

# Environment Agency permitting decisions

## Bespoke permit

We have decided to grant the permit for Gateway Energy Centre operated by Gateway Energy Centre limited.

The permit number is: EPR/EP3536EN/A001

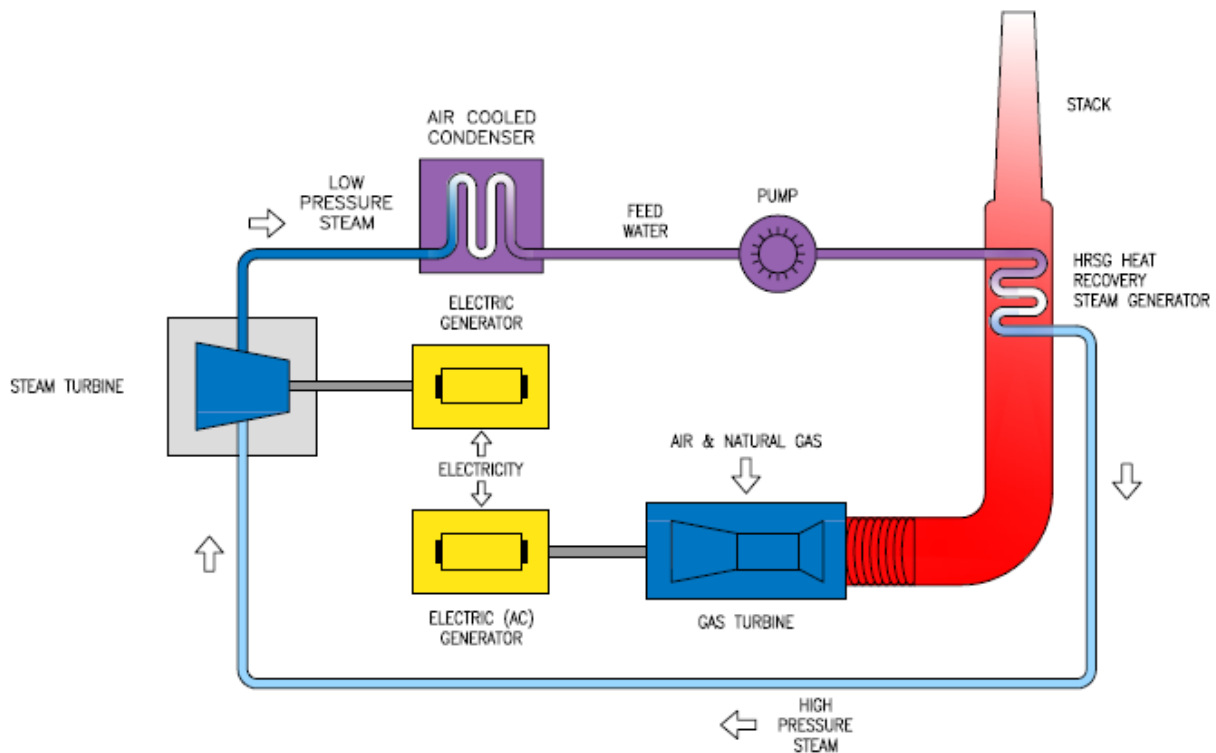
The operator is: Gateway Energy Centre Limited

The installation is: Gateway Energy Centre CCGT power Station

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

## Description of the main features of the Installation

Gateway Energy Centre (GEC) facility is a 1250MWe natural gas-fired Combined Cycle Gas Turbine (CCGT) electricity generating station. The site is located on former industrial/commercial land within the LG Port/LG Business and Logistics Park Development, The LG development on which GEC will be located is on the site of the former Shell Oil Refinery site at Shell Haven, near Corringham and Stanford-le-Hope.



The facility will comprise of two CCGT units generating a combined electrical output of ~1250MWe. Natural gas taken from a new underground pipeline will be burnt in the combustion chamber of each gas turbine from where the hot gases will expand through the gas turbine to generate electricity. The hot exhaust gases are then used in the heat recovery steam generator (HRSG) to generate steam, which in turn is used to generate electricity via steam turbine equipment. The spent steam leaving the steam turbine equipment will pass to an air cooled condenser (ACC) where it will be condensed. The resultant condensate will be returned to the HRSG for reuse. The flue gases will be discharged via two 75m stacks. GEC will be carbon capture ready (CCR) and combined heat and power ready (CHP-r) such that it could be retrofitted with carbon capture plant and combined heat and power (CHP) plant at a later date.

## **Purpose of this document**

This decision document:

- explains how the application has been determined
- provides a record of the decision-making process
- shows how all relevant factors have been taken into account
- justifies the specific conditions in the permit other than those in our generic permit template.

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

## **Structure of this document**

- Key issues
- Annex 1 the decision checklist
- Annex 2 the consultation, web publicising responses
- Annex 3 Meeting the requirements of Chapter III and Annex V of the Industrial Emissions Directive (IED).

## Key issues of the decision

Contents:

### Glossary

1. Chapter III of IED
2. Large combustion plant(s) description and number
3. Compliance route chosen for each LCP
4. Net thermal input
5. Minimum start up load and Minimum shut-down load (MSUL/MSDL)
6. Environmental Impact
7. Best Available Techniques
8. Emission limits
9. Monitoring Requirements
10. Meeting the requirements of the IED

## 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
ELV	emission limit value set out in either IED or LCPD
GT	gas turbine
HRSG	heat recovery steam generator
IED	Industrial Emissions Directive 2010/75/EC
LCP	large combustion plant – combustion plant subject to Chapter III of IED
MCR	Maximum Continuous Rating
MSUL/MSDL	Minimum start up load/minimum shut-down load
Part load operation	Operation during a 24 hr period that includes loads between MSUL/MSDL and maximum continuous rating (MCR). Also referred to as low load operation.

## 1. Chapter III of the IED

Chapter III of the Industrial Emissions Directive applies to new and existing large combustion plants (LCPs) which have a total rated thermal input which is greater or equal to 50MW. Articles 28 and 29 explain exclusions to chapter III and aggregation rules respectively.

The aggregation rule is as follows:

- A LCP has a total rated thermal input  $\geq 50\text{MW}$ .
- Where waste gases from two or more separate combustion plant discharge through a common windshield, the combination formed by the plants are considered as a single large combustion plant.
- The size of the LCP is calculated by adding the capacities of the plant discharging through the common windshield disregarding any units  $< 15\text{MWth}$ .

A “common windshield” is frequently referred to as a common structure or windshield and may contain one or more flues.

Chapter III lays out special provisions for LCP and mandatory maximum ELVs are defined in part 2 of Annex V for new plant, however it is worth noting that BAT requirements may lead to the application of lower ELVs than these mandatory values. Mandatory ELVs cannot be exceeded even if a site specific assessment can be used to justify emission levels higher than BAT.

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## 2. Large Combustion Plant(s) Description and Numbers

The Permit uses the DEFRA LCP reference numbers to identify each LCP. The LCPs permitted are as follows:

LCP410 (Emission point A1) and LCP411 (Emission point A2)

This LCPs consists of 2 x 1060MWth Natural gas fired CCGT's Units which vent separate 75m flues at emission points A1 and A2.

The original application included a request to consider two natural gas CCGT units generating a combined electrical output of  $\sim 1200\text{MWe}$ , the operator sought an amendment to the application during January 2015 to modify the electrical output from 1200MWe to 1250MWe, this was the direct result of technical developments and efficiency gains made by the supplier of the gas turbine engines, who could now provide higher capacity equipment for the site.

Revised ADMS air dispersion modelling was completed and supplied by the operator as a direct result of this change, including a summary of implication and changes to the original permit application.

### **3. Compliance Route**

The Applicant has proposed to operate LCP410 and LCP411 under the ELV compliance route, complying with the emission limits set out in part 2 of annex V of the IED.

### **4. Net thermal input**

The Applicant has stated that the combined Net Thermal Input of LCP410 and LCP411 is 2119.8MWth.

The Applicant has not provided sufficient information to demonstrate the net thermal input of the LCP as the plant has not been built yet. Consequently we have set improvement condition IC02, requiring them to provide this information within 12 months of the plant starting up.

### **5. Minimum start up load and Minimum shut-down load (MSUL/MSDL)**

The applicant has not provided sufficient information to set the MSUL/MSDL as the plant has not been built yet. Consequently we have set improvement condition IC01, requiring them to provide this information within 12 months of the plant starting up. Table S1.5 in the permit has been completed to reflect this too.

