**Industrial Emissions Directive**

# Response to the Environmental Permitting (England and Wales) Regulations 2016 Regulation 61(1) request for further information on compliance with BREF Requirements for Large Combustion Plant

CONNAH'S QUAY POWER STATION
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DEESIDE
CH5 4BP
Permit Reference: EPR/NP3037AF

## 1) Introduction

In response to your information notice dated 9th May 2018, issued under regulation 61(1) of the Environmental Permitting Regulations and in relation to the above permit, please find enclosed a report covering our response to the questions raised.

In answering the questions, we have referred to the Best Available Techniques (BAT) Reference Document (BRef) for Large Combustion Plants (LCP) issued 17th August 2017. This response relates to the four combined cycle gas turbines at Connah's Quay only. The Site Environmental Permit also includes the operation of the gas treatment plant as part of the installation, however this is not covered within the scope of this variation as it is not subject to the LCP BREF requirements.

## 2) Contents

- Response to Reg 61 questions
- Appendix 1 BAT Assessment Spreadsheet
- Appendix 2- H1 Water assessment for in response to LCP BREF Regulation 61 notice
- Appendix 3 - Risk assessment considering the possibility of soil and groundwater contamination.
- Appendix 4 - DEFINING EFFECTIVE DRY LOW $NO_X$ (E-DLN) OPERATION

## 3) Responses:

### a) Information on combustion plant between 1MWth and less than 50MWth.

Information relating to these plants has been provided in the accompanying spreadsheet.

### Compliance with BAT Conclusions

### Questions 1-4

Information has been provided in the attached spreadsheet describing how Connahs Quay currently meets the BAT requirements. Connahs Quay is either compliant or intends to be compliant with the relevant BREF conclusions. Connahs Quay does not intend to apply for any derogations now.

### Question 5

This question is not relevant to Connahs Quay.

### Question 6

a) We have carried out a review of discharges to surface waters and/or sewer from the site, all relevant discharge points are continually monitored in line with the requirements of the site environment permit and M18. The site has an appointed MCERTS officer, and all relevant monitoring equipment meets MCERTS requirements where possible.

b) We have carried out a screening tests for priority hazardous pollutants and any other relevant priority hazardous substances that are discharged to surface water. The full detail of this assessment is in Appendix 2. In summary all substances considered can been screened out as presenting no risk to the environment. Therefore, no further tests or modelling are required for discharges to surface waters from Connah's Quay.

**Question 7**

In accordance with question 7 of the Regulation 61(1) notice we carried out a risk assessment considering the possibility of soil and groundwater contamination at the installation for hazardous substance and this assessment is attached. In summary, this assessment concludes, all substances considered can been screened out as presenting no risk to the environment. Therefore, no further tests or modelling are required for discharges to surface waters from Connah's Quay. Further detail is set out in appendix 2.

**Appendix 1 BAT Assessment Spread sheet**

**Appendix 2 H1 WATER ASSESSMENT FOR CONNAH'S QUAY POWER STATION IN RESPONSE TO LCP BREF REGULATION 61 NOTICE**

**Appendix 3 Risk assessment considering the possibility of soil and groundwater contamination**

## Appendix 4 Defining effective dry low NOx (E-DLN) operation

The ISO Net Base Load Combined Cycle Gas Turbine (CCGT) Plant Efficiency, when firing on Natural Gas, is 55% based on historic performance testing, as declared previously. The associated Plant Net Thermal Input is 651 $MW_{th}$. These are the station average values, noting that there is little variation between units (see BAT 2 in Appendix 1).

The applicable top-of-range Annual $NO_x$ BAT-AEL for this Natural Gas fired, Dry Low $NO_x$ (DLN), combustion system is 40 mg/$m^3$ and this is the proposed Annual $NO_x$ Emission Limit Value (ELV). The current Permit Daily ELV of 75 mg/$m^3$ is higher than the Bref AEL therefore the daily ELV will reduce to 50 mg/$m^3$ at 15% $O_2$, dry. These Emission Limit Values (ELVs) are applicable only when the DLN system is fully effective.

The applicable top-of-range indicative CO Annual BAT-AEL is 30 mg/$m^3$ and the current monthly permit limit is 30 mg/$m^3$, therefore it is proposed that the Annual ELV is set at 30 mg/$m^3$ in line with the current Monthly ELV.

