

Natural Resources Wales permitting decisions

Variation and Consolidation of a bespoke Permit

We have decided to issue a Natural Resources Wales initiated variation for Pembroke Power Station in West Pennar, Pembroke, Pembrokeshire, SA71 5SS operated by RWE Generation UK plc.

The variation number is **EPR/DP3333TA/V004**.

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.

The Permit has been varied following the publication of the revised Best Available Techniques (BAT) Reference Document (BREF) for Large Combustion Plant (LCP). The associated BAT conclusions to this document were published on 17 August 2017 in the Official Journal of the European Union.

This variation incorporates the changes required by the Industrial Emissions Directive following a statutory review of permits in the Large Combustion Plant sector. These include the amendment of the wording of several permit conditions relating to notifications, changes to emission limits and monitoring requirements.

We are satisfied that the operator will be compliant with the published BAT conclusions which will apply from 17 August 2021.

Purpose of this document

This decision document:

- explains how we have carried out our statutory review of the Operator's Permit;
- why we have decided to vary the Permit as a result of that review; and
- why we have included the specific conditions in the revised Permit through the variation notice we are issuing.

It is our record of our decision-making process, to show how we have taken into account all relevant factors in reaching our position.

Structure of this document

- Assessment of Pembroke Power Station against the published BAT conclusions for large combustion plant.
- Annex 1 – Decision Checklist regarding relevant BAT Conclusions

Assessment of Pembroke Power Station against the published BAT conclusions for large combustion plant.

1. Our decision

We have issued a variation which will allow RWE Generation UK plc to operate the installation, subject to the conditions in the varied permit.

The variation does two things:

- it brings the permit into line with our modern regulatory template; and
- it varies the permit where appropriate to reflect the outcome of our statutory review and incorporate Best Available Techniques (BAT) and associated Emission Limit Values (ELVs).

We consider that, in reaching this decision, we have taken into account all relevant considerations and legal requirements and that the permit will continue to ensure that a high level of protection is provided for the environment and human health.

The original permit, issued on 10 November 2011 ensured that the installation, employed Best Available Techniques (BAT) and ensured a high level of protection for human health and the environment. We have altered the permit as a result of the statutory review, and we are confident that the new requirements will deliver a superior level of protection to that which was previously achieved.

2. The legal framework

The Variation and Consolidation Notice (which includes the consolidated permit as Schedule 2) will be issued under Regulation 20 of the Environmental Permitting (England and Wales) Regulations 2016 (EPR). The environmental permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* as described by the Industrial Emissions Directive (IED);

- subject to aspects of other relevant legislation which also have to be addressed.

We consider that, in issuing the Variation Notice and consolidated Permit, it will ensure that the operation of the installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

3. How we reached our decision

Requesting information to demonstrate compliance with BAT Conclusion techniques

We issued a Notice under Regulation 61(1) of the Environmental Permitting (England and Wales) Regulations 2016 on 10 May 2018 requiring the operator to provide information to demonstrate how the operation of their installation currently meets, or will subsequently meet, the revised standards described in the relevant BAT Conclusions document.

The Regulation 61(1) notice required the operator to:

- Describe the techniques that will be implemented before 17 August 2021, which will then ensure that operations meet the revised standard, or
- Justify why standards will not be met by 17 August 2021, and confirmation of the date when the operation of those processes will cease within the installation or an explanation of why the revised BAT standard is not applicable to those processes, or
- Justify why an alternative technique will achieve the same level of environmental protection equivalent to the revised standard described in the BAT Conclusions.
- Where the permitted activity involves the use, production or release of a hazardous substance, as defined in Article 3(18) of the Industrial Emissions Directive, RWE Generation UK plc were required to carry out a risk assessment considering the possibility of soil and groundwater contamination at the permitted installation with such substances. Where risk of such contamination is established prepare a

baseline report containing information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definite cessation of the activity.

With regard to the fourth bullet point above, RWE Generation UK plc have a site condition report from when the original permit was determined in 2011. In order to meet the requirements of the IED with regard to relevant hazardous substances, RWE Generation UK plc is appointing a specialist consultant who will, as a first step, perform a preliminary investigation at the installation in order to consider the possibility of soil and groundwater contamination by relevant hazardous substances.

Depending on the findings of the preliminary investigations, the following subsequent actions will be taken:

1. where the preliminary investigations determine that the risk of contamination with relevant hazardous substances is negligible, the preliminary investigation reports will be submitted to NRW for approval.
2. here a risk of contamination with relevant hazardous substances is established, a detailed investigation will be carried out. This will include the development of monitoring plans, which will be submitted to NRW for approval, prior to commencement of intrusive investigations. The output from each of the detailed investigations will be a baseline report which quantifies the state of soil and groundwater contamination by relevant hazardous substances.

Scheduling: The preliminary investigations were planned to commence at the end of 2018, with any required detailed investigations commencing at the end of 2019. It is intended that all works, including the final baseline reports, will be completed by mid-2020.

- Where the permitted activity involves the release of priority hazardous substances, as defined by the Water Framework Directive, RWE Generation UK plc were required to carry out a risk screening assessment considering the presence of priority hazardous substances at the permitted installation. Where a risk of these substances is established the operator is to sample the effluent and screen for the priority hazardous substances. If these substances are found to be present in the effluent stream, then assessment using the H1 tool and potential detailed dispersion modelling will be required to demonstrate that the effluent discharge will not have a significant impact to the receiving water.