## 6. Environmental Impact

### 6.1 Assessment Methodology

#### 6.1.1 Application of Environment Agency Web Guide for Air Emissions Risk Assessment

A methodology for risk assessment of point source emissions to air, which we use to assess the risk of applications we receive for permits, is set out in our Web Guide and has the following steps:

- Describe emissions and receptors
- Calculate process contributions
- Screen out insignificant emissions that do not warrant further investigation
- Decide if detailed air modelling is needed
- Assess emissions against relevant standards
- Summarise the effects of emissions

The methodology uses a concept of “process contribution (PC)”, which is the estimated concentration of emitted substances after dispersion into the receiving environmental media at the point where the magnitude of the concentration is greatest. The guidance provides a simple method of calculating PC primarily for screening purposes and for estimating process contributions where environmental consequences are relatively low. It is based on using dispersion factors. These factors assume worst case dispersion conditions with no allowance made for thermal or momentum plume rise and so the process contributions calculated are likely to be an overestimate of the actual maximum concentrations. More accurate calculation of process contributions can be achieved by mathematical dispersion models, which take into account relevant parameters of the release and surrounding conditions, including local meteorology – these techniques are expensive but normally lead to a lower prediction of PC.

#### 6.1.2 Use of Air Dispersion Modelling

For LCP applications, we normally require the Applicant to submit a full air dispersion model as part of their application, for the key pollutants. Air dispersion modelling enables the process contribution to be predicted at any environmental receptor that might be impacted by the plant.

Once short-term and long-term PCs have been calculated in this way, they are compared with Environmental Quality Standards (EQS).

Where an EU EQS exists, the relevant standard is the EU EQS. Where an EU EQS does not exist, our guidance sets out a National EQS (also referred to as Environmental Assessment Level - EAL) which has been derived to provide a similar level of protection to Human Health and the Environment as the EU EQS levels. In a very small number of cases, e.g. for emissions of Lead, the National EQS is more stringent than the EU EQS. In such cases, we use the National EQS standard for our assessment.

National EQSs do not have the same legal status as EU EQSs, and there is no explicit requirement to impose stricter conditions than BAT in order to comply with a national EQS. However, national EQSs are a standard for harm and any significant contribution to a breach is likely to be unacceptable.

PCs are considered **Insignificant** if:

- the **long-term** process contribution is less than **1%** of the relevant EQS; and
- the **short-term** process contribution is less than **10%** of the relevant EQS.

The **long term** 1% process contribution insignificance threshold is based on the judgements that:

- It is unlikely that an emission at this level will make a significant contribution to air quality;
- The threshold provides a substantial safety margin to protect health and the environment.

The **short term** 10% process contribution insignificance threshold is based on the judgements that:

- spatial and temporal conditions mean that short term process contributions are transient and limited in comparison with long term process contributions;
- the threshold provides a substantial safety margin to protect health and the environment.

Where an emission is screened out in this way, we would normally consider that the Applicant's proposals for the prevention and control of the emission to be BAT. That is because if the impact of the emission is already insignificant, it follows that any further reduction in this emission will also be insignificant.

However, where an emission cannot be screened out as insignificant, it does not mean it will necessarily be significant.

For those pollutants which do not screen out as insignificant, we determine whether exceedances of the relevant EQS are likely. This is done through detailed audit and review of the Applicant's air dispersion modelling taking background concentrations and modelling uncertainties into account. Where an exceedance of an EU EQS is identified, we may require the Applicant to go beyond what would normally be considered BAT for the Installation or we may refuse the application if the applicant is unable to provide suitable proposals. Whether or not exceedances are considered likely, the application is subject to the requirement to operate in accordance with BAT.

This is not the end of the risk assessment, because we also take into account local factors (for example, particularly sensitive receptors nearby such as SSSIs, SACs or SPAs). These additional factors may also lead us to include more stringent conditions than BAT.

If, as a result of reviewing of the risk assessment and taking account of any additional techniques that could be applied to limit emissions, we consider that emissions **would cause significant pollution**, we would refuse the Application.



## 6.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in Report 63628A (August 2014) and amendments (12 January 2015) of the Application. The assessment comprises:

- A screening assessment of emissions to air from the operation of the installation.
- Dispersion modelling of emissions to air from the operation of the installation.
- A study of the impact of emissions on nearby sensitive habitat conservation sites.

This section of the decision document deals primarily with the dispersion modelling of emissions to air from the installation and its impact on local air quality. The impact on conservation sites is considered in section 6.2.

The Applicant has assessed the Installation's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the Installation's stack emissions using the ADMS 5.0 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at Southend Airport between 2004 and 2008 this was agreed with the Environment Agency. The impact of the terrain surrounding the site upon plume dispersion was considered in the dispersion modelling.

The air impact assessments, and the dispersion modelling upon which they were based, employed the following assumptions.

- First, they assumed that the ELVs in the Permit would be the maximum permitted by Annex V of the IED. Emissions to air from the power station come from twin, 75 tall stacks, approximately 111 m apart and from a small auxiliary system with a 15 m stack.
- These substances modelled were:
  - Oxides of nitrogen (NO<sub>x</sub>), expressed as NO<sub>2</sub>
  - Carbon monoxide (CO) – As a result of a request for further information dated 09<sup>th</sup> July 2014.
- Second, they assumed that the Installation operates continuously at the relevant long-term or short-term emission limit values, i.e. the maximum permitted emission rate

We are in agreement with this approach. The assumptions underpinning the model have been checked and are reasonably precautionary.

The applicant derived background levels of NO<sub>2</sub> from DEFRA background mapping for the point of maximum impact (background 19 µg m<sup>-3</sup> at 0.8 km downwind) and also at the Stanford le Hope monitoring station (33 µg m<sup>-3</sup> some 4 km distant). For NO<sub>x</sub> backgrounds (Habitats) data from APIS was used.

As well as calculating the peak ground level concentration, the Applicant has modelled the concentration of key pollutants at Stanford-Le-Hope Automatic monitoring station in order to maximise the value of data presented in respect of existing ground level NO<sub>2</sub> concentrations.

The way in which the Applicant used dispersion models, its selection of input data, use of background data and the assumptions it made have been reviewed by the Environment Agency's modelling specialists to establish the robustness of the Applicant's air impact assessment. The output from the model has then been used to inform further assessment of health impacts and impact on habitats and conservation sites.

Our review of the Applicant's assessment leads us to agree with the Applicant's conclusions.

The Applicant's modelling predictions are summarised in the following sections.

### 6.2.1 Assessment of Air Dispersion Modelling Outputs

The Applicant's modelling predictions are summarised in the tables below.

Table 1 Worst case assessment of process contributions (Grid Max) NO<sub>2</sub>

<i>Averaging Period</i>	<i>Process Contribution (µg/m<sup>3</sup>)</i>	<i>Objective / Standard (µg/m<sup>3</sup>)</i>	<i>Percentage of Standard</i>	<i>Initial Interpretation</i>	<i>Assumed Background* (µg/m<sup>3</sup>)</i>	<i>Predicted Environmental Concentration (µg/m<sup>3</sup>)</i>	<i>Percentage of Standard</i>	<i>Interpretation</i>
Annual Average	1.0	40	2.4	Potentially Significant	19.2	20.2	50.5	Not Significant
19 <sup>th</sup> Highest Hourly Average	14.0	200	7.0	Not Significant	N / A	N / A	N / A	N / A

\* Taken from DEFRA Background Mapping (2014) at point of maximum process contribution to provide a worst case assessment. As indicated in Table 3.4, the DEFRA Background Mapping projections indicate an expected general improvement in ground level NO<sub>2</sub> concentrations.

Table 2 Assessment of NO<sub>2</sub> process at discrete receptor Stanford-le-Hope monitoring station

<i>Averaging Period</i>	<i>Process Contribution (µg/m<sup>3</sup>)</i>	<i>Objective / Standard (µg/m<sup>3</sup>)</i>	<i>Percentage of Standard</i>	<i>Initial Interpretation</i>	<i>Assumed Background* (µg/m<sup>3</sup>)</i>	<i>Predicted Environmental Concentration (µg/m<sup>3</sup>)</i>	<i>Percentage of Standard</i>	<i>Interpretation</i>
Annual Average	0.1	40	0.3	Not Significant	N / A	N / A	N / A	N / A
19 <sup>th</sup> Highest Hourly Average	6.5	200	3.3	Not Significant	N / A	N / A	N / A	N / A

CO

The Air Quality Standards Regulations 2010 (AQS) prescribe a limit of 10,000  $\mu\text{g}/\text{m}^3$  (as an 8-hour rolling average) for CO and it is this threshold against which the impacts of any process contribution from a point source are to be assessed. However the advanced nature of gas turbine technology is such that CO emissions are small and limited to 100  $\text{mg}/\text{Nm}^3$ , in accordance with the IED and the BAT associated emissions level for CO.

The maximum 8-hour rolling average process contribution has been modelled at 252.9 $\mu\text{g}/\text{m}^3$  which is approximately 2.5 per cent of the “short-term” AQS objective. As such the impact of CO emissions from the GEC has been screened out as being insignificant and does not require further assessment.

(i) Screening out emissions which are insignificant

Emissions CO and can be screened out as insignificant in that the process contribution is <10% of the short term EAQ/EAL.

Therefore we consider the Applicant’s proposals for preventing and minimising the emissions of these substances to be BAT for the Installation subject to the detailed audit referred to below.