The DLN system premixes the fuel with a large excess of combustion air, upstream of the combustor. The lean premix combustion system is much more complex, and more dependent on precision engineered components, than conventional diffusion flame systems and the $NO_x$ can increase over time, across outage cycles, due to degradation of the fuel injection system, air leakage into the combustor and/or instrumentation issues. The $NO_x$ emissions are also more sensitive to fluctuations in fuel quality and ambient conditions. For all of these reasons, the top-of-range BAT-AEL values are appropriate.

The IED (Annex V) specifies additional Monthly ELVs of 50 mg/$m^3$ for $NO_x$ and 100 mg/$m^3$ for CO. The current Permit specifies Monthly ELVs of 75 mg/$m^3$ for $NO_x$ and 30 mg/$m^3$ for CO. Therefore, Monthly ELVs of 50 mg/$m^3$ for $NO_x$ and 30 mg/$m^3$ for CO are appropriate in order to comply with either the IED or the current Permit (where lower). These apply only when the DLN system is fully effective.

The IED (Annex V) also specifies additional Annual Hourly Percentile ELVs of 100 mg/$m^3$ for $NO_x$ and 200 mg/$m^3$ for CO. The current Permit specifies Annual Hourly Percentile ELVs of 110 mg/$m^3$ for $NO_x$ and 60 mg/$m^3$ for CO. Therefore, Annual Hourly Percentile ELVs of 100 mg/$m^3$ for $NO_x$ and 60 mg/$m^3$ for CO are appropriate to be in line with the current Permit which is lower than IED. These apply only when the DLN system is fully effective.

Effective-DLN (E-DLN) is defined as the operating point above which compliance with the above Annual $NO_x$ and CO ELVs can be achieved with the DLN combustion system. Effective-DLN (E-DLN) also requires compliance with the above Monthly, Daily and Hourly Percentile ELV requirements.

The proposed E-DLN operating point is therefore defined as 250 $MW_e$ gross generated (equivalent to 70% of the guarantee ISO Base Load gross generation). It has been agreed with the regulators that effective DLN should be at the point at which CO and NOx emissions meet the appropriate ELVs. In this case, CO is the main constraint (at 30 mg/$m^3$) when starting the gas turbine from cold. However, some NOx hourly averages are also higher than 40 mg/$m^3$ between MSUL and 70% load.

The Minimum Start Up Load (MSUL) is currently defined by parameters relating to the load path followed during start-up and this definition remains unchanged including the back-stop value of 160 $MW_e$ (which is 44% of ISO Base Load). Operation between MSUL and the E-DLN operating point is regulated by specifying an additional Daily ELV only for both $NO_x$ and CO as per current UK arrangements. The Connahs Quay permit currently includes additional Daily ELVs of 75 mg/m$^3$ for $NO_x$ and 200 mg/m$^3$ for CO. Due to the higher values at start-up which can remain high for short period of time Connahs Quay needs to retain the current additional daily ELVs that apply from MSUL to base load.

Both E-DLN and MSUL are defined in relation to the current combustion and emissions characteristics whilst also taking into account potential future mechanical degradation of the gas turbine and the, as yet unknown, post-2021 operating regimes.

To summarise, Table 1 below details our proposed ELVs for BREF for the Connahs Quay CCGTs:

| Emission | Limit (mg/m$^3$) | Applies above | Type |
|---|---|---|---|
| NOx | 40 | e-DLN | Annual BAT-AEL |
| | 50 | e-DLN | Daily BAT-AEL |
| | 50 | e-DLN | IED Monthly ELV |
| | 100 | e-DLN | IED Annual Hourly 95$^{th}$ percentile ELV |
| | 75 | MSUL/MSDL | Current Part Load Daily Mean |
| CO | 30 | e-DLN | Annual BAT-AEL (indicative) |
| | 30 | e-DLN | Current Monthly ELV |
| | 30 | e-DLN | Current Daily ELV |
| | 60 | e-DLN | Current Annual Hourly 95$^{Th}$ percentile ELV |
| | 200 | MSUL/MSDL | Current Part Load Daily Mean |