ConocoPhillips (UK) Teesside Operator Limited

Teesside Crude Oil Stabilisation Terminal Environmental Permit Variation

Main Supporting Document

Reference: E2P-ARU-ZZ-ZZ-RP-YE-0018

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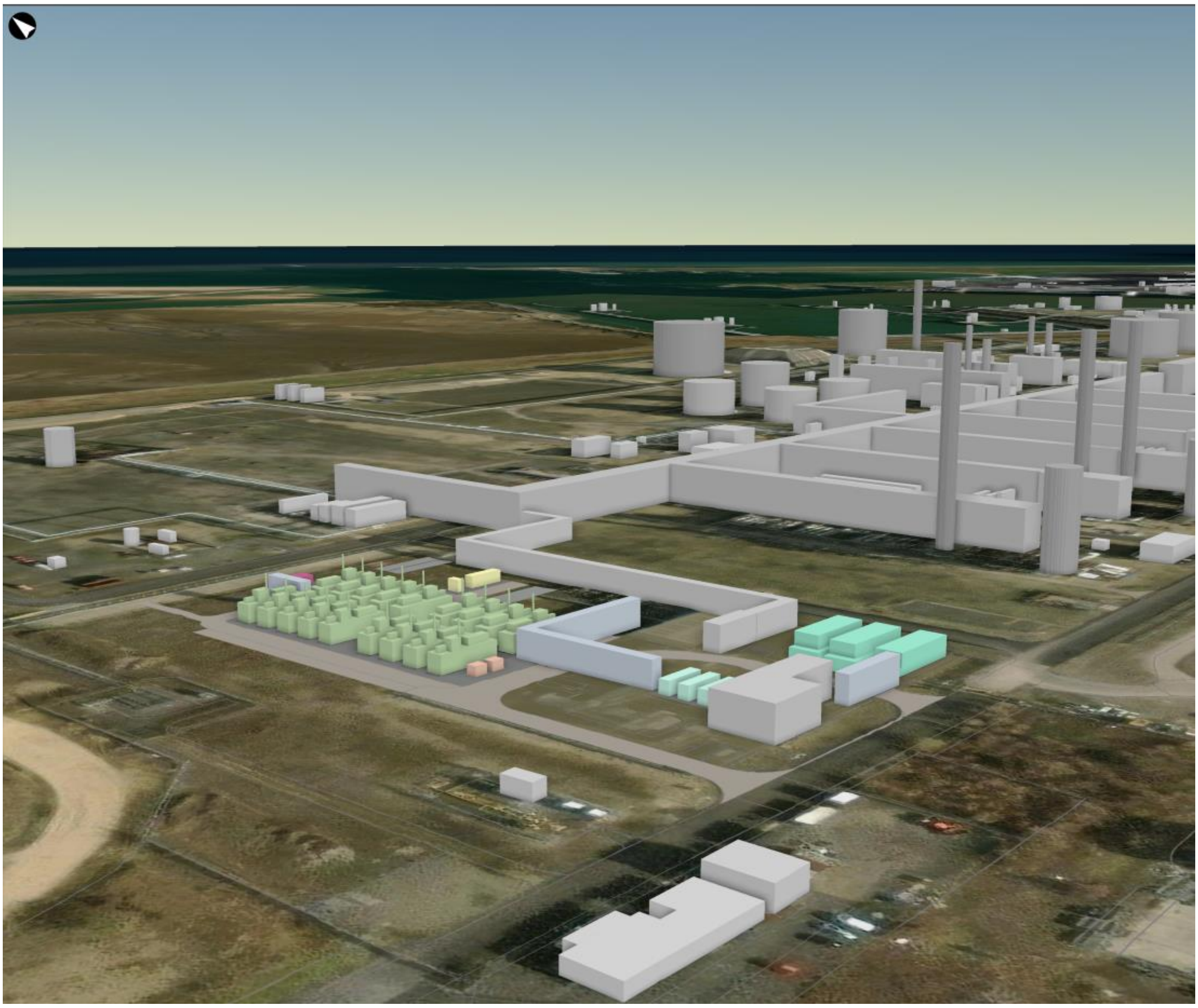

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List of Abbreviations

AC	Alternating current
ADMS	Atmospheric Dispersion Modelling System
AQS	Air Quality Standard
BAT	Best Available Techniques
BAT-AEELs	Best Available Techniques-Associated Energy Efficiency Levels
BAT-AELs	Best Available Techniques -Achievable Emission Levels
BATc	Best Available Techniques Conclusions document
Bgl	Below ground level
BRef	BAT Reference document
CBA	Cost Benefit Analysis
CHP	Combined Heat and Power
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CCGT	Combined Cycle Gas Turbine
DEA	Diethanol Amine
DeC_2 OHs	De-ethaniser overheads
EA	Environment Agency
EAL	Environmental Assessment Level
EED	Energy Efficiency Directive
EMS	Environmental Management System
EOL	Environmental Operating Limits
ESD	Emergency Shutdown System
E2P	Ethane to Power
EP	Environmental Permitting
ETP	Effluent treatment plant
GHG	Green House Gas
GT	Gas turbine
H_2S	Hydrogen sulphide
KO	Knock out
LCP	Large Combustion Plant
MWe	Megawatt electrical
MWth	Megawatt thermal
NGL	Natural Gas Liquids
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
OCGT	Open Cycle Gas Turbine
ppm	Parts per million
ppb	Parts per billion
PCR	Process Control Room

PLC	Programmable Logic Controller
ROL	Reliability Operating Limits
RSPB	Royal Society for the Protection of Birds
SCADA	Supervisory control and data acquisition
SCR	Selective Catalytic Reduction
SOL	Safe Operating Limit
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WFD	Water Framework Directive
wt%	Percentage by weight

1. Non-Technical Summary

This Main Supporting Document presents the supporting information for an Environmental Permit variation application under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) ('the EP Regulations'), submitted on behalf of ConocoPhillips (UK) Teesside Operator Limited ('ConocoPhillips') to vary the existing Environmental Permit for the Teesside Crude Oil Stabilisation Terminal (the 'Installation' or the 'Teesside Terminal'), reference EPR/QP3004PD. The Installation's location and Installation Site Boundary is provided in Figure 1 (Appendix A).

The Teesside Terminal is designed to receive crude oil from UK and Norwegian fields via an offshore pipeline and to produce, store and export stabilised crude oil and refrigerated natural gas liquids (NGLs). The NGL feed is fractionated at the Teesside Terminal into individual components (methane, ethane, propane and mixed butanes) in a series of fractionating towers. The methane and a portion of ethane is consumed in the combustion plant on site as fuel gas and the remaining ethane, propane and mixed butanes are refrigerated and stored onsite ready for bulk sale to world markets.

The current liquid ethane processing system at the Installation is reaching the end of its life due to a combination of declining volumes (including related throughput challenges) a narrow market for product and key assets approaching the end of their economic operational life. However, the Teesside Terminal will need to operate until the last remaining Ekofisk offshore production facility can viably produce oil and gas economically. The current premise is that the Installation will continue operating until 2048 however this may need to be extended if the offshore production facilities continue operation beyond this date. As such, an alternative outlet for the ethane is required.

The Teesside Terminal has three gas turbines and three steam boilers, which form one integrated steam raising plant. In addition, there are six crude oil stabilisation reboilers. These 'consumers' all operate on fuel gas extracted from the oil processed at the Installation; however, the existing plant does not have the capacity to utilise all of the excess ethane stream.

Therefore, following a review of potential solutions for alternative outlets for the ethane product stream, ConocoPhillips consider that the most viable option is to use the gas to produce electrical power for use by the Teesside Terminal, and as such are proposing the installation of a new power island within the existing Environmental Permit Installation Boundary.