- Where the compliance with the BAT conclusions leads to the substantial refurbishment or installation of new combustion plant with an aggregate thermal input of greater than 20MWth, which generates more than 100kWth of heat, RWE Generation UK plc must provide sufficient technical and commercial evidence to demonstrate compliance with Article 14, Paragraph 5 of Directive 2012/27/EU on Energy Efficiency. This must include an assessment of the technical feasibility and costs of installing a combined heat and power (CHP) system or providing district heating and, where this assessment shows that the costs are not disproportionate to the benefits, proposals to incorporate these measures into the plant.

Where the operator proposed that they were not intending to meet a BAT standard that also included a BAT Associated Emission Level (BAT-AEL) described in the BAT Conclusions Document, the Regulation 61(1) Notice requested that the operator make a formal request for derogation from compliance with that AEL (as provisioned by Article 15(4) of IED). In this circumstance, the Notice identified that any such request for derogation must be supported and justified by sufficient technical and commercial information that would enable us to determine acceptability of the derogation request. No derogation applied for.

The Regulation 61(1) Notice response from the operator was received on the 16 November 2018 and additional information provided on the 28 August 2019. We considered that the response contained sufficient information for us to commence determination of the permit review. The Operator did make a claim for commercial confidentiality but was later withdrawn. We have not received any information in relation to the Regulation 61(1) Notice response or subsequent additional information that appears to be confidential in relation to any party.

4. Key issues/Regulation 61(1) response

BAT Conclusions for the large combustion plants were published as a Commission Implementing Decision 2017/1442/EU) in the Official Journal of the EU on 17 August 2017. There are 75 BAT Conclusions. This annex provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This should be read in conjunction with the permit/variation notice issued.

A detailed response was received from RWE Generation UK plc. Following assessment of the Regulation 61(1) response, further information was requested from RWE Generation UK plc (request sent 10 June 2019). Where the operator has concluded that they have achieved BAT, and we are in agreement, no further information/justification has been sought by Natural Resources Wales.

The energy efficiency levels associated with the Best Available Techniques Conclusions

An energy efficiency level associated with the best available techniques (BAT-AEEL) refers to the ratio between the combustion unit's net energy output(s) and the combustion unit's fuel/feedstock energy input at actual unit design. The net energy output(s) is determined at the combustion unit boundaries, including auxiliary systems (e.g. flue-gas treatment systems), and for the unit operated at full load.

For a ≥ 600 MWth CCGT plant, the relevant BAT-AEEL is 50 – 60% for net electrical efficiency. RWE Generation UK plc stated that the net electrical efficiency for Pembroke Power Station is 59%, which is within this range. There are no BAT-AEELs for net total fuel utilisation, or net mechanical energy efficiency for CCGT ≥ 600 MWth.

5. Changes we have made

Improvement Conditions

Based on the information provided in the Regulation 61(1) response, we consider that we need to set improvement conditions. These conditions are set out below. We are using these conditions to require the operator to provide Natural Resources Wales with details that need to be established or confirmed during operations.

Reference	Requirement	Date
IC8	The operator shall produce and submit a written Black Start Response Plan to Natural Resources Wales, for approval. The plan shall contain an impact assessment demonstrating that	02/01/2021

	there is no significant environmental risk associated with black start operations and: • propose a methodology for minimisation of environmental impact during such a period of operation; and • include the procedure for the notification of black start operation and its duration. The methodology for operation and reporting set out in the report shall be implemented by the Operator from the date of approval by Natural Resources Wales.	
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There may be circumstances where there may be significant partial or total failure of the electrical supply system across Great Britain (note that the system in Northern Ireland is separate). In this circumstance (a Black Start Event), National Grid ESO (electricity system operator) may issue instructions (Black Start Instructions) to those plant who are providers of black start services to operate in order to re-establish the electrical grid system. More information on Black Start is available on the National Grid ESO website - <https://www.nationalgrideso.com/balancing-services/system-security-services/black-start>

During such an Event, it may be that plant called upon to operate may do so in a mode that is not optimised and may be operated in such a way that not all abatement equipment is operational or effective. It is therefore possible that such plant may exceed emission limit values included in the environmental permits.

To ensure that the impact of such operation is minimised as far as is practical, IC8 has been included in the permit. This improvement condition requires that the operator provides to NRW a Black Start Response Plan, which sets out what the operator will do during a Black Start Event.

This plan is expected to include:

1. An assessment of the potential impact from the operation of the plant during a Black Start Event. This can be demonstrated from a generic sector study and after event site specific assessment.
2. What actions (as far as is possible and practical) that the operator will undertake to minimise environmental impact during such a Black Start Instruction.
3. The procedure for the notification to NRW of the Black Start Instruction and how to provide information on the duration of the instruction.

Items 1, to 3 can also be addressed by inclusion of the above points in an updated version of the IED Compliance Protocol.

Emissions to Water

As part of our delivery of the Water Framework Directive requirements, we need to identify and assess the impact for all discharges to surface waters and/or sewer from the site for priority hazardous substances and any other relevant substances. The emissions monitoring for these substances should be carried out using the methods and standards described in the M18 guidance on “Monitoring of discharges to water and sewer”.

With reference to the risk assessment guidance on the gov.uk website entitled “Surface water pollution risk assessment for your environmental permit” (accessible via: <https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit>) the company carried out the following assessments:

- Screening tests for priority hazardous pollutants and any other relevant priority hazardous substances.
- For any substance which is not screened out by the screening tests further modelling, as described in the risk assessment guidance “Surface water pollution risk assessment for your environmental permit”.