(ii) Emissions unlikely to give rise to significant pollution

From the tables above NO<sub>x</sub> emissions (which were not screened out as insignificant) have been assessed as being unlikely to give rise to significant pollution in that the predicted environmental concentration is less than 100% (taking expected modelling uncertainties into account) of both the long term and short term EQS/EAL

For these NO<sub>x</sub> emissions, we have carefully scrutinised the Applicant’s proposals to ensure that they are applying the Best Available Techniques to prevent and minimise emissions of these substances. This is reported in section 7 of this document.

(iii) Emissions requiring further assessment

All emissions either screen out as insignificant or where they do not screen out as insignificant are considered unlikely to give rise to significant pollution.

### 6.2.2 Consideration of key pollutants

(i) Nitrogen dioxide (NO<sub>2</sub>)

The impact on air quality from NO<sub>2</sub> emissions has been assessed against the EU EQS of 40  $\mu\text{g}/\text{m}^3$  as a long term annual average and a short term hourly average of 200  $\mu\text{g}/\text{m}^3$ . The model used the Janssen’s equation to determine NO to NO<sub>2</sub> conversion, insufficient justification for the use of the equation was found, however the

Environment Agency agrees with the operator's conclusion on human health impacts and habitat deposition processes.

The above tables show that the grid maximum peak long term PC is >1% of the EUEQS and therefore cannot be screened out as insignificant. Even so, from the table above, the emission is not expected to result in the EUEQS being exceeded. The peak short term PC is <10% of the EUEQS and is not expected to result in the EUEQS being exceeded.

(ii) Dust

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. Thus for natural gas fired turbines dust emissions are not an issue.

(iii) Sulphur Dioxide

Natural gas, that meets the standard for acceptance into the National transmission System, is considered to be sulphur free fuel. Hence, sulphur dioxide emissions from burning natural gas, were not considered to be significant were not modelled by the Applicant. We agree with this approach.

(iv) Emissions to Air of CO<sub>2</sub>

For CO emissions, the peak short term PC is less than 10% of the EAL/EQS and so can be screened out as insignificant. Therefore we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT for the Installation.

### **6.3 Impact on Habitats sites, SSSIs, non-statutory conservation sites.**

#### **6.3.1 Sites Considered**

SPA/SAC:

The following Habitats (i.e. Special Areas of Conservation, Special Protection Areas and Ramsar) sites are located within 10Km of the Installation:

- Benfleet and Southend Marshes SPA/Ramsar
- Thames Estuary & Marshes SPA/Ramsar

SSSI:

The following SSSI (Site of Special Scientific Interest) sites are located within 2Km of the Installation

- South Thames Estuary & Marshes
- Holehaven Creek
- Vange & Fobbing Marshes
- Mucking Flats & Marshes
- Thundersley Great Common

Non-Statutory Sites:

The following SSSI sites are located within 2Km of the Installation:

- Manorway Fleet Reedbed
- Corringham/Fobbing Marsh

#### **6.3.2 Habitats Assessment**

The Applicant's Habitats assessment was reviewed by the Environment Agency's technical specialists for modelling, air quality, conservation and ecology technical services, who agreed that consultation with Natural England should be undertaken due to likely significant effect on the interest features of the protected sites.

The applicants modelling had used APIS background data for assessment of impacts on habitats but Environment Agency checks with DEFRA background data for NO<sub>x</sub> revealed potential atmospheric NO<sub>x</sub> levels already exceeding or approaching critical background levels for vegetation at these general locations.

The Environment Agency aim to take a pragmatic approach to estimating an appropriate background at any location. There are a number of available data sources including APIS, Defra background maps and measured data carried out by Local Authorities etc. In general, we would consider APIS to be a reliable data source, however, it is always appropriate to look at the surrounding area and consider possible nearby sources of pollution which could affect the background.

Although APIS and DEFRA levels differ, there are uncertainties in both sets of data and the main difference in levels is due largely to the size of the grid squares over which the data is averaged. DEFRA data is a finer resolution (1km<sup>2</sup>) than the APIS data (5km<sup>2</sup>). In essence we make decisions based on all available information and on a case by case basis. Where a site may be close to a busy road network, an urban area or an industrial area, we consider it prudent to always investigate a number of data sources in order to make an informed decision on likely background concentration to ensure we are correctly assessing the environmental risk to the site.

The way in which the Applicant used dispersion models, selection of input data, use of background data and the assumptions made have been reviewed by the Environment Agency's modelling specialists (AQMAU) to establish the robustness of the Applicant's air impact assessment. AQMAU check modelling on the ADMS dispersion modelling provided by the applicant concluded that atmospheric NO<sub>x</sub> (PC) predictions for air quality could be used for permit determination purposes. AQMAU check modelling showed that PC's from the GEC project at these sites may be slightly lower than those presented by the applicant however this finding must be considered in overall context of modelling uncertainty.

APIS does not consider the effects of atmospheric NO<sub>x</sub> on an individual site basis or habitat type and applies the 30µg/m<sup>3</sup> level as broad habitat.

Common biological effects for high levels atmospheric NO<sub>x</sub> are broadly indicated to be:

- Changes in species composition
- Vulnerability to direct damage of mosses, liverworts and lichens which receive their nutrients largely from the atmosphere.
- Visible symptoms for example, leaf discoloration.

A CRoW 'Appendix 4' for permits with potential for impact on Sites of Special Scientific Interest (SSSI), and an Appendix 12 (Stage 3 Appropriate assessment) for likely significant effect on SAC/SPA's was submitted to Natural England on the 09th June 2015 for consultation purposes.

The Environment Agency technical assessments considered the favourable condition site specific standards and the Appendix 12 assessment was carried out both alone and in-combination with other Plans Permissions and Projects (PPP) in the context of prevailing environmental conditions for air quality assessments.

Assessment results and predicted impacts from the GEC project were included for both DEFRA estimated background atmospheric NOx levels and APIS background critical levels.

## SAC/SPA

The appropriate assessment considered Long Term and Short Term Atmospheric NOx only as requiring further assessment based on the outcome of the Likely Significant Effect assessment (Appendix 11) as this was the only pollutant of concern due to the type of fuel being combusted. Emissions of SO<sub>2</sub> and CO are insignificant pollutants (Natural Gas) and are not considered further. Pollutant deposition was estimated by applying a deposition velocity to the predicted concentrations in accordance with Environment Agency AQTAG 06 guidance, all calculated deposition contributions were considered to be insignificant at <1% of any relevant site Critical Load (CLO) and were therefore not considered.

Tables 3 and 4 show applicants Long Term and Short Term predicted atmospheric NOx process contributions (PC) and total predicted environmental concentrations (PEC) when compared to a relevant critical level for all vegetation (Cle) of 30µg/m<sup>3</sup> at the closest part of the SPA/Ramsar from the Gateway Project. The PC is the modelled contribution from Gateway energy centre. The PEC equals the PC plus the existing background pollutant level at the site(s) for long Term **calculated from APIS**.

**Table 3: Assessment results – Pollutant concentrations (APIS Long Term)**

Site Name	Assumed Background (µg/m <sup>3</sup> )	Standard	Assumed Background as % of critical Level	Process Contribution (µg/m <sup>3</sup> )	Process Contribution as % of Critical level	Predicted Environmental Concentration (µg/m <sup>3</sup> )	Predicted Environmental Concentration as % of Critical Level
Thames Estuary and Marshes SPA/Ramsar (North)	20.12	<b>30</b>	67.1	0.81	<b>2.7</b>	20.64	<b>69.8</b>
Thames Estuary and Marshes SPA/Ramsar (South)	19.84		66.1	0.80	<b>2.7</b>	20.71	<b>68.8</b>
Benfleet and Southend Marshes SPA and Ramsar	19.33		64.4	0.73	<b>2.4</b>	20.90	<b>66.9</b>

**Table 4: Assessment results – Pollutant concentrations (APIS Short Term)**

Site Name	Assumed Background ( $\mu\text{g}/\text{m}^3$ )	Standard	Assumed Background as % of critical Level	Process Contribution ( $\mu\text{g}/\text{m}^3$ )	Process Contribution as % of Critical level	Predicted Environmental Concentration ( $\mu\text{g}/\text{m}^3$ )	Predicted Environmental Concentration as % of Critical Level
Thames Estuary and Marshes SPA/Ramsar (North)	40.24	75	53.7	22.40	<b>29.9</b>	62.6	<b>83.5</b>
Thames Estuary and Marshes SPA/Ramsar (South)	39.68		52.9	17.77	<b>23.7</b>	57.5	<b>76.6</b>
Benfleet and Southend Marshes SPA and Ramsar	38.66		51.5	5.40	<b>7.2</b>	44.1	<b>58.7</b>

#### Assessment by use of APIS Data 2010 - 2012

##### Long Term NO<sub>x</sub>

Table 3 above shows the long-term impact modelling of aerial NO<sub>x</sub> emissions from the proposed facility are >1% of the site specific atmospheric NO<sub>x</sub> environmental benchmark of  $30\mu\text{g}/\text{m}^3$  for both sites, however the predicted environmental contribution (PEC) are <70% of the relevant site Cle of  $30\mu\text{g}/\text{m}^3$  and therefore further assessment for these sites is not required.