The design for the proposed Ethane to Power ('E2P') Power Island is not yet finalised, as it will be dependent on the quantities of ethane available which is currently undergoing review, however it will consist of up to 16 gas engine units with each engine delivering 2 MWe, with a total installed generation capacity not exceeding 50MWe. Based on the maximum of 16 x 2 MWe engines, the total thermal input of the gas engines would be in the region of 77MWth and therefore the E2P Power Island will comprise a listed activity under the EP Regulations as a Section 1.1 Part A(1)(a): Burning of any fuel in an appliance with a rated thermal input of 50MW or more.

A substantial variation to the Environmental Permit for the Installation is required to incorporate the new E2P Power Island into the existing Section 1.1 Part A(1) (a) activity carried out at the Installation. In addition, a normal variation to the Section 1.2 Part A(1) (e)(i)(ii) loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil and stabilised crude petroleum activity is also required.

The E2P Power Island is expected to commence operation in late 2027 to enable the timely decommissioning of the existing ethane processing and storage equipment. It will be located within the existing Installation Site Boundary on the western part of the site on land which was previously occupied by the RWE Generation UK PLC's Seal Sands Power Station. This facility was operated under a separate Environmental permit (EPR/RP3130LN updated to EPR/CP3939QN) which has since been surrendered. The Seal Sands Power Station has now been largely demolished. As the site was operated under a separate Environmental Permit, a Site Condition Report has been produced to detail the baseline ground conditions for E2P Power Island area (Appendix B).

The fuel gas for the E2P Power Island will be a mix of methane and ethane, which is generated in the De-Ethaniser Overhead Stream (DeC$_2$ OHs) from the Teesside Terminal. The fuel gas will be transferred to E2P Power Island via a combination of underground and overground pipelines. The tie-in for E2P Power Island will be downstream of the Diethanol Amine (DEA) treatment, therefore, the fuel gas will be subjected to treatment within the DEA treatment plant to remove hydrogen sulphide (H_2S) before being transferred to E2P Power Island for use within the gas engines.

Although a maximum of 16 engines will be installed, a number of the engines will only be provided for redundancy purposes to ensure that the availability of the E2P Power Island meets target levels of 95% (upwards of 99% being desirable), thereby minimising the potential for flaring. It is envisaged that at the start of operation of the E2P Power Island, the maximum number of engines that will actually be required to operate for the quantities of fuel gas available would be 12. As the fuel gas volumes decline over time, the number of engines needing to operate would reduce, such that the number of engines operational are appropriate for the available fuel gas volume. The maximum number of engines needed to use the available fuel gas will only be operational for the first 4 years of operation, with numbers declining thereafter. After seven years of operation the number of required engines rapidly decreases. The fuel gas supply is anticipated to have been depleted by 2046.

A review of the E2P Power Island against the Best Available Techniques (BAT) for the Refining of Mineral Oil and Gas has been carried out and is provided in Appendix C. In addition, a Site-specific BAT assessment for the use of gas engines for the E2P Power Island has been carried out and is provided in Appendix D.

The raw materials to be used in the operation of the wider site will remain unchanged. For the E2P Power Island, the main raw material will be the fuel gas supply from the Teesside Terminal. The consumption of this is expected to peak in year 2029 with up to 35,000 tonnes of fuel gas being available, and this will reduce over time until the Teesside Terminal ceases operation and the E2P Power Island would no longer be required. There will be no storage of fuel gas at the E2P Power Island. Other raw materials include lubrication oil, water/ ethylene glycol 1:1 mix (cooling circuit), and utilities including nitrogen and instrument air.

Process wastes from the E2P Power Island are expected to be minimal and limited to waste lubrication oil and filters. The key process waste is anticipated to be waste lubricating oil, which will be collected and transported offsite to be disposed of via licensed 3rd party waste contractors, in line with regulatory requirements and existing Installation procedures. There may be small quantities of waste generated from maintenance and welfare activities, which will be stored, managed and disposed of appropriately.

Each gas engine will have an individual stack which will be additional point source emission to air at the Installation. The Emission Points have been designated as A20 to A35. An air quality impact assessment has been undertaken which includes an assessment of background air quality conditions, identification of human and ecological receptors, an assessment of baseline air quality impacts from the existing Teesside Terminal's operations, and an assessment of future air quality impacts from the existing operations and the E2P Power Island together. Baseline and future air quality impacts were assessed using the latest ADMS atmospheric dispersion model (version 6) and the assessment is provided in Appendix E.

The results of the air quality assessment of the indicative emissions from the maximum number of engines that could be installed for E2P Power Island indicated that there is unlikely to be any exceedances of Air Quality Standard (AQS) or Environmental Assessment Level (EAL) at identified human health receptors.

For ecological receptors the annual and daily mean NOx concentrations at most receptors are considered to be insignificant although, there were several receptors for each averaging period that could not be immediately screened out. However, there were no exceedances of the relevant Critical Levels for either averaging period, except in areas of the Teesmouth and Cleveland Coast SPA, Ramsar and SSSI, which are already exceeding the Critical Levels. Following discussions with the project Ecologist, it was determined that the affected receptors were mudflats or coastal and floodplain grazing marsh, both of which are not known to be sensitive to NOx. In addition, as the tidal mudflats undergo regular tidal inundation, there is no vegetation present and therefore it is considered that the NOx Critical Levels are not directly applicable to the locations where the maximum impacts occur. Given that the predicted concentrations were all below the respective Critical Levels, the professional judgement of the project Ecologist and air quality consultants has concluded that the overall effect on ecological receptors would be not significant. Ecological impacts from the annual average SO_2 concentration, nutrient nitrogen, and acid deposition are considered insignificant. As the number of operational engines decline over the lifetime of the E2P Power Island project, the associated impacts will also reduce.

The risk of odour being released as a result of the operation of the E2P Power Island is low as the fuel gas will not be odourised, and there will be no permanent sources of odorous substances for the operation of the E2P Power Island.

There will be no point source emissions to controlled water or groundwater from the E2P Power Island. Surface water run off may contain traces of oil from the engines' lubrication system so all effluent (including process effluent containing waste oils) will be routed to the existing Installation's effluent system and ETP. The design of the E2P Power Island is such that all activities containing liquid hydrocarbons will be in areas of made ground, which will be kerbed and routed such than any spills drain to the ConocoPhillips drainage system and are treated by the existing ETP.

There will be no point source emissions to land from the E2P Power Island.

It was confirmed during enhanced pre-application discussions with the Environment Agency (EA) that a noise impact assessment is not required due to the distance between the Installation and any residential receptors (>3km). However, a Noise Impact Assessment has been carried out for the purpose of the Planning Application required for the E2P Power Island, which addresses the potential for there to be noise impacts at ecological receptors, given the proximity of the Teesmouth and Cleveland Coast designated site (Ramsar, Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR))[1]. The Noise Impact Assessment is provided in Appendix F. The predicted noise emissions arising from the E2P Power Island do not exceed the 25th percentile of background noise level during the quietest night-time period at the closest human health receptor. As per BS 4142, where the rating level does not exceed background sound levels, this is an indication of a low impact, and therefore the Noise Impact Assessment confirms the EA's pre-application advice.

The Habitats Regulations Assessment prepared for the Planning Application submitted for the E2P Power Island (provided in Appendix G) project has utilised the noise assessment report to determine the potential impacts upon the bird species associated with the Teesmouth and Cleveland Coast SPA. The assessment has shown that the operation of the E2P Power Island, will ensure there are no likely significant effects upon the SPA site and the conservation objectives of it.

A Combined Heat and Power (CHP) Cost Benefit Analysis (CBA) and CHP-Readiness (CHP-R) Assessment has been undertaken to identify potential uses for thermal energy which will be generated through the use of the gas engines. This assessment is provided in Appendix H.