Within the outgoing power station discharge, all substances that were deemed likely to be present as a result of power station operations and were assessed quantitatively,

met the relevant EQS and were therefore screened out by the Phase 1 screening tests and not considered for further modelling as described in H1 Annex D1. The single exception to this was (Total Residual Oxidant) TRO. This was modelled by the operator and assessed extensively during our determination, and its impact deemed to be acceptable. The TRO will be discharged at a concentration in excess of the EQS and therefore a zone, or plume, will exist within the Milford Haven waterway in which the EQS will be exceeded. We consider that the presence of such a mixing zone is acceptable in principle and we have considered in detail the implications of its presence during the original permit determination. The variation will not see a change in TRO concentrations and the permitted TRO daily average limit at W1 will remain as 50 µg/l and not reviewed further.

The company used the H1 screening method to present the emissions data in spreadsheet form to carry out the Phase 1 screening tests and a copy was provided as part of the response to the Regulation 61(1) Notice. The information provided confirmed that the level of pollutants in the discharge were not higher than the EQS (apart from TRO as discussed above) limits for annual average and maximum concentrations. The pollutants are below EQS limits, so we consider the pollutant do not pose a risk to the environment.

Therefore, it can be concluded, for the purposes of this statutory permit review, that the discharge of priority hazardous substances and any other relevant substances to surface waters and/or sewer from the site has been assessed and is deemed acceptable. Emissions meet the requirements of the Water Framework Directive.

The specific BAT Conclusions on water emissions were also reviewed based on the large combustion plant BREF and conditions on water emissions are not applicable to Pembroke Power Station. No changes are made to the ELVs for emissions to water as a result of this variation.

The monitoring frequency for emission point W1(c) has been amended to quarterly average as was agreed previously via Improvement Condition 7.

Emissions to Water – Article 15(4) Derogations

No derogations.

Emissions to Air

There are changes to the ELVs for emissions to air taking into account BAT conclusions from the large combustion plant BREF.

For combustion of gaseous fuels (natural gas): BAT 42, 43, 44 and 45 apply and the tables below outline the BAT-AELs to be set. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit and the reference conditions are in Schedule 6 of the permit

Effective until 16 August 2021:

The table below outlines the existing parameters and limits set to implement the IED Annex V Limits:

Release point	Parameter	Monthly mean	Daily mean	Maximum hourly mean	Effective until
A1-A5	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	50 mg/m ³ 70% to base load ¹	50 mg/m ³ 70% to base load ¹ and MSUL/MSDL to base load ² MSUL/MSDL to base load ²	50 mg/m ³ 70% to base load ¹	16 August 2021
	Carbon Monoxide	100 mg/m ³ 70% to base load ¹	100 mg/m ³ 70% to base load ¹ 250 mg/m ³ MSUL/MSDL to base load ²	200 mg/m ³ 70% to base load ¹	

Note 1: This ELV applies when the load is >70% throughout the reference period.

Note 2: This ELV applies when the load varies between MSUL/MSDL and base load during the daily reference period. MSUL and MSDL are defined in table S1.5.

Effective from 17 August 2021:

The table below outlines the parameters and limits set to implement the BAT-AELs set out in the LCP BREF:

Release point	Parameter	Annual mean	Monthly mean	Daily mean	Maximum hourly mean	Effective from
A1-A5	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	43 mg/m ³ Effective Dry Low NOx to Base load ³	50 mg/m ³ Effective Dry Low NOx to Base load ³	50 mg/m ³ Effective Dry Low NOx to Base load ³ and MSUL/MSDL to base load ²	50 mg/m ³ Effective Dry Low NOx to Base load ³	17 August 2021
	Carbon Monoxide	30 mg/m ³ Effective Dry Low NOx to Base load ³	100 mg/m ³ Effective Dry Low NOx to Base load ³	100 mg/m ³ Effective Dry Low NOx to Base load ³ 250 mg/m ³ MSUL/MSDL to base load ²	200 mg/m ³ Effective Dry Low NOx to Base load ³	

Note 1: This ELV applies when the load is >70% throughout the reference period.

Note 2: This ELV applies when the load varies between MSUL/MSDL and base load during the daily reference period. MSUL and MSDL are defined in table S1.5.

Note 3: This ELV applies between the effective dry low NOx threshold and baseload. Effective dry low NOx thresholds are defined in Table S1.6.

Where applicable, tighter limits than those referenced in the LCP BREF document have remained in place to ensure no backsliding of limits. Maximum figures for hourly means have also been retained rather than changing to 95%iles. The main change in emission limits and monitoring following the publication of the LCP BREF is the inclusion of annual limits which were not previously in the permit.

The operator has proposed limits in line with the BAT-AELs set out in the 2017 LCP BAT Conclusions. Consequently, we have accepted the proposed limits and incorporated them into table S3.1 of the permit emission limits. We have also added two annual limits as required by the BREF. One for oxides of nitrogen (NO and NO₂ expressed as NO₂) (NO_x) and carbon monoxide (CO) emissions as detailed in the table above. The annual limit for NO_x is in line with footnote (8) of Table 24 of the Large Combustion Plant BREF in that for plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the BAT-AEL range, corresponding to [higher end] × EE/55, where EE is the net electrical efficiency of the plant determined at ISO baseload conditions. Therefore, the annual limit for NO_x as of 17 August 2021 will be 43mg/m³. The operator will demonstrate EE through routine auditing. For completeness, the Diesel emergency generators (A9-A11), Diesel driven fire pump (A14) and gas heater vents (preheater A6-8) have been included in table S3.1 with no emission limits set.

No Emission Limit Values are set for the less than 500 hours operation as in line with the BREF.

The reporting period will begin from the next full reporting period. Specifically, monthly reporting period begins the following completion of full month i.e. September 2021. Daily reporting period begins following completion of first full day i.e. 18 August 2021.

Emissions to Air – Article 15(4) Derogations

No derogations.