##### Short Term NO<sub>x</sub>

Table 4 shows that the short-term modelled process contributions of NO<sub>x</sub> from the proposed facility alone are >10% of relevant short term NO<sub>x</sub> benchmark of  $75\mu\text{g}/\text{m}^3$  at the Thames Estuary and Marshes SPA site at 23.7 - 29.9%, however as this is <100% (OI 67\_12) of the relevant site Cle of  $75\mu\text{g}/\text{m}^3$  we can conclude no adverse effect on the site integrity of the Thames Estuary and Marshes SPA and Ramsar from this proposal alone.

The short term process contributions alone at Benfleet and Southend Marshes are <10% of the relevant benchmark and we can therefore conclude no adverse effect on the site integrity of Benfleet and Southend Marshes SPA and Ramsar from this proposal alone.

#### Assessment by use of DEFRA 2011 Data (Estimated)

A review of 2011 annual estimated atmospheric background NO<sub>x</sub> concentrations presented in Defra background maps, shows that atmospheric NO<sub>x</sub> concentrations for both sites appears to be approaching the annual environmental benchmark of  $30\mu\text{g}/\text{m}^3$



at Benfleet and Southend Marshes at 28.7µg/m<sup>3</sup> and already exceeded at Thames Estuary and Marshes with indicative levels of 32.9µg/m<sup>3</sup>, 32.9µg/m<sup>3</sup> and 33.3µg/m<sup>3</sup>, this is in contrast with the data as provided in APIS which estimates background concentration to be in the region of 10µg/m<sup>3</sup> less. APIS data was used by the applicant to calculate their impacts in the permit application.

Table 5 shows the predicted LT environmental atmospheric NOx concentrations when DEFRA assumed background concentrations are considered instead of APIS background data. The long-term impact modelling of aerial NOx process contributions from the proposed facility remain unchanged however the predicted environmental contribution (PEC) is now >70% of the relevant site Cle of 30µg/m<sup>3</sup> and therefore further assessment (Appropriate assessment) for these sites is now required.

**Table 5: Estimated pollutant concentrations using DEFRA Long Term background data.**

Site Name	Assumed Background (µg/m <sup>3</sup> )	Standard	Assumed Background as % of critical Level	Process Contribution (µg/m <sup>3</sup> )	Process Contribution as % of Critical level	Predicted Environmental Concentration (µg/m <sup>3</sup> )	Predicted Environmental Concentration as % of Critical Level
Thames Estuary and Marshes SPA/Ramsar (North)	32.9– 33.3	<b>30</b>	109 – 111	0.81	<b>2.7</b>	33.71 - 34.11	<b>112.4 – 113.7</b>
Thames Estuary and Marshes SPA/Ramsar (South)				0.80			
Benfleet and Southend Marshes SPA and Ramsar	28.7		95.6	0.73	<b>2.4</b>	29.43	<b>98.1</b>

Table 6 shows short-term modelled process contributions of NOx from the proposed facility alone are >10% of relevant short term NOx benchmark of 75µg/m<sup>3</sup> at parts of the Thames Estuary and Marshes SPA site at 23.7 - 29.9%, however with DEFRA background data being used this is now >100% (OI 67\_12) of the relevant site Cle of 75µg/m<sup>3</sup> and therefore further assessment (Appropriate assessment) for these sites was required.

The short term process contributions at Benfleet and Southend Marshes remain unchanged at <10% of the relevant benchmark and we therefore conclude no adverse effect on the site integrity of Benfleet and Southend Marshes SPA and Ramsar.

**Table 6: Estimated pollutant concentrations using DEFRA Long Term background data (Short Term)**

Site Name	Assumed Background ( $\mu\text{g}/\text{m}^3$ )	Standard	Assumed Background as % of critical Level	Process Contribution ( $\mu\text{g}/\text{m}^3$ )	Process Contribution as % of Critical level	Predicted Environmental Concentration ( $\mu\text{g}/\text{m}^3$ )	Predicted Environmental Concentration as % of Critical Level
Thames Estuary and Marshes SPA/Ramsar (North)	65.8 – 66.6	75	87.7 – 88.8	22.40	<b>29.9</b>	95.7 – 96.5	<b>127.6 – 128.6</b>
Thames Estuary and Marshes SPA/Ramsar (South)				17.77	<b>23.7</b>	83.6 – 84.4	<b>111.4 – 112.5</b>
Benfleet and Southend Marshes SPA and Ramsar	57.4		51.5	5.40	<b>7.2</b>	64.6	<b>86.1</b>

## SSSI

Tables 7 to 8 show the applicants predicted process contribution (PC) and total predicted environmental concentrations (PEC) when compared to a relevant critical level (Cle) of  $30\mu\text{g}/\text{m}^3$  at the closest part of the SSSI from the Gateway Project. The PC is the modelled contribution from Gateway energy centre. The PEC equals the PC plus the existing background pollutant level at the site(s) for long Term calculated from APIS.

**Table 7: Assessment results – Pollutant concentrations (Long Term)**

Site Name	Assumed Background (µg/m <sup>3</sup> )	Standard	Assumed Background as % of critical Level	Process Contribution (µg/m <sup>3</sup> )	Process Contribution as % of Critical level	Predicted Environmental Concentration (µg/m <sup>3</sup> )	Predicted Environmental Concentration as % of Critical Level
Holehaven Creek SSSI	26.18	<b>30</b>	87.3	2.12	<b>7.1</b>	28.30	<b>94.3</b>
South Thames Estuary and Marshes SSSI	19.84		66.1	0.80	<b>2.7</b>	20.64	<b>68.8</b>
Mucking Flats and marshes SSSI	20.53		68.4	0.18	<b>0.6</b>	20.71	<b>69.0</b>
Vange and Fobbing Marshes SSSI	20.35		67.8	0.55	<b>1.8</b>	20.90	<b>69.7</b>
Thundersley Great Common SSSI	19.33		64.4	0.53	<b>1.8</b>	19.86	<b>66.2</b>

**Table 8: Assessment results – Pollutant concentrations (Short Term)**

Site Name	Assumed Background (µg/m <sup>3</sup> )	Standard	Assumed Background as % of critical Level <sup>(1)</sup>	Process Contribution (µg/m <sup>3</sup> )	Process Contribution as % of Critical level	Predicted Environmental Concentration (µg/m <sup>3</sup> )	Predicted Environmental Concentration as % of Critical Level
Holehaven Creek SSSI	52.36	<b>75</b>	69.8	21.28	<b>28.4</b>	73.6	<b>98.2</b>
South Thames Estuary and Marshes SSSI	39.68		52.9	17.77	<b>23.7</b>	57.5	<b>76.6</b>
Mucking Flats and marshes SSSI	41.06		54.7	5.41	<b>7.2</b>	46.5	<b>62.0</b>
Vange and Fobbing Marshes SSSI	40.70		54.3	13.83	<b>18.4</b>	54.5	<b>72.7</b>
Thundersley Great Common SSSI	38.66		51.5	6.06	<b>8.1</b>	44.7	<b>59.6</b>

1. Assumed short term background based on 2 x long term background

## APIS Data

### Long Term

Based on a review of latest APIS data, Table 4 shows the long-term impact modelling of aerial NO<sub>x</sub> emissions from the proposed facility are >1% of the site specific atmospheric NO<sub>x</sub> environmental benchmark of 30µg/m<sup>3</sup> for all relevant sites except Mucking Flats and Marshes SSSI, however the process contribution + existing background levels (PEC) are <70% of the relevant site CLe of 30µg/m<sup>3</sup> at all locations except Holehaven Creek SSSI a detailed assessment for these sites is therefore not required. In respect of Holehaven Creek SSSI PEC is <100% of the NO<sub>x</sub> CLe of 30ug/m<sup>3</sup> and it can therefore be assumed that no adverse effect is likely and operations are not likely to lead to damage of the site.

### Short Term

Based on a review of latest APIS background data, Table 5 Shows that the short-term modelled process contributions of NO<sub>x</sub> from the proposed facility is >10% of relevant atmospheric NO<sub>x</sub> benchmark of 75µg/m<sup>3</sup> at all locations except Mucking Flats and Thundersley Common SSSI. However this is <100% of the relevant site CLe of 75ug/m<sup>3</sup> it can therefore be assumed that no adverse effect is likely and operations are not likely to lead to damage of the site.

### DEFRA 2011 Data (Estimated)

A review of 2011 annual estimated atmospheric background NO<sub>x</sub> concentrations presented in Defra background maps, shows that atmospheric NO<sub>x</sub> concentrations for all SSSI sites appear to be approaching or have already exceeded the annual environmental benchmark of 30µg/m<sup>3</sup>, this is in contrast with the data as provided via the APIS website and that used by the operator to calculate impacts.

In addition Natural England expressed particular interest in the potential impacts on Thundersley Common and the Vange and Fobbing Marshes SSSI's. Indicative background data from DEFRA maps for Atmospheric NO<sub>x</sub> is presented in Table 6. Agency check modelling concluded that PC's from the GEC project at these sites may be slightly lower than those presented by the applicant however this finding must be considered in overall context of modelling uncertainty.