The Installation has an existing ISO14001:2015 accredited Environmental Management System (EMS), which will be updated to include additional operating procedures to manage the various aspects of the operation of the E2P Power Island, including but not limited to emissions monitoring, accident management, waste minimisation and management, and infrastructure maintenance.

As well as the changes detailed above associated with the E2P Power Island, it is also requested that the reference to the CHP plant comprising 2 x 278 MWe gas turbines, 2 x 150 MW steam turbines and 2 x auxiliary boilers, and associated Emission Points A20 to A23 are removed from the site's Environmental Permit. This plant and the associated Emission Points were proposed for a planned Liquified Natural Gas Plant that has never been installed at the Teesside Terminal and therefore do not exist at the Installation.

[1] Department for Environment Food and Rural Affairs (No date) Multi-Agency Geographic Information for the Countryside (MAGIC) Map Application. [Online]. Available at: https://magic.defra.gov.uk/MagicMap.aspx (Accessed 14/11/2024)

2. Introduction

ConocoPhillips (UK) Teesside Operator Limited ('ConocoPhillips') operates the Teesside Crude Oil Stabilisation Terminal (the 'Installation' or the 'Teesside Terminal') in Billingham, Teesside, under the existing Environmental Permit reference EPR/QP3004PD. The Installation's location and Site Installation Boundary is shown in Figure 1 (Appendix A).

ConocoPhillips are proposing to develop an Ethane to Power ('E2P') Power Island at the Installation, which will consist of up to 16 gas engine units with each engine delivering 2 MWe, with a total installed generation capacity not exceeding 50MWe. Based on the maximum of 16 x 2 MWe engines, the total thermal input of the gas engines would be in the region of 77MWth and therefore the E2P Power Island will comprise a listed activity under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) ('the EP Regulations') as a Section 1.1 Part A(1)(a): Burning of any fuel in an appliance with a rated thermal input of 50MW or more. The location of the E2P Power Island within the Installation and an indicative layout is shown in Figures 3 and 4 (Appendix A).

This Main Supporting Document presents the supporting information for a substantial Environmental Permit variation application made under the EP Regulations 2016, and is submitted on behalf of ConocoPhillips to add the Section 1.1 Part A(1)(a) combustion activity and enable a normal variation to the existing Section 1.2 Part A(1) (e)(i)(ii) the loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil and stabilised crude petroleum activity, as advised by the Environment Agency (EA) in pre-application discussions.

ConocoPhillips intend to sub-contract the day-to-day operation of E2P Power Island to a third-party contractor but will keep ultimate control over the whole Installation and therefore will remain the legal Operator. This is discussed further in Section 2.4.

A review of the E2P Power Island against the Best Available Techniques (BAT) for the Refining of Mineral Oil and Gas has been carried out and is provided in Appendix C. In addition, a Site-specific BAT assessment for the use of gas engines for the E2P Power Island has been carried out and is provided in Appendix D.

2.1 Proposed Operations

2.1.1 Listed Activities under Schedule 1 of the EP Regulations

There are number of activities carried out at the Installation which fall under Schedule 1 of the EP Regulations, as detailed in Table S1.1 of the Installation's Environmental Permit. This variation application will vary the existing the Section 1.1 Part A(1) (a) combustion activity and the existing Section 1.2 Part A(1) (e) activity of handling or treating crude oil and stabilised crude petroleum. It is therefore proposed to vary Schedule 1 Table S1.1 of the existing Environmental Permit, as shown in Table 2-1.

Table 2-1: Table S1.1 Schedule 1 Listed Activities

Activity listed in Schedule 1 of the EP Regulations	Description of Specified Activity	Limits of Specified Activity	Changes Detailed in this Variation
Section 1.2 Part A(1) (e)(i)(ii)	The loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil and stabilised crude petroleum (Primary activity)	Primary activity at the terminal is the stabilisation of crude oil. Stabilised crude storage, loading and handling of stabilised crude petroleum via jetties 1, 2, 4 & 5 and export pipeline.	A normal variation to the main activity carried out on site.
Section 1.1 Part A(1) (a)	Burning of any fuel in an appliance with a rated thermal input of 50 MW or more.	6 x 40MWth reboilers for heating crude oil **LCP 62** 3 x 31.2MWth gas turbines	Substantial variation of the activity to enable the installation of a new Gas Engine Power Island.

Activity listed in Schedule 1 of the EP Regulations	Description of Specified Activity	Limits of Specified Activity	Changes Detailed in this Variation
		3 x 104 MWth boilers for production of steam **CHP** 2 x 278 MWe gas turbines with 2 x 150 MW steam turbines **New boiler plant for CHP** 2 x auxiliary boilers	Removal of the combustion elements associated with the CHP (including the new boiler plant for the CHP).
Section 5.1 Part A(1) (a)	The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day.	Routine flaring of waste gases from the main flare A16 and stand-by flare A17	No change to this activity.
Section 5.3 Part A(1) (a) (ii)	Disposal of hazardous waste in a facility with a capacity of more than 10 tonnes per day (by biological treatment)	Physico-chemical treatment of waste waters containing oil in the on-site effluent treatment plant.	No change to this activity.
Section 5.4 Part A(1) (a) (ii)	Disposal of non-hazardous waste in a facility with a capacity of more than 50 tonnes per day (by physico-chemical treatment)	Physico-chemical treatment of waste waters and storage of sludge in the on-site effluent treatment plant.	No change to this activity.

2.2 Decarbonisation Readiness

In October 2024, the UK Government published a response to a consultation on the Decarbonisation Readiness proposals to expand the Carbon Capture Readiness requirements. The proposals aim to maximise the decarbonisation potential of new build and substantially refurbishing combustion power plants, and ensure the requirements keep pace with the emergence of new decarbonisation technologies.

The Decarbonisation Readiness requirements will be implemented through the EP Regulations however it will not come into effect for environmental permit applications until after 28th February 2026.

2.3 Environmental Setting

The Installation is situated within a highly industrialised area of Teesside, surrounded by various industries such as chemical manufacturing, renewable energy facilities, and associated infrastructure including pipelines, roadways, rail lines, and wharfs.

The River Tees stretches from the southeast and round to the northeast of the Installation and has RAMSAR, Site of Special Scientific Interest (SSSI) (Teesmouth and Cleveland Coast), National Nature Reserve (NNR) designations. The Teesmouth and Cleveland Coast SSSI extends to the north and west of the Installation.

Directly to the north of the Installation is Seal Sands, with chemical manufacturing facilities and Hartlepool Power Station beyond. To the northwest are oil storage facilities, to the northeast multiple jetties and to the east, there are multiple tank farms, jetties, wharfs, vacant scrubland, and the foreshore. On the far bank of the River Tees to the east there is heavy industry including Teesport Docks and Redcar Bulk Terminal.

To the west of the Installation are the Teesside Gas Processing Plant, an industrial railway, chemical manufacturing facilities, and brine fields, with RSPB Saltholme located to the southwest.

To the south, there are oil storage facilities with multiple jetties, chemical manufacturing, the Tees Industrial Substation, an industrial railway, and a renewable power station, with nature reserves to the southwest.

Further detail on the environmental setting and local receptors is presented in Section 7.

2.4 Operator

ConocoPhillips will employ a Contractor to supply specialist services to facilitate the operation of E2P Power Island on a day-to-day basis but will remain the legal Operator for the facility. The GOV.UK guidance of legal operator[2] defines the operator as having sufficient control of the activity or facility, for example:

1. have day-to-day control of the facility or activity, including the manner and rate of operation;
2. make sure that permit conditions are complied with;
3. decide who holds important staff positions and have incompetent staff removed, if required;
4. make investment and financial decisions that affect the facility's performance or how the activity is carried out; and,
5. make sure activities are controlled in an emergency.