Directive 2012/27/EU on Energy Efficiency (EED)

Compliance with the BAT conclusions has not resulted in the substantial refurbishment or installation of new combustion plant with an aggregate thermal input of greater than 20MWth, which generates more than 100kWth of waste heat, and all combustion units at the station will be limited to <1500 hours/year operation. Therefore, it is not necessary to demonstrate compliance with Article 14, paragraph 5 of the EED.

Other IED BREFs relevant to the permit review

There are no specific listed activities within Table S1.1 of the permit that are within scope of other published BREFS.

Emissions from Storage, Energy Efficiency, Industrial Cooling Systems BREFs and Monitoring Emissions to Air and Water from IED Installations Reference Report on Monitoring are relevant, however, the key aspects associated with the power station are fixed by the existing infrastructure and no applicable changes or upgrades are appropriate for the remaining life of the station, subject to any requirements to amend conditions in the permit under Article 18 of the IED, or other relevant domestic legislation.

The LCP BATC and the emission monitoring requirements set out in Annex V of IED are in line with the Monitoring Emissions to Air and Water from IED Installations Reference Report on Monitoring. These requirements have been transposed into the Permit.

Condition 1.2 of the permit (Energy Efficiency) requires that the operator shall take appropriate measures to ensure that energy is used efficiently in the combustion activity and also to review on a minimum four yearly basis whether there are opportunities to improve the energy efficiency of the activities and take appropriate measures in line with what is identified. Appropriate measures would include those that are included in the Energy Efficiency BREF.

Similarly permit condition 3.2.1 requires that Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution and permit condition 3.2.3 requires that all liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container. Appropriate measures would include those that are included in the Emissions from Storage BREF.

These conditions are enforceable and we consider that they are sufficient to prevent unauthorised emissions from storage and deliver continuous improvements in energy efficiency at the installation.

Requirements set out in the Industrial Cooling Systems BREF that are relevant to power stations have been addressed through current compliance with existing legislation associated with European eel protection and fish passage, Habitats Directive risk assessments and other designated site protection, water abstraction

control and the Water Framework Directive. Noise has also been assessed during previous determinations.

We recognise that the Emissions from Storage, Energy Efficiency and Industrial Cooling Systems BREFs are now over 10 years old and are due for revision. As such, we consider that the site's compliance with the relevant LCP BATCs, coupled with the permit conditions described above are sufficiently protective as an interim measure, pending the publication of the updated BREFs. Our guidance EPR RGN 12 "Statutory Periodic Permit Reviews" (October 2014) explains that "Permit reviews for installations will normally follow production of revised Best Available Techniques (BAT) standards in EU BAT Reference (BREF) documents for each sector". The permit review is triggered by the publication of the main activity BREF for the sector (LCP in this case) and when this happens, we are required to review the permit against all other relevant extant BREFs at the same time. This ensures that all reviews occur at the same time for a particular sector and that sites where multiple BREFs are applicable are not held in a continuous state of review.

IED paragraph (13) states that "The Commission should aim to update BAT Reference documents not later than 8 years after the publication of the previous version". On this basis, the current LCP BREF is due to be updated by 2025, when the next LCP permit review will be triggered. Any relevant secondary BREFs which have been updated in the meantime (e.g. Emissions from Storage, Energy Efficiency and Industrial Cooling Systems) will be considered as part of this next LCP Permit review, unless the installation undergoes a substantial change as set out in IED Article 20, in which case such a review may occur at an earlier time.

The UK left the EU on 31 January 2020 and entered a Transition Period, during which it will continue to apply EU law. The IED, BAT conclusions published prior to EU Exit and BAT conclusions published during the Transition Period apply in the UK. Arrangements are being put in place to determine BAT for the UK after the end of the Transition Period.

6. Conclusion

We consider that the installation already employed what used to be BAT, and that the operator has achieved significant improvements in performance since the permit was originally granted. The revised BREF and its BAT-AELs provide the opportunity to consider further environmental improvements.

We believe this variation provides a sound basis for ongoing regulation of the installation and we are satisfied that the operator is currently achieving or will be achieving all relevant BAT by 17 August 2021.

We believe that we have ensured compliance with all relevant legal requirements in carrying out this review and making our determination on the variation.

Annex 1: Decision checklist regarding relevant BAT Conclusions

BAT Conclusions for the large combustion plants were published as a Commission Implementing Decision ((EU 2017/1442) in the Official Journal of the EU on 17 August 2017. There are 75 BAT Conclusions. This checklist provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This annex should be read in conjunction with the consolidated variation notice.

All BAT Conclusions arising are listed by number in order below;

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
General BAT conclusions		
1.	Environmental Management Systems Improve overall performance Implement and adhere to an EMS that incorporates key features identified	Currently Compliant The station operates a local EMS which is fully integrated with the RWE Generation UK EMS which is certified to ISO14001: 2015, approval number ISO14001-00012295, the requirements of ISO14001:2015 are consistent with the requirements of BAT1 <i>ix - application of sectoral benchmarking on a regular basis. Specifically for this sector, it is also important to consider the following features of the EMS, described where appropriate in the relevant BAT. RWE is represented on a number of different sectoral groups such as JEP, Energy UK and Eurelectric. As part of this participation we submit data to support the assessment of sector performance measures. These in turn inform the application of BAT by the Regulatory authorities.</i>