### Specific SSSI OLD's

Operations likely to damage have been examined for all SSSI sites.

There are no specific OLD relating to Poor air quality for any of the SSSI's

## 6.4 Environment Agency Conclusions

The Environment Agency concluded no adverse effect on the site integrity of Thames Estuary and Marshes SPA/Ramsar and Benfleet and Southend Marshes SPA/Ramsar either alone or in combination from the proposed permission. And that the proposed permission was not likely to damage any of the flora, fauna or geological or physiological features which are of special interest. This is in light of the following main points:

- The methodology used in the applicants modelling to determine the impact on air quality uses a number of worst case assumptions. These include the following:
  - a) It is assumed that the plant will continually operate at the maximum emission limits ( $50\text{mg}/\text{m}^3$ ) allowed under the Industrial Emissions Directive and that this occurs on the worst day of meteorological data from the 5 years of data that was used in the modelling. In reality, this will not be the case and actual emissions will be less than the limits.
  - b) The maximum ground level concentrations are considered in each case. These concentrations occur in small areas; in general the concentrations will be much lower over wider areas of the conservation sites.
- The in combination assessment found that the APIS and DEFRA background data used in the modelling and assessment of impacts for annual and daily NO<sub>x</sub> will most likely have included emissions from the Coryton Refinery and Tilbury Power Station prior to the conversion to Biomass fuel. Coryton refinery was closed in 2012 and plans to convert the site to an oil storage depot were dropped in September 2014 with no clear plans to return the refinery to its previous working condition. Therefore the background NO<sub>x</sub> concentrations used in the assessment are likely to reflect previous higher levels of background concentrations.

Having examined historical records as part of the in-combination assessment the predicted PC's from the Gateway project as a whole do not exceed the modelled PC's from the former Coryton facility. This does not include the additional reduction made by the Tilbury bio-mass conversion, therefore an assumption can be made that there will be no worsening of atmospheric NO<sub>x</sub> levels as a result of the GEC Project on both SPA/Ramsar sites.

- There will be uncertainty associated with background concentration data, however there is potential for significant decreases in NO<sub>x</sub> background levels with time as indicated by DEFRA and APIS projections (Year adjustment factors 2011- 2030) for NO<sub>x</sub> background levels.

- Concentrations of NO<sub>x</sub> are currently at or below the site-relevant Critical Level values given for both SPA features on the Air Pollution Information System ([www.apis.ac.uk](http://www.apis.ac.uk)). This system is considered to be a reliable and best available source for the purposes of undertaking habitats assessments.
- Environment Agency check modelling confirms relatively small NO<sub>x</sub> process contributions at or below the 2% of the Critical level of 30µg/m<sup>3</sup> for the proposal.
- The Predominant habitats at both SPA/Ramsar sites are indicated to be marine tidal rivers, estuaries, mud flats and lagoons (Littoral sediments) ~60-90%, these habitat types are shown not to be affected by atmospheric NO<sub>x</sub> (APIS).

## 6.5 Natural England Consultation Response

Natural England responded to the consultation on the 28<sup>th</sup> July 2015 (Appendix 12 Appropriate assessment) and 16<sup>th</sup> July 2015 (Appendix 4) and confirmed agreement with the Environment Agency's conclusion that given the conservative nature of the modelled data, low sensitivity of predominant habitat types (Marine), indicative APIS background data, relatively small process contributions and likely localised NO<sub>x</sub> reduction as a result of the Tilbury Biomass conversion and Coryton refinery closure the proposed plan will not adversely affect the integrity of the Thames Estuary and Marshes SPA/Ramsar or Benfleet and Southend Marshes SPA/Ramsar either alone or in combination and is not likely to damage any of the flora, fauna or geological or physiological features which are of special interest (SSSI).

### Assessment of Non-Statutory Sites

The Applicant submitted collected data on the aerial emissions that would be generated by the proposed development and modelling was undertaken which showed that for all pollutants of Concern (NO<sub>x</sub>) N deposition), PC did not exceed 100% of any relevant Critical Level or Critical load and is therefore insignificant.

**Table 9: Assessment results – Pollutant concentrations Long and Short Term Maximum PC at - non-statutory sites**

Receptor	EQS	PC	%EQS
Corringham / Fobbing Marsh LWS	30ug/m3	0.44	1.46
Manorway Fleet Reedbed LWS		1.16	3.86
Corringham / Fobbing Marsh LWS	75ug/m3	0.47	0.62
Manorway Fleet Reedbed LWS		1.14	1.52

For all modelled receptors the Long Term Process Contribution of NOx are <100% of the relevant Critical Level function and therefore insignificant.

### Calculated total N deposition

For all modelled receptors the Process Contribution is <100% of the relevant Critical Load function and is therefore insignificant.

**Table 10: Assessment results – Nutrient Nitrogen Deposition at - non-statutory sites**

Receptor	PC (Total N, as N (kg/ha/y))	% of lower band of Critical Load
Corringham / Fobbing Marsh LWS	0.045	0.3
Manorway Fleet Reedbed LWS	0.0117	0.8

A full assessment of the application and its potential to affect the site(s) habitat has been carried out as part of the permitting process. We consider that the application will not affect the features of the site/species/habitat

## 6.6 Emissions to Water

### 6.6.1 Water discharge swale System (Under management of DP World)

There are no direct emissions of process waters directly to WFD controlled waters. Boiler blowdown waters will be discharged to dedicated blowdown vessels and sent to the demineralisation plant to be re-used or discharged to the LG Park Drainage System managed by DP World.

These vessels will be open to atmosphere and, as such, some of the blowdown immediately evaporates ('flash off'). Typical volumes of blowdown waters will be

approximately 370m<sup>3</sup> after flashing off however the flow rate of the boiler blowdown will be based on the mass flow through the steam turbines, which will be a function of the electrical load of GEC.

The demineralisation plant effluent will be a concentrated solution of all the dissolved solids present in the raw mains water, produced as a result of any effluent neutralisation requirements. During normal operation the water treatment plant is anticipated to produce an effluent of up to 80 m<sup>3</sup>/day.

Section 4.4.16 to 4.6.18 of the original application describes the techniques for dealing with process waters including typical boiler blowdown analysis, the analysis showed a Phosphate content of 5mg/l as PO<sub>4</sub> from the use of trisodium phosphate (Un-reacted carry over) as an oxygen scavenger for the protection of the HRSG boiler from corrosion.

Process waters discharged from the facility (Point W1) will be collected in an open swale system managed by DP world together with surface waters and discharge waters from other commercial premises on the LG Park development. These waters will drain to an open lagoon system (Carters Lagoon) providing further dilution prior to final fate discharge via pumping under separate consent to the River Thames (responsibility of DP world). As the swale system on the LG development park is an open system the Environment Agency were concerned with potential amenity impacts resulting from the proposed levels of phosphates within blowdown waters which could potentially have a negative localised impact, elevated levels of phosphates are known to stimulate the growth of plankton and aquatic plants and can in extreme circumstances lead to anaerobic environments. A Schedule 5 request for further information was issued to the operator on the 17<sup>th</sup> March 2015 requesting the operator to provide options for further phosphate/removal reduction in blowdown waters prior to discharge to the LG Park swale system.

The operator responded to this request on 24<sup>th</sup> November 2015 confirming that trisodium phosphate would be substituted with the use of caustic (sodium hydroxide) in the steam / water circuit, this will have the effect of eliminating the phosphate content in boiler blowdown waters from 5mg/l to <1mg/l, there will still however be a small amount of residual phosphate in the overall combined discharge from the concentrate discharge derived from the RO demineralisation process which is required to make up clean boiler waters lost as part of the blow down process. These phosphates are background concentrations in the raw water quality sourced directly from Thames water and are therefore unavoidable in nature.

Emissions of ammonia are likely to be reacted ionised ammonia at final fate discharge and are unlikely to pose any environmental risk given the final fate discharge is the



River Thames. The River Thames at point of discharge is considered tidal in nature and hyper-nitrified with regard to Nitrogen however doesn't exhibit the biological symptoms of a eutrophic system due to high dilution ratios and high turbidity levels. There are no EQS standards for Phosphorus discharges into Trac waters and discharges from the facility are not considered to pose any environmental risk at point of final fate discharge.

## 6.7 Noise Impacts

The application contained a noise impact assessment which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise attenuation measures. Measurements were taken of the prevailing ambient noise levels to produce a baseline noise survey and an assessment was carried out in accordance with BS 4142:1997 to compare the predicted plant rating noise levels with the established background levels. The applicant's assessment, dated May 2014, pre-dates publication of the revised BS4142:2014 in November 2014

The applicant conducted a baseline noise survey on 27<sup>th</sup> and 28<sup>th</sup> January 2010 at six noise sensitive receptor (NSR) locations, located approximately 1km to 4km from the centre of the GEC. Measurements were taken during the day and night, in accordance with the principles set out in BS4142:1997 and BS7445:2003<sup>1</sup>. Following the survey the consultant has used the lowest recorded background noise levels (L<sub>A90</sub>) during a typical weekday for comparison with the rating level.