These points have been considered when determining who would be the legal Operator, ConocoPhillips or the appointed Contractor for the E2P Power Island. It was determined that ConocoPhillips are considered to have sufficient control over the operation or the facility and are therefore considered to be the legal Operator. The justification for this is detailed in the following sections:

Day to Day Control

There will be a contractual agreement in place between the ConocoPhillips and the E2P Power Island Contractor. ConocoPhillips have existing arrangements with other third-party contractors at the Installation and the relationship with the Contractor for E2P Power Island will be managed in the same way.

Ultimately, ConocoPhillips will have overall control of E2P Power Island as they will be responsible for the supply of the fuel gas which will be combusted in the gas engines and will use the majority of electrical power generated. Utilities, such as water, compressed air and nitrogen will also be provided by the Teesside Terminal and surface water drainage from the E2P Power Island will enter the Installation's drainage system.

Compliance with Permit Conditions

ConocoPhillips currently hold the Environmental Permit that allows them to undertake the listed activities at the Teesside Terminal. As ConocoPhillips hold the Permit, they will be responsible for ensuring that the Permit conditions are complied with. ConocoPhillips will formally communicate the requirements of the Environmental Permit along with other existing protocols to the Contactor. There will be regular communication between ConocoPhillips and the Contractor.

Staffing Decisions

Though ConocoPhillips will have expectations and oversight of how the E2P Power Island will be operated, it will be the Contractor who will be responsible for staff recruitment, retention and performance including compliance with Teesside Terminal procedures. However, as part of the selection process ConocoPhillips will assess the level of experience of each potential vendor at a company level and the individual employees. All staffing decisions will also be subject to approval by ConocoPhillips. ConocoPhillips will assign a Contract Owner who will have oversight and responsibility for every aspect of the contract.

ConocoPhillips currently operate their site in accordance with the Environmental Management System (EMS) which is accredited to ISO14001. As part of the operation of E2P Power Island, the Contractor will also be audited for compliance with ISO14001.

Investment and Financial Decisions

ConocoPhillips will be responsible for making the financial decisions which affect the performance of the E2P Power Island as they ultimately have ownership over the facility. Site investment to ensure performance to

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[2] Environment Agency, 'Legal operators and competence requirements: environmental permits' (2019), https://www.gov.uk/guidance/legal-operator-and-competence-requirements-environmental-permits#what-a-legal-operator-is

contractual targets will be managed as part of formal communication routes between ConocoPhillips Contract Owner and the Contractor.

Emergency Control

ConocoPhillips have existing emergency procedures for the Installation which will apply also apply to E2P Power Island.

3. Site Condition Report

The E2P Power Island would be located on approximately 2.1 ha of land that is within the Teesside Crude Oil Stabilisation Terminal Installation Boundary (shown in Figure 3 Appendix A). This land was previously occupied by the RWE Generation UK PLC's Seal Sands Power Station, which was operated under a separate Environmental Permit (EPR/RP3130LN before being transferred to EPR/CP3939QN). This permit was fully surrendered on 20th March 2024.

As part of the surrender of this permit, a surrender Site Condition Report was prepared and submitted by RWE, and the EA were satisfied that the necessary measures were taken during the operation of the facility to avoid a pollution risk resulting from the operation of the regulated facility. The EA considered it to be a low-risk surrender.

A Site Condition Report has been submitted with this Variation application as it has not been possible to ascertain whether the E2P Power Island area was included in the original Site Condition Report prepared for the existing Installation. The Site Condition Report is provided in Appendix B.

A Geo-Environmental Desk Study has been undertaken to review the published geological information for the site. The Geo-Environmental Desk Study outlines the ground conditions which have been interpreted based on published 1:50,000 scale British Geological Survey (BGS) maps of the area[3], and previous Ground Investigations (GI). This Geo-Environmental Desk Study has been provided as part of the Site Condition Report in Appendix B.

A brief summary of the sensitivity of the E2P Power Island area is provided here:

- **Geology**: Superficial deposits beneath the site are Tidal Flat Deposits of the Quaternary Period, which is underlain by Glacial Till comprising stiff to very stiff clay.
- **Hydrogeology**: The Tidal Flat Deposits beneath the site are classified as a Secondary Undifferentiated Aquifer, however the bedrock is a Secondary B aquifer.
- **Hydrology**: The site is located in the Tees Lower and Estuary Operational Catchment. The statutory Main Rivers within in 1km of the Installation Site boundary include the River Tees (directly adjacent to northeastern boundary) and Greatham Creek (approximately 500 m northwest). The Installation Site boundary is approximately 1 km from the mouth of a Water Framework Directive (WFD) coastal waterbody named Tees Coastal. The site is in a Flood Zone 1 (less than 1 in 1,000 annual probability of river or sea flooding).
- **Land use**: The Installation is mainly surrounded by industrial land use. The River Tees which is bound by existing industrial uses on both banks, is located 1km to the east of the site. There are no populated residential areas located within 3km of E2P Power Island.

[3] British Geological Survey (no date) *GeoIndex Onshore – bedrock geology*. [Online] Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.50698345.1154182254.1717081573-233619999.1717081573 (Accessed December 2024)

4. Operating Techniques

4.1 Technical Standards

The following technical standards are considered to be applicable to this permit variation application:

- Best Available Techniques (BAT) Reference (BRef) Document for the Refining of Mineral Oil and Gas (Refineries BRef)[4]; and
- BAT Conclusions for Refining of Mineral Oil and Gas (Refineries BATc)[5].

A review of the E2P Power Island against the Refineries BATc has been provided in Appendix C. As the operation of the existing Teesside Terminal has already undergone a BAT review, the BAT assessment carried out to support this Environmental Permit variation covers only those sections of the Refineries BATc that are concerned with general operating techniques and combustion units.

4.2 Process Description

4.2.1 Overview

ConocoPhillips are seeking to install additional plant and equipment at the Installation to allow the combustion of ethane to produce electricity. The proposed E2P Power Island will consist of up to 16 gas engine units with each engine delivering 2 MWe, with a total installed generation capacity not exceeding 50 MWe. Based on the maximum of 16 x 2 MWe engines, the total thermal input of the gas engines would be in the region of 77 MWth. The final number of engines has yet to be selected, however this Environmental Permit variation application has been based on the worst-case number of engines being installed.

At present the Teesside Terminal is permitted to receive unstabilised crude oil from the UK and Norwegian fields via an offshore pipeline and to produce, store and export stabilised crude oil refrigerated/ pressurised natural gas liquids (NGLs). Within the NGL area of the plant NGL feed is fractionated into individual components (methane, ethane, propane, and mixed butanes) in a series of fractionating towers. The methane is consumed as plant fuel. The ethane, propane, and mixed butanes are normally stored in storage tanks/ vessels ready for bulk sale to world markets.

Due to a combination of declining crude oil throughput, plant turndown limitations and obsolescence of product storage, ConocoPhillips has identified the preferred option of the E2P Power Island as an alternative outlet for ethane product, to generate electricity through its combustion in gas engines.

The Teesside Terminal has three gas turbines and three steam boilers, which form one integrated steam raising plant. In addition, there are six crude oil stabilisation reboilers. These 'consumers' all operate on fuel gas extracted from the oil processed at the Teesside Terminal; however, the existing plant does not have the capacity to utilise all of the excess ethane/ methane stream. Therefore, it is proposed to install the gas engines at the E2P Power Island to utilise the gas and provide additional power to the Installation. Any surplus energy generated will be sent to the local distribution network.

Numerous small engines are considered to provide the required level of flexibility to facilitate the success of the project and minimise the potential for flaring, given the fluctuating and ultimately declining fuel gas volumes available. The consideration of other available options and the ultimate selection of gas engines is detailed in the Site-specific BAT Assessment provided in Appendix D.