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
		<i>x- quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT9). PEB-ENV-LP-3019, PEB-ENG-LP-6562. See also response to BAT 9.</i> <i>xi - a management plan in order to reduce emissions to air and/or to water during other than normal operating conditions, including start-up and shutdown periods (see BAT 10 and BAT 11). See responses to BAT 10 and 11.</i> <i>xii - a waste management plan to ensure that waste is avoided, prepared for reuse, recycled or otherwise recovered, including the use of techniques given in BAT 16. GMD-ENV-007, GMD-ENV-IR-007; BAT 16 is not applicable.</i> <i>xiii - a systematic method to identify and deal with potential uncontrolled and/or unplanned emissions to the environment, in particular:(a) emissions to soil and groundwater from the handling and storage of fuels, additives, by-products and wastes (b) emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities; N/A. Site Accident Management Plan; Site Incident Management and Recovery Plan.</i> <i>xiv - a dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from loading, unloading, storage and/or handling of fuels, residues and additives. N/A.</i> <i>xv - a noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including;</i> <i>(a) a protocol for conducting noise monitoring at the plant boundary</i> <i>(b) a noise reduction programme</i> <i>(c) a protocol for response to noise incidents containing appropriate actions and timelines</i> <i>(d) a review of historic noise incidents, corrective actions and dissemination of noise incident knowledge to the affected parties; N/A.</i> <i>xvi - for the combustion, gasification or co-incineration of malodorous substances, an odour management plan including:</i> <i>(a)a protocol for conducting odour monitoring</i> <i>(b)where necessary, an odour elimination programme to identify and eliminate or reduce the odour emissions.</i>

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
		(c) a protocol to record odour incidents and the appropriate actions and timelines (d) a review of historic odour incidents, corrective actions and the dissemination of odour incident knowledge to the affected parties. N/A.
2.	Efficiency Determine net electrical efficiency and/or net total fuel utilisation and/or net mechanical efficiency Carry out a performance test at full load.	Currently Compliant The station carried out a full load performance test on the following dates: LCP 286 (A1) 13/07/15, LCP382 (A2) 10/09/15, LCP383 (A3) 23/05/15, LCP384 (A4) 07/12/15, LCP385 (A5) 24/10/15, using the methods within appropriate standards, including ASME PTX 46, ISO2314, IEC953-2, the net electrical efficiency for each unit is as follows; LCP 286 (A1) 58.24% , LCP 382 (A2) 58.61%, LCP 383(A3) 58.72%, LCP384 (A4) 58.68%, LCP385 (A5) 58.77%
3.	Monitoring of process parameters Monitor key process parameters for emissions to air and water specified in the corresponding table. Monitoring of specified process parameters.	Currently Compliant The station continuously monitors flue gas emissions for flow, oxygen content, temperature and pressure as required by BAT 3. Water content is not monitored as the sample is dried prior to analysis. ⁷ Flow determination is by continuous calculation using fuel flow rate in line with the requirements from the Industrial Emissions Directive Compliance Protocol. This Protocol is regularly reviewed and is currently being updated to ensure that it fully reflects the requirements of the LCP BREF.
4.	Monitoring of emissions to air Monitor emissions to air with at least the frequency in the corresponding table and in accordance with the EN standards. Monitor emissions to air with at least the frequency in the corresponding table and in accordance with the EN standards.	Currently Compliant The site monitors CO and NOX as required by BAT 4 for natural gas fired turbines. Monitoring is carried out continuously in accordance with EN14181, Local site procedures give specific details of the monitors used.
5.	Monitoring of emissions to water from flue-gas treatment Monitor emissions to water with at least the frequency in the corresponding table and in accordance with the EN standards. Monitor emissions to water with at least the frequency in the corresponding table and in accordance with the EN standards.	N/A Pembroke does not have FGD

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
6.	Environmental performance Improve general environmental performance A variety of techniques	Currently Compliant The station optimises the environmental performance of its combustion plant through techniques b, c, d, e given in BAT 6. Summary of details of the maintenance programme are provided in response below tables. No advanced control systems are employed to control CO and unburnt hydrocarbon specifically other than the continuous monitoring of plant performance described above that would identify issues around both of these parameters. Reducing CO emissions would likely increase NOx emissions, therefore a balance must be found here, whilst also considering the impact of any changes on efficiency and plant integrity. The release of unburnt hydrocarbons would impact efficiency therefore temperature within the turbines are managed to maximise efficiency whilst not compromising the other two elements discussed above.
7.	Reduce emissions of ammonia to air Reduction of ammonia emissions where SCR or SNCR is used. BAT is to optimise the design and/or operation and to meet associated AELs.	N/A Pembroke does not have SCR or SNCR
8.	Prevent or reduce emissions to air Prevent or reduce emissions to air during normal operating conditions. Ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.	N/A Pembroke is not fitted with abatement Summary of details of the maintenance programme are provided in response below tables. The turbines are equipped with a function known as Active TAT (Temperature After Turbine) Control or ATC. Should the NOx emission reach a certain level the Operator can initiate the ATC which results in a change to the combustion settings, effectively a partial re-map, that reduces firing temperature and therefore NOx. The turbines are also equipped with C2+ analysers that can prompt a change in the combustion parameters should the C2+ component of the gas change. See the response to BAT 9 below for more details. In addition to ATC the monitoring of plant performance described above would identify issues with NOx emissions. Reducing NOx emissions would likely increase CO emissions, therefore a balance must be found here, whilst also considering the impact of any changes on efficiency and plant integrity.
9.	Environmental performance and reduce emissions to air Inclusion of a number of elements in the quality assurance/quality control programmes for all the fuels used, as part of the EMS. Techniques (i), (ii) and (iii).	Currently Compliant The fuel gas supplied to the site has been assessed in accordance with technique (i) and is continuously monitored in accordance with technique (ii) Measurement of HHV (used to derive LHV), CH4, C2H6, C3, C4+ and CO2 is carried out continuously using an online gas chromatograph which carries out calculations in accordance with ISO6976. The gas chromatograph is calibrated annually in accordance with ISO17025. The data supplied from the gas monitoring system is used to assess the performance of the plant in