Receptor Ref.	NSR1	NSR2	NSR3	NSR4	NSR5	NSR6
<b>Daytime results</b>						
Rating Level, dB	27.3	29.1	31	32.9	36.9	25.8
Background Level, L <sub>A90</sub> , dB	44	45	45	38	54	43
Excess of Rating over Background, dB	-16.7	-15.9	-14	-5.1	-17.1	-17.2
<b>Night time results</b>						
Rating Level, dB	27.3	29.1	31	32.9	36.9	25.8
Background Level, L <sub>A90</sub> , dB	41	37	37	31	38	38
Excess of Rating over Background, dB	-13.7	-7.9	-6	1.9	-1.1	-12.2

At all NSR locations calculated Daytime rating is -5.1dB or Lower, only one location NSR4 shows an increase in night-time noise at +1.9dB in accordance with BS4142:1997 this level is unlikely to cause complaint.

<sup>1</sup> BS7445:2003 - Description and measurement of environmental noise, (Parts 1-3)

The consultant has listed the BAT likely to be incorporated to reduce noise emissions from the proposed plant, to be fitted to the gas turbines, heat recovery steam generators (HRSG's), pipes and ductwork, pumps and motors, steam generators, and intermittent sources such as emergency steam vents. BAT includes, as appropriate, low noise air cooled condensers, acoustic enclosures, acoustic cladding, high performance silencers, diffusers, absorptive silencers and acoustic insulation. Although described in general terms, the applicant's proposed BAT are considered appropriate for the facility.

The GEC site is located within the London Gateway development on the north bank of the River Thames in Thurrock, Essex, 30 miles (48 km) east of central London. It comprises a new deep-water port, which is able to handle the biggest container ships in the world, as well as one of Europe's largest logistics parks, providing access by road and railways to London and the rest of Great Britain. The re-development project, being undertaken by DP World, significantly increases the capabilities of the Port of London in handling container shipping, to help meet the growing demand for container handling at Britain's ports. Construction began in February 2010, and is expected to take several years, with the port and logistics park being completed in stages.

Given the location and nature of the development we conclude that noise generated by the proposed power station will be below levels expected to have an adverse impact outside of the installation boundary and can be classed as 'low impact' as defined within BS4142:2014.

The operator is required to undertake a follow-up noise assessment in accordance with BS4142:2014 once the plant is operational, in order to validate the modelling predictions. The provision of a report which describes this assessment including a description of the as-built design with respect to noise control measures is also required as part of an Improvement Condition (IC 2) on the permit.

## 7. Application of Best Available Techniques

### 7.1 Scope of Consideration

In this section, we explain how we have determined whether the Applicant's proposals are the Best Available Techniques for this Installation.

- We consider in particular control measures for the emissions which were not screened out as insignificant in the previous section on minimising the installation's environmental impact. They are: Emissions of Oxides of nitrogen (NO<sub>x</sub>), expressed as NO<sub>2</sub>
- We consider energy efficiency, and options for Combined Heat and Power, and the compliance with the Energy Efficiency Directive;
- We consider the cooling system proposed

Chapter III of the IED specifies a set of maximum emission limit values. Although these limits are designed to be stringent, and to provide a high level of environmental protection, they do not necessarily reflect what can be achieved by new plant. Article 14(3) of the IED says that BAT Conclusions shall be the reference for setting the permit conditions, so it may be possible and desirable to achieve emissions below the limits referenced in Chapter III. However BAT Conclusions and a revised BREF for LCP have not yet been drafted or published, so the existing BREF and Chapter III of the IED remain relevant.

Even if the Chapter III limits are appropriate, operational controls complement the emission limits and should generally result in emissions below the maximum allowed; whilst the limits themselves provide headroom to allow for unavoidable process fluctuations. Actual emissions are therefore almost certain to be below emission limits in practice, because any Operator who sought to operate its installation continually at the maximum permitted level would almost inevitably breach those limits regularly, simply by virtue of normal fluctuations in plant performance, resulting in enforcement action (including potentially prosecution) being taken. Assessments based on, say, Chapter III limits are therefore "worst-case" scenarios.

We are satisfied that emissions at the permitted limits would ensure a high level of protection for human health and the environment in any event.

## 7.2 Consideration of Combustion Plant

The operator has chosen to operate a CCGT plant in single shaft arrangement which we consider to be BAT.

## 7.3 Consideration of emission control measures

We have reviewed the techniques used by the operator and compared these with the relevant guidance notes.

### **Operating Techniques for insignificant emissions**

Emissions of CO have been previously screened out as insignificant, and so the Environment Agency agrees that the Applicant's proposed technique[s] is BAT for the installation.

We consider that the emission limits included in the installation permit reflect the BAT for the sector.

### **Operating Techniques for NON-insignificant emissions**

Emissions of Oxides of nitrogen (NO<sub>x</sub>), expressed as NO<sub>2</sub> cannot be screened out as insignificant. The Environment Agency has therefore assessed whether the proposed techniques are BAT.

The proposed techniques/ emission levels for priorities for control are in line with the benchmark levels contained in the Combustion Activities Technical Guidance Note (EPR 1.01) and we consider them to represent appropriate techniques for the facility. The permit conditions ensure compliance with relevant BREFs and ELVs deliver compliance with BAT-AELs.

## 7.4 Energy efficiency

### 7.4.1 Consideration of energy efficiency

We have considered the issue of energy efficiency in the following ways:

1. The use of energy within, and generated by, the Installation which are normal aspects of all EPR permit determinations. This issue is dealt with in this section.
2. Choice of cooling system
3. Combined Heat and Power

### 7.4.2 Use of energy within the Installation

Having considered the information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that energy is used efficiently within the Installation.

The Application details a number of measures that will be implemented at the Installation in order to increase its energy efficiency.

### 7.4.3 Choice of Cooling System

The applicant has assessed Once-through cooling, cooling towers and air cooling for the GEC project as part of the original planning application under Section 36 and further with relevant stakeholders and the Environment Agency. The operator has concluded that air cooling is optimal and site specific BAT for the following reasons:

- A number of land agreements would be required from DP World, Shell and other landowners to run once through cooling water pipework from the GEC site to the intake and outfall. Also, to ensure the warmer outfall does not affect the intake the intake structure may have to be at the opposite side of the port to the outfall. Such agreement for land rights for direct or hybrid cooling with DP World is not forthcoming reflecting the build out of the port in particular and the potential disruption to its operations;
- The pipeline infrastructure, which would comprise a significant culvert construction would need to cross underneath the existing seawall, flood defences and railway lines. It will therefore be inherently complex and expensive and air cooling would avoid this complexity and cost;
- LG Port will undertake regular dredging to maintain the integrity of the port operations. This has the potential to disrupt and adversely affect the cooling water intake quality and is likely to impact on the GEC plant performance (in respect of efficiency and availability).

- Once-through cooling requires a significant amount of water abstracted from the River Thames with warmer water discharged from the power station condenser, which would place further ecological stress on the River Thames.
- Cooling towers would also have the same abstraction and discharge ecological stress issues as noted above, albeit on a smaller scale as water will be required for make up to the cooling towers; and

Although once through cooling is considered to be more energy efficient than hybrid or closed loop air cooling, the Environment Agency agrees with the applicant that in this instance closed loop air cooling represents Site Specific BAT for this location as access to cooling waters (Thames) is not viable due to engineering and land access constraints.

#### 7.4.4 Combined Heat and Power

Our CHP Ready Guidance - February 2013 considers that BAT for energy efficiency for new combustion power plant is the use of CHP in circumstances where there are technically and economically viable opportunities for the supply of heat from the outset.

The term CHP in this context represents a plant which also provides a supply of heat from the electrical power generation process to either a district heating network or to an industrial / commercial building or process. However, it is recognised that opportunities for the supply of heat do not always exist from the outset (i.e. when a plant is first consented, constructed and commissioned).

In cases where there are no immediate opportunities for the supply of heat from the outset, the Environment Agency considers that BAT is to build the plant to be CHP Ready (CHP-R) to a degree which is dictated by the likely future opportunities which are technically viable and which may, in time, also become economically viable.

Our CHP-R guidance also states that opportunities to maximise the potential for heat recovery should be considered at the early planning stage, when sites are being identified for incineration facilities.

The location of the Installation largely determines the extent to which waste heat can be utilised, and this is a matter for the planning authority. The Installation will generate electricity only and has been specified to maximise electrical output with little or no use of waste heat.

The CHP Assessment was undertaken through estimates of potential heat loads. As the site is currently being developed specific detailed requirements are not available and it is considered that more detailed information regarding the tenant's heat requirements would be required for a more accurate assessment. The operator will re-consult at a later date with tenants of the LG Development once their detailed heat requirements are known. However to allow any identified and additional future CHP opportunities to be realised, the design (and final build) of the project will incorporate a number of appropriate features which will allow the future implementation of CHP. The plant will be designed and constructed to be CHP – ready in accordance with DEFRA's Good Quality CHP guidance.