As well as the installation of the E2P Power Island, it is also requested that the reference to the CHP plant comprising 2 x 278 MWe gas turbines, 2 x 150 MW steam turbines and 2 x auxiliary boilers, and associated Emission Points A20 to A23 are removed from the site's Environmental Permit. This plant and the associated

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[4] Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas, under Directive 2010/75/EU of the European Parliament and of the Council, European IPPC Bureau, February 2015

[5] Commission Implementing Decision of 9 October 2014 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, for the refining of mineral oil and gas, October 2014

Emission Points were proposed for a planned Liquified Natural Gas Plant that has never been installed at the Teesside Terminal, and therefore do not exist at the Installation.

4.2.2 Fuel Gas Supply

The Teesside Terminal's main function is to stabilise the crude oil received from the Norwegian oil fields. The amount of available excess fuel gas is therefore a function of the crude oil throughput of the Terminal, which is on a continuing declining trend.

The fuel gas for the E2P Power Island will be sourced from the downstream point of the De-Ethaniser Overhead Stream (DeC$_2$ OHs). The process tie-in for E2P Power Island into the existing Installation will be located downstream of the existing Diethanol Amine (DEA) treatment and dehydration loop.

Over time, with the decline in throughput at the Installation, the production of fuel gas for use in the gas engines will decrease correspondingly. As part of the design process, two scenarios are being assessed a 'Average Gas Production' scenario and a 'Maximum Fuel Gas Production' scenario. The volumes associated with each scenario, are shown in Table 4-1.

Table 4-1 Fuel Gas Production Scenarios

Year	Predicted Design Case	
	Average Fuel Gas (kg/h)	Maximum Fuel Gas (kg/h)
2027	3,053	3,663
2028	3,195	3,834
2029	3,302	3,963
2030	2,949	3,539
2031	2,176	2,611
2032	2,869	3,443
2033	2,498	2,998
2034	1,897	2,276
2035	1,686	2,024
2036	1,397	1,677
2037	621	745
2038	617	740
2039	371	445
2040	606	728
2041	366	439
2042	364	436
2043	365	438
2044	365	438
2045	125	150
2046	0	0
2047	0	0

Although these fuel gas volumes may be subject to further refinement through the detailed design stage, for the purpose of the assessment of the maximum number of engines and the air quality impacts, the maximum fuel gas case has been used, as a worst case. It can clearly be seen that the available fuel gas will decrease rapidly after the first 7 years, and therefore the number of operating engines (and their associated impacts) will reduce correspondingly. Further detail on this is provided in the Site-specific BAT Assessment (Appendix D).

New pipework will be installed to transfer the fuel gas from the DeC_2 OHs to the E2P Power Island via above and below ground pipework. All pipework will be fully welded to minimise the risk of leaks. Any below ground pipework will be contained within a concrete trench. New gas detection and alarms will be installed on the E2P Power Island. Existing leak detection and alarms at the Teesside Terminal will be reviewed and supplemented if required to ensure the detection of the fuel gas stream.

4.2.3 Fuel Gas Composition

The fuel gas will be predominately a mix of both ethane and methane and will be subjected to H_2S removal within the existing DEA unit (the H_2S removal process is outlined in Section 4.2.3.1). The fuel gas composition outlined in Table 4-2 represents the treated gas stream specification downstream of the existing DEA units.

Table 4-2 Fuel Gas Composition

Fuel gas Component	Proportion
Ethane	80 – 85 wt%
Methane	15 – 20 wt%
Propane	Trace
Butane	Trace
Carbon dioxide	< 0.5 wt%
Hydrogen sulphide	< 10 ppm (wt)
Mercury	< 1 ppb (µg/kg)

In pre-application discussions with the EA, it was highlighted that the presence of mercury within the fuel gas stream should be considered. Refineries BAT 43 states that in order to prevent emissions of mercury when present in raw natural gas, BAT is to remove the mercury and recover the mercury-containing sludge for waste disposal.

An assessment was undertaken to assess the mercury content in the towns gas supply and also the mercury content of the fuel gas supply. The mercury content of the town gas supply to the Teesside Terminal was found to be 0.02µg/kg.

The tie-in for the fuel gas will be downstream of the existing mercury removal beds. The fuel gas for the E2P Power Island was found to be 0.01 µg/kg, and therefore lower than that in the towns gas. Therefore, no additional mercury removal is proposed for the E2P Power Island. As the mercury removal beds comprise part of the existing Teesside Terminal operations it is considered that they will have previously been reviewed against the Refineries BATc and therefore no further review has been carried out.

The feed gas will be subjected to H_2S removal, heating and pressure reduction prior to transfer to the E2P Power Island. The H_2S removal and pressure reduction are existing processes at the Installation and will therefore not be assessed against BAT as part of this Environmental Permit variation, however for completion these processes are summarised in the following sections.

4.2.3.1 H_2S Removal

H_2S removal will take place using the existing DEA treatment and dehydration loop. The existing system currently removes H_2S to less than 5 ppm(v) and is sized for existing fuel gas treatment, the flow rate of which will remain unchanged as a result of the E2P project.

The existing DEA system is an amine wash system where the De-Ethaniser overhead stream is treated using a DEA solution in a DEA contactor (absorber tower). There are three DEA trains operating in duty, standby and maintenance.

In the DEA contactor, H_2S and carbon dioxide (CO_2) from the fuel gas stream are chemically absorbed in the DEA solution. Following absorption, the DEA is removed from the base of the contactor, preheated, and then transferred to the DEA Still for removal of the H_2S and CO_2. The regenerated DEA is returned to the contactor for reuse and the H_2S and CO_2 are cooled and then scrubbed in a reflux accumulator. The H_2S and CO_2 are then routed to the hot vent header for destruction in the existing flare system.

The DEA contactor also has an integral scrubber located at the bottom of the contactor column where the treated De-Ethaniser overhead gases are routed so that traces of DEA carryover are knocked out. The treated gas will then be sent to overhead product dehydrators to remove any moisture content before being transferred to the E2P Power Island.

The system is essentially closed, however at varying intervals fresh DEA is required to 'top up' the system to address loss by entrainment, or decomposition and to maintain the strength to approximately 30%.

4.2.3.2 Pressure Reduction

The pressure of the fuel gas will need to be reduced from 14 barg to an intermediate pressure for transfer from the existing Teesside Terminal operations to the E2P Power Island and then to 3 barg for use in the gas engines. The pressure reduction will therefore occur over two stages. A pressure control valve will be used to achieve this pressure reduction.

The first pressure reduction units will be installed at the existing Installation and the second will be located at the boundary of E2P Power Island. The system volume between the two pressure let downs will act as a buffer capacity to dampen any pressure swings from upstream and downstream.

To minimise impact on the Terminal's plant, a pressure sustaining valve will be installed to maintain upstream pressure by opening and closing the value as required. This ensures that only when there is excess fuel gas in the system, that results in an increase in fuel gas pressure, will the control valve open and allow the fuel gas to flow to the E2P Power Island.

4.2.4 E2P Power Island Operation

Once the fuel gas has been transferred to the E2P Power Island, it will be sent to the gas engines. The gas engines will be reciprocating engines with a maximum aggregated capacity of a maximum of 77MWth. The maximum number of engines installed will be 16, however this will be dependent on the final detailed design. As such, for the purpose of this Environmental Permit variation, a maximum number of 16 engines have been assumed as a worst-case.

Some of the installed engines will be for redundancy, to enable the availability of the E2P Power Island to meet target levels of 95% (upwards of 99% being desirable) thereby minimising the potential for flaring as a result of engines undergoing maintenance outages.