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
		accordance with technique (iii) Gas characterisation is undertaken continuously through the use of a gas chromatograph. Analysis of data is undertaken daily by the Commercial Engineer in order to identify any changes in gas composition that could affect the station in the short term, and detailed interrogation of the data is completed monthly by the Performance Engineer in order to satisfy the requirements of the EU ETS. National Grid Gas burnt at Pembroke is likely to come from one of two sources: Qatar via the local LNG installations or from the North Sea. To date the majority of gas burnt has been Qatar gas and as a result very little variation is seen in its composition, therefore no changes have been required to the turbine combustion parameters to compensate for changing gas composition. Each turbine is also equipped with C2+ analysers that are able to modify the combustion parameters automatically should the C2+ component of the gas exceed a certain level, these are also known as URAS measurements. The engine settings are corrected based on the C2+ measured by these analysers. This concept is also called "wide range logic". This operating concept has several advantages: - o Reliability: The engine is adjusted with a safe margin towards blow-out dynamics even with high changing gas compositions (Wobbe index). - o Emissions: The engine settings can change to compensate should NOx increase as a result of C2+ increase. However due to the very stable nature of the gas burnt at Pembroke this C2+ function has not initiated to date. Turbines are mapped following the processes and considerations described above in order to optimise the three elements of emission, efficiency and plant integrity. See also, Summary of details of the maintenance programme are provided in response below tables.
10.	Reduce emissions to air and/or water Prevent or reduce emissions to air during other than normal operating conditions (OTNOC). A variety of techniques.	Currently Compliant Pembroke does not have a specific OTNOC management plan. However, the requirements of BAT11 are met by existing site documentation, for example; gas turbine starts are optimised based on plant condition (i.e warmth category) to minimise emissions during start-up. All plant components are included within the site specific preventative maintenance programmes. The frequency of maintenance is dependent on component duty. Emissions during start-up and shutdown operations are monitored and reviewed to identify if corrective actions are required. Emissions to air and water are assessed as part of the annual environmental performance report. In the event of an accident or environmental incident, we would review the emissions, cause etc as part of our incident investigation process and ensure any relevant corrective and / or preventive action is implemented. Further details relating to site -specific EMS documents that address relevant OTNOC management plans and periodic monitoring and assessments relevant to OTNOC emissions:

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		Electronic Dispatch & Logging (EDL) warmth categories and profiles used to manage start-ups. PEB/LP/ENV 3012 Monitoring & Measurement Procedure. GMD ENV 009 Environmental Reporting. GMD ENV IR 009 Environmental Reporting. AOA 4392 CEMS Fault/ Air Emission Limits. Environmental Limit Card Covers Commissioning Limits. Annual EPRTTR and Environmental Performance Reports." Emissions to air and water are assessed as part of the annual EPRTTR and environmental performance reports through use of either measurements or emission factors.
11.	Monitoring of emissions to air and/or to water Monitoring of emissions to air and/or to water during OTNOC. Appropriately monitor emissions to air and/or to water during OTNOC.	Yes - compliant by 31/07/2021 Pembroke is currently investigating whether all OTNOC are covered by the range of our CO analysers. Subject to the conclusion of this investigation Pembroke will review options for compliance and implement an appropriate BREF compliant option before 31/07/2021 if required. See BAT 10.
12.	Energy efficiency Increase the energy efficiency for units operated ≥ 1500 h/yr A variety of techniques	Currently Compliant See BAT 40
13.	Reduce water usage and the volume of contaminated waste water discharged Reduce water usage and the volume of contaminated waste water discharged Use of one or both of the techniques specified in the associated table.	N/A - Currently sampling drains from the main cooling water system issue into the surface water run off system for discharge. This results in this waste water stream having a high level of salts due to the presence of seawater, the associated table in the BREF document states that this conclusion is not applicable where high levels of salts due to seawater are present.
14.	Prevent contaminated of uncontaminated waste water and to reduce emissions to water Prevent contaminated of uncontaminated waste water and to reduce emissions to water	Currently Compliant Contaminated process water streams which could contain small amounts of oil are collected separately to uncontaminated surface run off and uncontaminated process waters. Once collected, potentially contaminated streams are treated in full retention separators to remove any oily residues before they are combined with uncontaminated streams for discharge. Immediately prior to discharge the combined stream

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	Segregate waste water streams and to treat them separately, depending on the pollutant content.	is passed through a by-pass separator to ensure any remaining oil is removed. Water treatment plant effluent is collected separately and treated in its own neutralisation tank prior to discharge with the main cooling water.
15.	Reduce emissions to water Reduce emissions to water from flue-gas treatment A variety of techniques	N/A Pembroke does not have flue gas treatment.
16.	Reduce waste sent for disposal To reduce the quantity of waste sent for disposal A variety of techniques	Currently Compliant There are no waste products as identified by BAT 16 caused directly by the combustion process in a CCGT plant. Other waste arisings from site activities are dealt with according the waste hierarchy.
17.	Reduce noise emissions To reduce noise emissions A variety of techniques	Currently Compliant Noise emissions are reduced by the application of techniques a, b, c, d and e as identified in BAT 17, further site-specific information can be found in the Operational Noise and Vibration Management Plan.
Combustion of solid fuels (coal and/or lignite)		
18.	Environmental performance Improve overall performance Techniques in associated table.	N/A Greyed out sections are not relevant
19.	Efficiency Increase efficiency Techniques in associated table.	N/A
20.	Prevent or reduce emissions of NOx	N/A

