO (MSUL/MSDL to baseload) - gas		100		100	110	200		100		100	100	200
SOx (MSUL/MSDL to baseload) - gas				35	38.5	70				35		
Dust (MSUL/MSDL to baseload) - gas				5	5.5	10				5		
NOx (MSUL/MSDL to baseload) - oil		380		200	220	400		90		200	220	400
CO (MSUL/MSDL to baseload) - oil		125						100		125.0	125.0	250.0
SOx (MSUL/MSDL to baseload) - oil				250	275	500					275	
Dust (MSUL/MSDL to baseload) - oil				25	27.5	50					27.5	

Some key points:

- 1) The ELVs as per the Aalborgs derived earlier. But indicated earlier these ELVs, because the WHB Auxiliary firing is operating in emergency mode, apply with an oxygen reference of 15% O<sub>2</sub>.
- 2) The gas oil ELVs will only apply when an LCP has operated on standby gas oil fuel for more than 10 days during periods of gas supply interruption and will be carried out periodic sampling
- 3) SO<sub>2</sub> and dust on natural gas can be by calculation so the ELV effectively applies across all averaging periods

This is the clarification for the ELVs for LCP393 (a) - OCGT – A3 (still part of A2 LCP)

A3 GT OCGT.  Parameter	Current ELVs			Annex V – ELV for a GT >50MW as OCGT is <21MW and not LCP these won't apply			ELV route proposed initially (this was for LHD option)			ELV route determined		
	Monthly average (mg/m3)	Daily mean (mg/m3)	maximum of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means
NOx (MSUL to baseload) - gas		250		50	55	100		150			250	
CO (MSUL to baseload) - gas		100		100	110	200		100			100	
SOx (MSUL to baseload) - gas												
Dust (MSUL to baseload) - gas												
NOx (MSUL to baseload) - oil		380		90	99	180		200			380	
CO (MSUL to baseload) - oil		125		100	110	200		100			125	
SOx (MSUL to baseload) - oil												
Dust (MSUL to baseload) - oil												

- 1) Current ELVs apply over the MSUL to base load
- 2) This is only a 6MWelec GT operating for a limited time so proportionately is a significantly small proportion of the fuel use in the sugar production and CHP generally. This is not significantly large plant operating as an ESI. However the OCGT operation would come under significant scrutiny from the upcoming BRef and energy efficiency audits required by the permit
- 3) We need to report hours above MSUL/MSDL (as normal operation) to track BAT and minimisation of poorer energy efficiency events.

This is the clarification for the ELVs for LCP393 (a) – Biomass Boilers – A57 (still part of A2 LCP)

Parameter	Current ELVs		Annex V – ELV			ELV route proposed			ELV route determined		
	96%ile of 48 0.5 hourly means	maximum of 0.5 hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means	Monthly average (mg/m3)	Daily mean (mg/m3)	95%ile of hourly means
A2 Biomass flue (A47)											
NOx (MSUL/MSDL to baseload)	300	450	300	330	600		300		300	300	450
CO (MSUL/MSDL to baseload)	250	375					250		250	250	375
SOx (MSUL/MSDL to baseload)	300	450	200	220	400		200		200	200	400
Dust (MSUL/MSDL to baseload)	25	37.5	30	33	60		25		25	25	37.5
HCl (MSUL/MSDL to baseload)	30	45					30		30	30	45
VOC (MSUL/MSDL to baseload)	20						20		20	20	
Dioxins (MSUL/MSDL to baseload)	0.5ng/m3						0.5ng/m3		0.5ng/m3	0.5ng/m3	

Some key points:

- 1) The ELVs for the biomass boilers apply from MSUL/MSDL to baseload
- 2) The current permit has ELVs applying over averaging periods based on waste incineration i.e. half-hourly periods. This is not appropriate as the biomass is a fuel.
- 3) EPR1.01 Benchmark has very similar ELVs as the current permit for biomass but has daily averages for new plant. The current ELV interval would likely imply a higher daily mean equivalent (i.e. 2 readings can be greater than the limit so actual mean would thus be higher than this ELV); and hence slightly tighter than Annex V daily equivalent if used as a daily mean ELV. Thus the current ELVs represent limits to keep to, to avoid backsliding. It is thus also reasonable to use these as daily means (and scale for the shorter time intervals)
- 4) However HCl & CO continuous is not specified for IED. One can either keep the present limits with their 0.5 hourly intervals peak and 95%ile, or convert them for convenience to a reasonable IED equivalent based on a daily mean.
- 5) Dioxins and VOC are not sampled continuously so retained as a single ELV over a sampling period.
- 6) Our non-ESI guide states "Where a shorter term ELV is tighter than Annex V, the longer term limit will usually be set at the same level" - this means that the monthly ELVs are all set not by the ratio based on daily being 110% but are set to the daily mean.



Reporting efficiency:

In order to ensure the efficiency of plant using fossil fuels or biomass is maximised and regularly recorded, condition 2.7.4 and condition 2.4.2 and tables S4.2 and 2.1.12 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. Conditions 2.10.11 (2.10.11.1 to 2.10.11.7 inclusive are added)

Resource efficiency metrics:

A more comprehensive suite of reporting metrics has been added to the permit template for ESI plant. Table S4.1 "Resource Efficiency Metrics" has been added requiring the reporting of various resource parameters.

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

The original permit has condition 1.6.1 ‘there are no pre-operational conditions’. This is then followed by two additional conditions 1.6.2 and 1.6.3 added under the variation for the biomass boilers. This could create a confusion so is replaced with ‘1.6.1 null condition’

The original permit transfer MP3530HZ/T001 incorrectly specified the registered office address. This has been corrected to:-

Thames Refinery  
 Factory Road  
 Silvertown  
 London  
 E16 2EW

**Biomass:**

There is a requirement to be clearer about what biomass material can be burned within the boilers, for this reason it is necessary to include a new condition 2.4.1.5 (replacing 2.6.4) and table as follows:

Condition 2.4.1.5 Fuel for combustion in the biomass boilers shall only be accepted if:

- (a) it is of a type listed in table S2.1.13 and
- (b) it conforms to the description in the documentation supplied by the producer and holder.

Table 2.1.13 Permitted waste types for combustion in Large Combustion Plant	
Waste code	Description
02 01 03	WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING - Plant-Tissue waste. This shall be in the form of wheat husks.

The allowed sulphur content of gas oil fuel is no longer allowed to be 0.2% so table 2.1.12 has 0.2% replaced by 0.1% as follows:

Table 2.1.12 Raw materials and fuels	
Raw materials and fuel description	Specification
Gas oil	Not exceeding 0.1% w/w sulphur content
Natural Gas	-

LCPs for the last time in 2015 are required to submit data for annual emissions of dust, sulphur dioxide and oxides of nitrogen including energy usage using form AAE1 via the NERP Registry. For this reason IC16 has been added to the improvement condition table.

Listed activity reference:

The effluent treatment plant listed activity reference has been updated to reflect the new schedule references within IED. The activity is now listed as Section 5.4 Part A (1)(a)(ii)

Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by- Physico-chemical treatment.