Reciprocating engines have been selected as they are capable of quick start-ups and shutdowns allowing for flexibility of use depending on demand. The purpose of having a series of smaller gas engines is to allow the facility to easily respond to the changes in demand and the reducing fuel gas volumes over time. For example, if there is a greater volume of fuel gas supply, engines can be brought online to accommodate the additional supply. Gas engines provide high availability and reliability, and the modular small engines would enable flexibility within the E2P Power Island to minimise the potential for flaring and allow on site capacity to easily respond to meet the changing availability of the fuel gas. Further consideration of this is provided in the Site-specific BAT Assessment provided in Appendix D.

It is expected that during the first 9 years of operation there will be a greater supply of fuel gas, as such more engines are likely to be operational during this period. Following this date the fuel gas supply rate will have decreased to approximately half of its starting volume, and therefore overtime the number of gas engines operating will also decrease.

In a reciprocating engine, fuel is combusted in the cylinders of a multi-cylinder gas engine, utilising the air that is usually first pressurised by turbo charger(s) and then compressed by the pistons. The force developed turns a crank shaft, which then turns an alternator, which generates the electricity for export to the electricity network. Each engine will have a dedicated stack associated with it, for the discharge of exhaust gases to atmosphere.

Each engine will be housed within an enclosure which will comprise the following:

- container lube oil system which will be sourced from the bulk storage on the E2P Power Island;
- A fire and gas alarm system which will be installed in every engine container.
- gas engine cooling water jacket system comprising a water/ glycol coolant mix; and
- exhaust stack.

The E2P Power Island's oil transfer pumping system will automatically top up the engines during running and will be able to be drained via fixed pipework. The automated oil transfer functionality will facilitate the following:

- filling of the localised engine fresh oil tanks from the bulk oil tank;
- filling the oil pan from the local tank (during running) or the bulk tank (during servicing);
- emptying of the oil pan to the bulk waste oil tank;

The system will be fitted with level switches to denote low level within the oil tank. Oil shut-off devices will also be provided to safeguard transfer operation.

The gas engines will be situated in two parallel rows running north to south in the centre of the E2P Power Island, as shown in Figure 4 (Appendix A).

Each engine will have an exhaust which will be mounted on the roof of the enclosures. The height of each exhaust will be approximately 10.4m above ground level. The exhausts will be made of stainless steel and fitted with silencers. The exhausts will be designed to prevent condensate or rain from entering the silencer or engine.

4.2.5 Ancillary Equipment and Structures

To support the operation of the gas engines, a series of ancillary equipment and structures will be required and are outlined in the following sections.

Fuel Gas Heater

Two new inline electric heaters will be installed to heat the incoming fuel gas stream to 20ºC. The heaters will be located at the boundary of E2P Power Island. The electric heater will be thyristor controlled. The thyristor will regulate the power to the electric heaters by controlling when in the alternating current (AC) cycle the power is turned on.

Knockout Drum

In the past, ConocoPhillips have seen upset conditions upstream of the De-Ethanisers resulting in water carry over from the Dehydrator Beds. A Knockout (KO) drum will therefore be provided as a means of protecting the E2P Power Island from any liquid carry over from upstream processes.

Under normal operating conditions there will be no liquid in the fuel gas stream. Any liquid that is collected in the KO drum will be manually blown into the warm vent system.

Flare System

There are two existing flares at the Instillation designated to provide warm and cold pressure relief. The built-in redundancy and flexibility of the E2P Power Island has been designed to minimise the use of a flare, as detailed in the Site-specific BAT Assessment (Appendix D). However, in the event that pressure relief is required, the fuel gas will be transferred to the existing flare.

An overpressure vent from the existing Teesside Terminal has been implemented to protect the new plant equipment and pipework from overpressure. If the pressure at the tie-in of E2P Power Island to the existing Teesside Terminal inlet exceeds the set point, a valve will open to route the fuel gas to the flare to reduce upstream pressure.

Fire Protection

To support the operation of the gas engines a fire protection system will be installed at E2P Power Island. Each engine will have its own fire suppression system. In addition, there will be hydrants within the E2P Power Island that would be fed from the existing fire main routed around the E2P Power Island.

Water Supply Infrastructure

A small amount of cooling water mixed with glycol will be required to supply the gas engines water jackets. These will be closed loop systems and will be topped up using water sourced from the Teesside Terminal. When required, discharges from the gas engines' cooling system which will be collected and transported offsite to be disposed of via licensed 3rd party waste contractors, in line with regulatory requirements and existing Installation procedures.

4.3 Utilities

4.3.1 Instrument Air and Nitrogen

The E2P Power Island will require instrument air and nitrogen in the operation of the gas engines, which will be sourced from the existing Teesside Terminal sources.

4.3.2 Water/ Glycol

The gas engines will have a closed-circuit jacket water cooling system comprising water and glycol. Water to the jacket will be supplied from the existing Teesside Terminal facilities to E2P Power Island. The water jackets will require occasional top up as well as drain during maintenance periods.

4.4 Process Control

The E2P Power Island will be controlled by its own dedicated control system. The new system will be connected to the existing Process Control Room (PCR) at the Teesside Terminal where it will be remotely monitored. The Installation has detailed procedures for defining, monitoring and responding to Safe Operating Limits (SOLs), Reliability Operating Limits (ROLs), and Environmental Operating Limits (EOLs), which will also be applied to the E2P Power Island. It is anticipated that the new system will be integrated and with uniform functions similar to that of the current control and safety systems used at the Installation. The control system and its operation will be largely automated with in process control and monitoring.

The operational data collected from the monitoring of the E2P Power Island will allow the plant processes and maintenance procedures to be reviewed and optimised.

4.5 Management Systems

The E2P Power Island will be operated in line with the existing Environmental Management System (EMS) for the Teesside Terminal which is compliant with the guidance set out by the EA[6] and in the Refineries BATc (BAT 1). The EMS will be amended to include the proposed operations of the E2P Power Island prior to the commencement of the operation.

The EMS and procedures will be available for inspection by the EA upon request, and will be applicable to all staff, contractors and visitors to the Installation. The EMS has been developed to enable compliance with the Environmental Permit and relevant legislative requirements for the protection of the environment and human health.

4.6 General Maintenance

The objective of plant maintenance is to ensure that the E2P Power Island, including utility connections, operate safely and reliably. Inspection and maintenance activities have been considered in the E2P Power Island's design and layout during the design process.

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[6] Develop a management system: environmental permits - GOV.UK (www.gov.uk)

Ongoing maintenance, occurring during normal operation, will be via the Contractor's Maintenance Management System and subject to audit by ConocoPhillips as the legal Operator.

4.7 Raw Materials

The use of hazardous materials within the Installation will be eliminated by design where possible, and minimised where it is not practical to eliminate them. In areas where chemicals are being handled, the flooring will be paved and kerbed/ bunded to ensure that spillages and/ or leaks in those areas are contained, manually cleaned up and disposed of appropriately, in line with the existing Installation's spillage management procedures. Any liquid chemicals stored will be kept in appropriately bunded and segregated areas.

Raw materials will be stored in appropriate containers, within suitable spill protection including; double skinned tanks with leak detection, on bunded pallets, on drip trays, in specifically designed cabinets and cupboards or other appropriate storage units and areas. Storage of raw material substances for use in the E2P Power Island will be within a dedicated new Workshop/ Stores building.

The EMS will comprise procedures for controlling raw material delivery including for oil transfer operations, and spill response procedures. Spill kits will be available at various locations at the E2P Power Island, including the designated area for material delivery.

The main raw material used will be the fuel gas which will fuel the gas engines. The composition of the fuel gas is detailed in Table 4-2. As outlined in Section 4.2, the fuel gas supply will decrease overtime. No fuel gas will be stored prior to combustion in the gas engines. All other raw materials and their predicted storage volumes are detailed in Table 4-3.