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
	Prevent or reduce emissions of NO _x emissions to air while limiting CO and N ₂ O emissions to air from the combustion of coal and/or lignite. A variety of techniques and associated AELs	
21.	Prevent or reduce emissions of SO_x, HCl and HF Prevent or reduce emissions of SO _x , HCl and HF emissions to air from the combustion of coal and/or lignite. A variety of techniques and associated AELs	N/A
22.	Reduce dust and particulate-bound metal emissions Reduce emissions of dust and particulate-bound metal emissions to air from the combustion of coal and/or lignite. A variety of techniques and associated AELs	N/A
23.	Prevent or reduce emissions of mercury Prevent or reduce emissions of mercury emissions to air from the combustion of coal and/or lignite. A variety of techniques and associated AELs	N/A
Combustion of solid fuels (solid biomass and/or peat)		
24.	Prevent or reduce emissions of NO_x Prevent or reduce emissions of NO _x emissions to air while limiting CO and N ₂ O emissions to air from the combustion of solid biomass and/or peat. A variety of techniques and associated AELs	N/A
25.	Prevent or reduce emissions of SO_x, HCl and HF Prevent or reduce emissions of SO _x , HCl and HF emissions to air from the combustion of solid biomass and/or peat. A variety of techniques and associated AELs	N/A

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26.	Reduce dust and particulate-bound metal emissions Reduce emissions of dust and particulate-bound metal emissions to air from the combustion of solid biomass and/or peat. A variety of techniques and associated AELs	N/A
27.	Prevent or reduce emissions of mercury Prevent or reduce emissions of mercury emissions to air from the combustion of solid biomass and/or peat. A variety of techniques and associated AELs	N/A
Combustion of liquid fuels (HFO and/or gas-oil-fired boilers)		
28.	Prevent or reduce emissions of NOx Prevent or reduce emissions of NOx emissions to air while limiting CO and N2O emissions to air from the combustion of HFO and/or gas oil in boilers. A variety of techniques and associated AELs.	N/A
29.	Prevent or reduce emissions of SOx, HCl and HF Prevent or reduce emissions of SOx, HCl and HF emissions to air from the combustion of HFO and/or gas oil in boilers. A variety of techniques and associated AELs.	N/A
30.	Reduce dust and particulate-bound metal emissions Reduce emissions of dust and particulate-bound metal emissions to air from the combustion of HFO and/or gas oil in boilers. A variety of techniques and associated AELs.	N/A
Combustion of liquid fuels (HFO and/or gas-oil-fired engines)		
31.	Energy efficiency BAT-associated energy efficiency levels (BAT-AEELs)	N/A

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
	Specified techniques and associated AEELs.	
32.	Prevent or reduce emissions of NOx Prevent or reduce emissions of NOx emissions to air from the combustion of HFO and/or gas oil in reciprocating engines. A variety of techniques and associated AELs	N/A
33.	Prevent or reduce emissions of CO Prevent or reduce emissions of CO and volatile organic compounds from the combustion of HFO and/or gas oil in reciprocating engines. A variety of techniques and associated AELs	N/A
34.	Prevent or reduce emissions of SOx, HCl and HF Prevent or reduce emissions of SOx, HCl and HF emissions to air from the combustion of HFO and/or gas oil in reciprocating engines. A variety of techniques and associated AELs	N/A
35.	Reduce dust and particulate-bound metal emissions Reduce emissions of dust and particulate-bound metal emissions to air from the combustion of HFO and/or gas oil in reciprocating engines. A variety of techniques and associated AELs	N/A
Combustion of liquid fuels (gas oil fired gas turbines)		
36.	Energy efficiency BAT-associated energy efficiency levels (BAT-AEELs) Specified techniques and associated AEELs.	N/A
37.	Prevent or reduce emissions of NOx Prevent or reduce emissions of NOx emissions to air from the combustion of gas oil in gas turbines. A variety of techniques	N/A

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38.	Prevent or reduce emissions of CO Prevent or reduce emissions of CO from the combustion of gas oil in gas turbines. A variety of techniques and associated AELs	N/A
39.	Prevent or reduce emissions of SOx and dust Prevent or reduce emissions of SOx and dust emissions to air from the combustion of gas oil in gas turbines. A variety of techniques and associated AELs	N/A
Combustion of gaseous fuels (natural gas)		
40.	Energy efficiency BAT-associated energy efficiency levels (BAT-AEELs) Specified techniques and associated AEELs	Currently Compliant Applicable AEEL 50-60% CCGT Operation: The station uses technique (a) in BAT 40 as well as a combination of techniques; a, b, c, d, f, g, h, given in BAT 12.
41.	Prevent or reduce emissions of NOx Prevent or reduce emissions of NOx emissions to air from the combustion of natural gas in boilers A variety of techniques	N/A, this only applies to fired gas boilers not CCGT's
42.	Prevent or reduce emissions of NOx Prevent or reduce emissions of NOx emissions to air from the combustion of natural gas in gas turbines A variety of techniques. Please also define effective dry low NOx load where applicable.	Currently Compliant Yearly Average 10-40 Daily Average 18-50 From BAT 42, the following combination of techniques apply: a & c From table 24: As an existing CCGT plant of 756MWth and a net fuel utilisation of <75% the annual limit for NOx is 40mg/Nm ³ . However, the plant has an electrical efficiency of 59% (based on the average of the individual unit efficiencies) therefore footnote 8 applies. Consequently, the annual average emission limit for this site is 43mg/m ³ and 50mg/m ³ as a daily average based upon the current permit ELV. The effective DLN point for the LCP's at this station is defined as 70% load which is equal to 315 MW. The curves