We consider that, within the constraints of the location of the Installation explained above, the Installation will recover heat as far as practicable, and therefore that the requirements of Article 6(6) are met.

We have set permit condition 1.2.2 to require the operator review the viability of Combined Heat and Power (CHP) implementation at least every 4 years, or in response to any of the specific factors listed in the condition.

The Operator is required to report energy usage and energy generated under condition 4.2 and table S4.2 in Schedule 4. This will enable the Environment Agency to monitor energy efficiency at the Installation and take action if at any stage the energy efficiency is less than proposed.

There are no site-specific considerations that require the imposition of standards beyond indicative BAT, and so the Environment Agency accepts that the Applicant's proposals represent BAT for this Installation.

## 8. Emission limits

The operator has proposed limits in line with part 2 annex V of the IED and emission benchmarks (BAT) given in Combustion Activities Technical Guidance Note (EPR 1.01). As discussed in section 6 above, emissions at these limits will not cause significant pollution. Consequently we have accepted the proposed limits and incorporated them into table 3.1 of the permit.

“Low Load” Gas Turbine Emission Limits: set when the load varies between MSUL/MSDL and base load during the daily reference period:

IED Annex V ELVs for GTs apply when the load is >70%. However, the Applicant has also agreed that IED Annex V ELV's will additionally apply when the load varies between MSUL/MSDL and base load during the daily reference period.

As discussed in section 6, they have provided air dispersion modelling data demonstrating that these emissions will not cause significant pollution. We have reviewed the operator's assessment of the environmental risk and justification for the limits and consider it to be satisfactory for the substances specified. IED Annex V ELVs still apply for operation at >70% load.

## 9. Monitoring & Reporting

Gas fired plant:

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

The IED Annex V ELVs for oxides of nitrogen and carbon monoxide apply to OCGTs, CCGTs and mechanical drive 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.

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. For a new plant, such as this, in pre-operational commissioning the same requirement applies

#### 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.

#### Resource efficiency metrics:

A more comprehensive suite of reporting metrics has been added to the permit template for Electrical Supply Industry (ESI) plant. Table S4.2 “Resource Efficiency Metrics” has been added requiring the reporting of various resource parameters, as this is an ESI power plant. This table is being used for all ESI plant.

## 10. 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.	N/A
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.	N/A
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;	N/A
37	Provisions for malfunction and breakdown of abatement equipment including notifying the EA.	N/A
38	Monitoring of air emissions in accordance with Ann V Pt 3	3.5, 3.6
40	Multi-fuel firing	N/A
41(a)	Determination of start-up and shut-down periods	2.3.12 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 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.	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	NA
Ann V Pt 1(6(1))	Definition of natural gas	Schedule 6, Interpretation
Ann V Pt 2	Emission limit values	3.1.2 Schedule 3, Table S3.1
AnnV Pt 3(1)	Continuous monitoring for >100MWth for specified substances	3.5, 3.6 Schedule 3, Table S3.1
AnnV Pt 3(2, 3, 5)	Monitoring derogations	3.5.1 Schedule 3, Table S3.1

<b>IED Article Reference</b>	<b>IED requirement</b>	<b>Permit condition</b>
AnnV Pt3(4)	Measurement of total mercury	N/A
AnnV Pt3(6)	EA informed of significant changes in fuel type or in mode of operation so can check Pt3 (1-4) still apply	N/A
AnnV Pt3(7)	Monitoring requirements	3.5.1 Schedule 3, Table S3.1
AnnV Part 3(8,9,10)	Monitoring methods	3.5, 3.6
AnnV Pt 4	Monthly, daily, 95%ile hourly emission limit value compliance	3.5.1 Schedule 3, Table S3.1
AnnV Pt7	Refinery multi-fuel firing SO <sub>2</sub> derogation	N/A

## Annex 1: decision checklist

This document should be read in conjunction with the application, supporting information, site condition report evaluation report (SECRET) and permit.

Aspect considered	Justification / Detail	Criteria met
		Yes
<b>Receipt of submission</b>		
Confidential information	A claim for commercial or industrial confidentiality has not been made.	✓
Identifying confidential information	We have not identified any information provided as part of the application that we consider to be confidential. The decision was taken in accordance with our guidance on commercial confidentiality.	✓
<b>Consultation</b>		
Scope of consultation	<p>The consultation requirements were identified and implemented. The decision was taken in accordance with our Public Participation Statement and our Working Together Agreements. For this application we consulted the following bodies on the original application:</p> <ul style="list-style-type: none"> <li>➤ Environmental Health Department, Wakefield Metropolitan District Council</li> <li>➤ Public Health England</li> <li>➤ Directors of Public Health</li> <li>➤ Health and Safety Executive</li> <li>➤ National Grid.</li> </ul> <p>Further consultation was made on 23/01/2015 to those respondents of the original consultation, due to further information being received (Amendment to the application by the operator to increase from 1200MWe to 1250MWe output).</p>	✓
Responses to consultation	The web publicising, and consultation responses (Annex 2) were taken into account in the decision. The decision was taken in accordance with our guidance.	✓
<b>Operator</b>		
Control of the facility	We are satisfied that the applicant (now the operator) is the person who will have control over the operation of the facility after the grant of the permit. The decision was taken in accordance with EPR RGN 1 Understanding the meaning of operator.	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
<b>European Directives</b>		
Applicable directives	All applicable European directives have been considered in the determination of the application. The requirements of Chapter III and Annex V of the IED relating to large combustion plant have been implemented in this permit.	✓
<b>The site</b>		
Extent of the site of the facility	The operator has provided plans which we consider are satisfactory, showing the extent of the site of the facility including discharge and emission points. Two plans are included in the permit and the operator is required to carry on the permitted activities within the site boundary.	✓
Site condition report	<p>The operator has provided a description of the condition of the site.</p> <p>We consider this description is satisfactory. The decision was taken in accordance with our guidance on site condition reports and baseline reporting under IED– guidance and templates (H5).</p>	✓
Biodiversity, Heritage, Landscape and Nature Conservation	<p>The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat.</p> <p>A full assessment of the application and its potential to affect the site(s) species/habitat has been carried out as part of the permitting process. We consider that the application will not affect the features of the site, species or habitat</p> <p>Formal consultation has been carried out with Natural England.</p> <p>Please see Key issues section 6.3</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
<b>Environmental Risk Assessment and operating techniques</b>		
EIA	<p>In determining the application we have considered the Environmental Statement dated February 2010. We have also considered the planning permission and the committee report approving it.</p> <p>The original Consent application (26th April 2010) for GEC comprised of an application under Section 36 of the Electricity Act 1989 to the Department of Energy and Climate Change (DECC) to construct and operate a power station of greater than 50MWe together with deemed planning permission under Section 90 of the Town and Country Planning Act 1990, this was approved on 11th August 2011.</p> <p>In August 2014, the operator submitted an application to the Department of Energy and Climate Change (DECC) requesting that the original Section 36 Consent was varied so as to allow an increase in the permitted generation capacity of GEC from about 900 MW to up to 1250 MW. In preparing the application, the information included in the original Environmental Statement (Parsons Brinckerhoff, February 2010) and the May 2015 Study was reviewed and updated/supplemented.</p>	✓
Environmental risk	<p>We have reviewed the operator's assessment of the environmental risk from the facility. The operator's risk assessment is satisfactory. The assessment shows that, applying the conservative criteria in our guidance on Environmental Risk Assessment, all emissions may be categorised as environmentally insignificant with the exception of NO<sub>2</sub> emissions to air.</p> <p><u>Point source emissions to air:</u></p> <p>In order to check the validity of the applicants' predictions, the Environment Agency undertook its own detailed check of the modelling and the dispersion modelling data using ADMS version 5.1. Following the review of the range of operating conditions submitted by the applicant, the Environment Agency considers that the facility is unlikely to contribute to exceedances of the EQSs for human health provided that the local background concentrations remain sufficiently below the EQS.</p> <p>Please see key issues section 6.3</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
	<p><u>Point source emissions to water:</u></p> <p>There are no emissions directly to controlled waters or sewer</p> <p>Please see key issues section 6.3</p> <p><u>Fugitive emissions to land and water:</u></p> <p>Section 3 - Supporting Information: Form B2 contains the H1 risk assessment which covers fugitive emissions to water and groundwater. The key risks being leaks from or failures of storage tanks, leaks from tanker offloading and failure of pipework or drains. The Environment Agency have reviewed the operators preventative measures (see operating techniques section below) and consider that fugitive emissions will not pose a significant risk to the environment.</p> <p><u>Fugitive emissions to air:</u></p> <p>Steam from the HRSG, auxiliary boilers, start-up vents, pressure relief valves, blow down vents and steam turbine seals have the potential to create steam clouds. However, it is considered unlikely that the steam will reach offsite due to the separation distances thus preventing steam being released off of the site.</p> <p>Natural gas combustion is inherently a non-odorous process no associated odour is anticipated outside of the permitted installation boundary.</p> <p><u>Noise:</u></p> <p>There are a number of noise sources associated with the Installation and these could potentially impact nearby sensitive receptors</p> <p>Please see key issues section 6.7.</p>	