Table 4-3: Additional Raw Materials

Material	Purpose	Estimated Maximum Storage Quantity	Estimated Annual Consumption
Fuel gas	Fuel source	No storage	Refer to Table 4-1
Lubrication oil	Use within gas engines	$20m^3$	$<10m^3$
Glycol	Gas engine cooling (water jacket closed loop system)	No storage	$<10m^3$
Nitrogen	Use within process	No storage	Minimal compared to existing Installation operations.

4.8 Waste

The E2P Power Island will be integrated with the existing EMS to manage raw material and water use, in order to minimise waste generation in accordance with existing procedures and indicative BAT requirements (Refineries BATc, BAT 14). Through existing procedures, ConocoPhillips ensures that waste is minimised, reused, recycled or recovered in accordance with the waste hierarchy.

General wastes from the E2P Power Island are expected to be minimal and will be appropriately disposed of via licensed 3rd party waste contractors, in line with regulatory requirements and existing Installation procedures.

Waste lubricating oil will be generated from the use of the engines. The waste oil generated will be stored within an integrally bunded bulk storage tank with 110% spill capacity. The tank can hold 20,000 litres. Waste lubrication oil will be collected and transported off site by a third-party contractor to be disposed of at an appropriate and licensed facility.

All wastes will be stored in appropriate, labelled containers and stored in designated bunded waste storage areas. All bulk waste storage tanks will be within bunds with 110% capacity of the primary container.

All other wastes generated such as packaging and general wastes will be managed through existing waste management practices at the installation, implemented through the Installation's EMS and in accordance with BAT.

Wastes anticipated to be generated by the operation of the E2P Power Island, including estimated quantities and generation frequency i.e. continuous/ intermittent/ occasional, are shown in Table 4-4.

Table 4-4: Anticipated Waste Stream Generated in the E2P Power Island

Waste Stream	Estimated Annual Quantity	Generation frequency	Disposal Route
Waste lubrication oil	<10m^3	Occasional	Collected for off-site treatment by licenced 3rd party waste contractor.
Glycol	<10m^3	Occasional	Collected for off-site treatment by licenced 3rd party waste contractor.

4.9 Energy Efficiency and Energy Use

Under Article 14 of the Energy Efficiency Directive (2012/27/EU) (EED), operators of certain types of combustion installations >20MWth are required to undertake an assessment of opportunities for cogeneration (also known as combined heat and power (CHP)) or supplying a district heating or cooling network. It requires that a cost-benefit analysis in accordance with Part 2 of Annex IX of the EED is carried out in order to assess the cost and benefits of providing for the operation of a new installation as a high-efficiency cogeneration installation.

A cost benefit analysis and CHP Readiness study has been carried out to support the Environmental Permit variation application and is provided in Appendix H.

The Teesside Terminal already operates a CHP plant to drive the gas refrigeration units and provide hot air for increased boiler combustion efficiency and there is no scope to accept any additional heat sources from the E2P Power Island at the Installation.

The cost benefit assessment identified that numerous theoretical heat loads do exist within the required 15km radius of the Installation. The majority of the potential domestic load is centred around settlements south of the Tees, Hartlepool to the North and Billingham to the West.

A high proportion of the waste heat produced by the proposed reciprocating engines will be in the range of 90°C (jacket cooling water), with potential for only up to 10% to be recovered at a higher grade 250-300°C (10.4 m stack flue gas exit). However, given the declining availability of the fuel supply, subsequent decreasing volume of heat available from the E2P Power Island and the additional significant cost and complexity of a system requiring multiple export routes to reach the demand, it is concluded that heat extraction from the E2P Power Island does not offer an economically viable solution.

Nevertheless, the generator containers will be provided with flow/ return flanges on one side which could be used to retrofit jacket water heater recovery equipment at a later date if opportunities for CHP are identified in the future. Additional heat recovery equipment is available from the engine provider, which would include changing the dual coil radiator to two separate radiators (jacket water & intercooler radiators). It is therefore considered that that E2P Power Island will be CHP-Ready should future opportunities become available.

4.9.1 Energy Use

In the initial stage of operations, the E2P Power Island is expected to combust a maximum of 77 MWth of process fuel gas from the DeC_2 OHs for up to 8,760 hours of annual operation. As previously detailed, the fuel gas supply will reduce overtime, with the fuel gas flowrate expected to reduce to approximately <22 MWth by the year 2036. The number of operational gas engines will decrease in line with the reducing fuel gas volumes to ensure that the E2P Power Island operates efficiently.

The electrical load of the Terminal is 8MW, the parasitic load for the E2P Power Island is expected to be 1.1 MW and the electrical energy will be sourced from the E2P Power Island itself.

The main electrical equipment to be used for the operation of the E2P Power Island include:

- HVAC systems such as an electrical water jacket pump, preheat device to provide gas engine cooling and air intake fan for ventilation;
- Electric starter motors for engine starting system;
- Lube oil system pumps;
- Monitoring systems, including gas detection and fire detection;
- Gas conditioning systems – heating
- Lighting

It is intended that the E2P Power Island project will enable the Teesside Terminal to embark on a range of electrification measures across the Installation, which will significantly reduce combustion emissions from other sources across the Installation.

4.9.2 Energy Efficiency

Fiscal standard metering will be in place for the measurement of gas consumed, this will be used as part of a four-hour efficiency test to determine the gross efficiency of each gas engine; the target minimum thermal efficiency of each gas engine is >40%.

There are no specific energy efficiency levels detailed in the Refineries BATc, however the Large Combustion Plant BATc details energy efficiency levels associated with the use of BAT (BAT-AEELs). The BAT-AEELs for different types of combustion plant are provided in Table 4-5. The electrical efficiency of the proposed gas engines is > 40% and therefore is in line with the BAT-AEELs for gas engines and Open Cycle Gas Turbines (OCGTs).

Table 4-5: Large Combustion Plant BATc BAT-AEELs

Combustion Unit	Net Electrical Efficiency (%)
New Closed Cycle Gas Turbines (CCGTs) 50 - 600MW_{th}	53.0 – 58.5
New OCGT >50MWth	36 – 41.5
New Gas engines	39.5 – 44.0

The Refineries BAT (BAT 2) states that an appropriate combination of techniques should be applied to use energy efficiently, including design techniques such as heat integration; heat and power recovery; process control and maintenance techniques such as process optimisation; and production techniques such as use of Combined Heat and Power. Process control and maintenance techniques will ensure that the gas engines operate efficiently.

The following measures will be used to maximise energy efficiency across the E2P Power Island:

- The Contractor service agreement will incentivise the Contractor's operation and maintenance to optimise operating load sharing across the generators and individual generator running hours while minimising the amount of fuel gas sent to the Installation's flare system;
- The plant components will be sized appropriately for the design capacity of the plant, so that each element is operating optimally and efficiently;
- Use of high efficiency motors and variable speed drives to minimise electricity load;
- Optimise power consumption; and
- Regular planned maintenance in order to maximise the efficiency of the equipment and plant, with performance monitoring with audits to optimise the maintenance schedule.

In addition, each engine will be made ready to transfer thermal energy for future energy recovery purposes (e.g. a site Lower Temperature Hot Water circuit) by the Contractor ensuring associated equipment can be installed in the future. Flanged connections will be installed on the jacket water flow and return connections to facilitate such a connection and are to be fitted with blank flanges.

5. Emissions

5.1 Emissions to Air

As well as the changes associated with the E2P Power Island, existing Emission Points A20 to A23 require removal from the Environmental Permit, as these Emission Points were associated with a CHP plant that was never installed, and therefore do not exist at the Teesside Terminal. As such, these Emission Point reference will be utilised for the E2P Power Island.