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		included in the sheet "DLN curves" show the eDLN point for NOx. The station would like retain the current part load NOx limit of 50 mg/Nm3 as a daily average between MSUL and eDLN and the existing monthly, daily and hourly IED limits for loads above 70%. Pembroke would like to retain the <500 hours open cycle running option agreed under the IED variation during 2015 and can meet the indicative open cycle AELs for NOx when outside the defined start up and shutdown thresholds quoted in table S1.5 within the stations permit.
43.	Prevent or reduce emissions of NOx Prevent or reduce emissions of NOx emissions to air from the combustion of natural gas in engines. A variety of techniques	N/A Pembroke does not have gas engines
44.	Prevent or reduce emissions of CO Prevent or reduce emissions of CO emissions to air from the combustion of natural gas A variety of techniques and associated AELs	Currently Compliant 30mg/Nm3 Pembroke uses optimised combustion to reduce CO emissions to air. The BREF AEL of 30mg/Nm3 applies. The eDLN point for CO is proposed as 315 MW which is equivalent to 70% load. An eDLN curve for CO is included in the sheet "DLN curves". The station would like to retain the existing part load CO limit of 250mg/Nm3 and the current monthly, daily and hourly IED limits for loads above 70 %. Pembroke would like to retain the <500 hours open cycle running option agreed under the IED variation during 2015. There are no indicative AELs for CO contained within the BREF for gas fired OCGT operating for less than 1500 hours.
45.	Prevent or reduce emissions of non-methane volatile organic compounds (NMVOC) and methane emissions Prevent or reduce emissions of non-methane volatile organic compounds (NMVOC) and methane emissions to air from the combustion of natural gas in spark-ignited lean-burn gas engines A variety of techniques and associated AELs	N/A

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Combustion of iron and steel process gases		
46.		N/A
47.		N/A
48.		N/A
49.		N/A
50.		N/A
51.		N/A
Combustion of gaseous and/or liquid fuels on offshore platforms		
52.		N/A
53.		N/A

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54.		N/A
Combustion of process fuels from the chemical industry		
55.		N/A
56.		N/A
57.		N/A
58.		N/A
59.		N/A
Co-incineration of waste		
60.		N/A
61.		N/A

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
62.		N/A
63.		N/A
64.		N/A
65.		N/A
66.		N/A
67.		N/A
68.		N/A
69.		N/A
70.		N/A
71.		N/A

No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
Gasification		
72.		N/A
73.		N/A
74.		N/A
75.		N/A

BAT 6, 8 and 9

As the elements discussed in BAT 6, 8 and 9 are intrinsically linked the following introductory response is relevant to all three BAT conclusions. Specific information requested in the different BAT conclusions is addressed directly following the introductory text.

The process of determine how a gas turbine will operate is referred to as mapping. This mapping process can be undertaken at its initial commissioning, when returning from maintenance (either planned or unplanned) or at any time during its operational life if there is a need to improve its performance. When mapping a machine there are three elements to consider: emissions, efficiency and plant integrity. Establishing the correct balance to ensure environmental conditions are met (NO_x and CO), the maximum electricity is generated for the amount of gas burnt (therefore minimising the amount of CO₂ released per megawatt [MW]) whilst ensuring the plant operates in a safe manner that ensures its longevity, is a complex balancing act. The improvement of one of these three elements will inevitably impact the others. Therefore minimising NO_x emissions, for example, would likely result in increased CO and CO₂ release, and could compromise plant integrity.

Where a turbine is positioned in this mapping process is determined by the experience of the commissioning engineers who take into account the influences

in play such as environmental permitting limits as well as the age and condition of the plant.

Each turbine has a defined maintenance programme which consists of A (7 to 10 days duration), B (~14 days) and C (~50 days) inspections or outages. The interval between inspections is decided by Equivalent Operating Hours (EOH) and a maximum number of starts, these are determined by the turbine manufacturer and operator. EOH consists of the number of hours in operation as well as a factor based on starts, stops, load shedding etc. The scope of work for each outage is made up of predetermined maintenance, replacement of components, reactive maintenance and upgrades if available. The aim is to return the turbine in an improved condition in terms of efficiency, emissions and plant integrity.

During operation of the turbines their efficiency is monitored daily by our Performance and Commercial Engineers, with more detailed interrogation of data carried out monthly or if daily checks raise any concerns. This involves examining numerous data from gas flow and composition, temperatures, pressures and electricity output. Detailed efficiency measurements are also undertaken periodically by our central technical support teams, as a minimum following return to service from extended maintenance. The combination of frequent onsite monitoring and periodic detailed measurements will identify if a turbine is not performing to the levels expected of it in terms of MWs produced versus gas burnt, and therefore CO₂ released, bearing in mind its age and placement in its maintenance schedule. Should this be the case investigations into likely causes are undertaken, remedies identified and completed where possible, bearing in mind the impact on the other two elements of turbine performance (emissions and plant integrity). This can range from relatively simple adjustments that may be undertaken on load, to more complex invasive maintenance and re-mapping which require the unit to be taken out of service. It is not in the interest of the station from an economic or environmental perspective to continue to operate a turbine inefficiently; therefore this monitoring is considered part of the routine day to day activities of these engineers.

Environmental performance (in this context, NO_x and CO) is monitored by the operational staff in the control room and by the control system which has various alarm settings to inform operators of the approach to emissions limits. It is also monitored daily by the Environmental Engineers, as well as monthly and quarterly in more detail. If emission are seen to be increasing, either in the short term (hours), medium term (days) or longer term (weeks and months) investigations are undertaken. The same process is followed as described above in order to remedy any issues. Plant integrity is monitored continuously by the operational staff in the control room and by the control system which has various alarm settings to inform operators of changes in operational parameters. This information is also monitored daily, and over longer time scales, by the Engineering department and by our central technical support teams. The same process is followed as described above in order to remedy any issues.