Aspect considered	Justification / Detail	Criteria met Yes
	<p>The BS4142:1997 assessment provided by the applicant has been reviewed by the Environment Agency. We agree with the operator that that noise generated by the proposed power station is low risk and unlikely to cause complaint. The applicant's assessment, dated May 2014, pre-dates publication of the revised BS4142:2014 in November 2014.</p> <p><u>Accident risks:</u></p> <p>There are potential accident risks and hazards associated with the Installation. The Accident Management Plan will form a key part of both the EMS and the Site Emergency Plan and will be communicated to all employees, managers and contractors who work at the site and tested using regular drills or exercises. A preventative accident regime will consider a wide range of potential hazard scenarios resulting from both normal and abnormal operating conditions.</p> <p>Prior to commissioning the plant, a site plan will be produced which identifies the location of emergency spill kits, firefighting equipment, drain caps, drainage detail, chemical, oil and waste storage, discharge points and local neighbours. The entire site will be included within a Fire Protection System and the fire-fighting system will be tested periodically. Sizing of bunded areas and fire water treatment will be determined in accordance with PPG18 'Managing Fire Water and Major Spillages' and 'CIRIA Report 164: Design of Containment Systems for the Prevention of Water Pollution from Industrial Incidents'.</p> <p>The Installation will not be a Control of Major Accident Hazards (COMAH) site and will not impact on the health and safety activities of any such sites in the vicinity.</p>	



Aspect considered	Justification / Detail	Criteria met
		Yes
Operating techniques	<p>We have reviewed the techniques used by the operator and compared these with the relevant guidance notes. Emissions of carbon monoxide have been previously screened out as insignificant and so the Environment Agency agrees that the applicant's proposed techniques are BAT for the installation.</p> <p>NO<sub>2</sub> emissions to air are not insignificant and have been discussed in further detail in the Key Issues and Environmental Risk Sections of this document. Dry Low NOx (DLN) gas turbines are to be used as standard at GEC limiting the production of NOx.</p> <p>The proposed techniques/emission levels for priorities for control are in line with the benchmark levels contained in the TGN and we consider them to represent appropriate techniques for the facility. The permit conditions ensure compliance with relevant BREFs and ELVs deliver compliance with BAT-AELs.</p> <p>We have considered the applicants' justification for departure from the guidance with respect to closed loop cooling and accept this. Reasons and details are provided in Section 7.4.3 in the Key Issues Section of this document.</p> <p>The installation does not have combined heat and power (CHP). To ensure the power station is CHP ready (CHP-r), space requirements will be incorporated into the equipment layout design within the turbine buildings and at detailed design provision for steam or hot water options will be considered. A blank connection will be provided to facilitate future steam off take from the steam-turbine casing at an intermediate point. Please see Section 7.4.4 in key issues.</p> <p>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 four yearly energy efficiency review.</p>	✓
<b>The permit conditions</b>		

Aspect considered	Justification / Detail	Criteria met
		Yes
Use of conditions other than those from the template	Based on the information in the application, we consider that we do not need to impose conditions other than those in our permit template, which was developed in consultation with industry having regard to the relevant legislation.	✓
Pre-operational conditions	<p>Based on the information in the application, we consider that we need to impose pre-operational conditions as follows:</p> <ul style="list-style-type: none"> <li>➤ Prior to the commencement of commissioning, the Operator shall send a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS.</li> <li>➤ Prior to the commencement of commissioning, the Operator shall submit a report on the baseline conditions of soil and groundwater at the installation. The report shall contain the information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definitive cessation of activities provided for in Article 22(3) of the IED.</li> </ul>	✓
Improvement conditions	<p>Based on the information on the application, we consider that we need to impose an improvement condition. We have imposed an improvement condition to ensure that:</p> <ul style="list-style-type: none"> <li>➤ definitions of the minimum start-up load (MSUL) and the minimum shut-down load (MSDL) parameters are set</li> <li>➤ provision of net rated thermal input values for LCP420 and LCP421.</li> <li>➤ Confirmation of implementation of the EMS and progress towards ISO14001 certification.</li> </ul>	✓
Incorporating the application	We have specified that the applicant must operate the permit in accordance with descriptions in the application, including all additional information received as part of the determination process. These descriptions are specified in the Operating Techniques table in the permit.	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
Emission limits	<p>We have decided that emission and process limits should be set for the parameters listed in the permit and have incorporated them into Tables S3.1 and S3.2. The following substances (other than CO which is required by Annex V of the IED) have been identified as being emitted in significant quantities to either air or water and ELVs and equivalent parameters or technical measures based on BAT and Annex V of the IED have been set for these:</p> <p><u>Air:</u> nitrogen oxides carbon monoxide</p> <p><u>Water:</u> pH</p> <p>NO<sub>2</sub> emissions to air are only considered significant with regards to emissions from the HRSG stacks.</p> <p>Sulphur dioxide emissions will be reported as six monthly concentrations on the basis of the fuel sulphur content without continuous or periodic monitoring being carried out. This is because only trace quantities of sulphur are present in UK natural gas.</p> <p>For gas turbines the Environment Agency does not require any reporting for dust emissions as natural gas is an ash free and highly efficient combustion process and the turbines do not generate additional particulate matter. The fuel gas is filtered as well as the intake air resulting in a lower dust concentration in the flue emissions compare to the ambient air.</p> <p>The IED Annex V ELVs for oxides of nitrogen and carbon monoxide apply to CCGTs when the load is &gt;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 the beginning of shut-down.</p> <p>Air and water modelling/assessment data has been provided and demonstrates that the emissions will not cause significant pollution. We have reviewed the operator's assessment of the environmental risk and consider it to be satisfactory for the substances specified.</p>	✓
Monitoring	<p>We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified. These monitoring requirements have been imposed in order to meet the requirements of Annex V of the IED.</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
	Based on the information in the application we are satisfied that the operator's techniques, personnel and equipment have either MCERTS certification or MCERTS accreditation as appropriate.	
Reporting	<p>We have specified reporting in the permit. Sulphur dioxide emissions will be reported on fuel sulphur content since only trace quantities of sulphur are present in UK natural gas. Dust emissions will not be reported as the fuel gas and inlet air is filtered resulting in lower dust content.</p> <p>We made these decisions in accordance with the requirements of Annex V of the IED.</p>	✓
<b>Operator Competence</b>		
Environment management system	<p>There is no known reason to consider that the operator will not have the management systems to enable it to comply with the permit conditions. The decision was taken in accordance with our guidance on what a competent operator is.</p> <p>The applicant is planning to have a management system in place which complies with International Standard ISO14001. An improvement condition is included requiring the operator to submit a written report on its implementation within 6Mths from date of commissioning the facility.</p>	✓
Relevant convictions	The Case Management System and National Enforcement Database have been checked to ensure that all relevant convictions have been declared. No relevant convictions were found.	✓
Financial provision	There is no known reason to consider that the operator will not be financially able to comply with the permit conditions. The decision was taken in accordance with our guidance on what a competent operator is.	✓

## Annex 2: Consultation and web publicising responses

Summary of responses to consultation, and web publication and the way in which we have taken these into account in the determination process.

<b>Response received from</b>
Public Health England - 08/06/2015.
<b>Brief summary of issues raised</b>
Based on the information contained in the application supplied to us, Public Health England has no significant concerns regarding the risk to the health of the local population from this installation.  This consultation response is based on the assumption that the permit holder shall take all appropriate measures to prevent or control pollution, in accordance with the relevant sector guidance and industry best practice.
<b>Summary of actions taken or show how this has been covered</b>
Appropriate measures are discussed in "Operating Techniques" section of this decision document.

<b>Response received from</b>
National Grid - 04/08/2014.
<b>Brief summary of issues raised</b>
National Grid has identified that it has no record of apparatus in the immediate vicinity of your enquiry.  National Grid therefore has no objection to these proposed activities.
<b>Summary of actions taken or show how this has been covered</b>
No further action required

<b>Response received from</b>
Director of Public Health – 04/09/2014 and 23/01/2015
<b>Brief summary of issues raised</b>
<p>Recommendation made by Public Health England that any Environmental Permit issued for this site should contain conditions that the following potential emissions do not impact upon public health:</p> <ul style="list-style-type: none"> <li>• Emissions to air, principally oxides of carbon and nitrogen.</li> </ul>
<b>Summary of actions taken or show how this has been covered</b>
<p>04/09/2014</p> <p>The operator has proposed limits in line with part 2 annex V of the IED and emission benchmarks (BAT) given in Combustion Activities Technical Guidance Note (EPR 1.01). As discussed in section 6 above, emissions at these limits will not cause significant pollution. Consequently we have accepted the proposed limits and incorporated them into table 3.1 of the permit.</p> <p>23/01/2015</p> <p>PHE do not wish to make further comments or representations to this application.</p>