The E2P Power Island will comprise a listed activity under the EP Regulations as a Section 1.1 Part A(1)(a): Burning of any fuel in an appliance with a rated thermal input of 50MW or more, however as the fuel gas originates as a result of the Teesside Terminal crude oil stabilisation activities, the BAT-AELs for combustion plant on refineries are applicable to the E2P Power Island, as provided in the Refineries BATc and shown in Table 5-1.

Table 5-1: Applicable BAT-AELs for Combustion Plant from the Refineries BATc

Pollutant	Emission Limit	Source
Oxides of nitrogen (NOx)	30 - 100mg/Nm^3	New unit gas-fired combustion unit (BATc Table 10)
Carbon Monoxide (CO)	<100mg/Nm^3	Combustion units (BATc Table 15)
Sulphur Dioxide (SO_2)	5 - 35mg/Nm^3	New multi-fuel fired combustion plant (BATc Table 13)
Dust	N/A	No limit for refinery off-gas in the BATc.

Reference conditions: standard temperature and pressure, dry, 15% O_2

Each gas engine will emit waste combustion gases through a 10.4 m high stack, the location of these is shown in Figure 4 (Appendix A).

The emissions from an individual engine are detailed in Table 5-2, with the same emissions occurring from each operational engine.

Table 5-2: Emissions Inventory – Each Engine

Emission Point	Stack height (m)	Stack Diameter (m)	Temp (°C)	Actual flow rate (Am/hr)	O_2 Content (%)	H_2O Content (%)	Normalised flow (Nm^3/hr)	Efflux velocity (m/s)	Pollutant	Emission Conc$^{\underline{n}}$ (mg/Nm^3)	Release rate (g/s)
A20 – A35	10.4	0.6	484	26,367	9.1	10.5	17,023	30.8	Oxides of nitrogen	95	0.45
									Sulphur dioxide	35	0.17
									Carbon monoxide	100	0.47

Normalised to dry gas, 0°C, 15% oxygen

The achievable NOx emissions from the engines have been confirmed by the suppliers as 95mg/Nm^3 and therefore are slightly below the Refineries BATc BAT-AEL for new plant of 100mg/Nm^3.

Engine suppliers have indicated that a NOx emission of 75mg/Nm^3 could be achieved through the use of secondary abatement, such as Selective Catalytic Reduction (SCR), however this would result in an associated emission of ammonia from the engines. The Air Impact Assessment (Appendix E) has considered the application of SCR to the engines, and it is considered that the minimal reduction in NOx emission achieved is outweighed by the additional ammonia released, and its impact on ecological receptors in the vicinity of the E2P Power Island.

Further consideration of the application of BAT 34 for the reduction of NOx emission to air is provided in Appendices C and D.

The achievable SO_2 emissions from the engines will be dependent on the H_2S content of the fuel gas supplied by the Teesside Terminal. As detailed in Section 4.2.3.1, the existing DEA unit removes H_2S to <5ppm and therefore it is considered that SO_2 emissions at the Refineries BATc BAT-AEL for new plant of <35 mg/Nm^3 will be achievable by primary means. Although it is considered that actual emissions will be significantly less than 35 mg/Nm^3 (potentially being less than 5mg/Nm^3), the upper end of the BAT-AEL has been applied at this stage of the plant design. Further consideration of the application of BAT 36 for the reduction of SO_2 emission to air is provided in Appendices C and D.

BAT for CO emissions (BAT 37) is to use combustion operation control. CO emissions from gas engines cannot meet the BAT-AEL of <100mg/Nm^3 by combustion controls alone, and therefore it is envisaged that a catalyst will be required to meet the BAT-AEL.

An Air Impact Assessment of the operation of the existing Teesside Terminal and the E2P Power Island has been carried out and is provided in Appendix E.

5.2 Emissions to Water

5.2.1 Existing Installation Drainage

All surface water and process drainage generated at the existing Installation is directed to the existing ETP. The ETP includes primary and secondary treatment, including plate separators, dissolved air flotation and chemical dosing (peroxide and flocculants). All treated effluent is then discharged under set emission limits via Emission Point S1, to the Bran Sands Wastewater Treatment Works.

5.2.2 E2P Power Island Drainage

There will be no discharges of process waters from the E2P Power Island and any liquid wastes (i.e. lubricating oils or water/ glycol mix from the water jacket) will drain via a drain point in the gas engines enclosure and be collected and transported offsite to be disposed of via licensed 3rd party waste contractors, in line with regulatory requirements and existing Installation procedures.

The E2P Power Island area has an existing sump which was utilised by the Seal Sands Power Station to send non-hazardous liquid emissions to the Teesside Terminal drainage system. This sump will therefore be reused for surface water and fire water drainage from the E2P Power Island.

The E2P Power Island area will be covered by fully impermeable surfacing consisting of reinforced concrete foundations with an infill slab. A new/ extended perimeter road will also be drained towards the existing sump.

Domestic drainage from the E2P Power Island's welfare facility will be connected to an existing Klargester unit, which will require collection and off-site disposal via a licensed 3rd party waste contractors.

A drainage plan for E2P Power Island is provided in Figure 5 (Appendix A).

5.3 Emissions to Sewer

There will be no emissions to sewer as a result of this Environmental Permit variation.

5.4 Emissions to Land

There will be no emissions to land as a result of this Environmental Permit variation.

5.5 Fugitive Emissions

Fugitive emissions have the potential to occur from flanges, seals, valves and equipment vents during transfer operations. The E2P Power Island will be designed to minimise the risk of fugitive emissions.

In line with the Refineries BATc BAT 6, each gas engine enclosure will be fitted with a gas and fire detection and alarm system which will be connected to the PLC. In addition, new gas detection and alarms will be installed on the E2P Power Island. Existing leak detection and alarm systems on the Teesside Terminal will be reviewed and supplemented if required to ensure the detection of the fuel gas stream.

All pipework will be fully welded and to minimise the risk of leaks. Any below ground pipework will be contained within a concrete trench.

Areas handling chemicals will comprise hardstanding and be kerbed/ bunded to ensure that spillages and/ or leaks in those areas are contained, manually cleaned up and removed for treatment off-site. To minimise rainwater collection (and therefore inventory), these areas will be located indoors or be provided with rain shelters, where practicable and safe to do so.

5.6 Odour

In the unlikely event that odour is produced as a result of the operation of the E2P Power Island, the Installation's EMS would ensure that any offsite odour issues were managed in accordance with the Enquires and Complaints Procedure, which is reviewed annually, or in the event of odour complaints being received by the Installation. The Installation has to date never received a complaint in relation to odour.

5.7 Noise

During as pre-application meeting held with the Environment Agency on 8th May 2024, it was stated that *"Noise is unlikely to be appreciable at the nearest residential receptors due to distance (4.5km) however the impact on ecological receptors should be considered"*. Following the meeting, further clarification of the distance to the nearest residential receptor was provided to the who confirmed that even at 3km impacts would not be an issue and no Noise Impact Assessment for human receptors was needed to support the Environmental Permit variation application.

The Noise Impact Assessment that was completed for the planning application has been provided in Appendix F and assesses the potential impacts associated with the operation of the E2P Power Island on the closest noise sensitive receptor. As part of the assessment a 3-dimensional noise prediction model was constructed to predict noise emission from plant items and an assessment of their likelihood of impact has been undertaken in line with British Standard BS 4142. The predicted noise emissions arising from the E2P Power Island do not exceed the 25th percentile of background noise level during the quietest night-time period at the closest human health receptor. As per BS 4142, where the rating level does not exceed background sound levels, this is an indication of a low impact, and therefore the Noise Impact Assessment confirms the EA's pre-application advice.

The Habitats Regulations Assessment prepared for the Planning Application submitted for the E2P Power Island (provided in Appendix G) project has utilised the noise assessment report to determine the potential impacts upon the bird species associated with the Teesmouth and Cleveland Coast SPA. The assessment has shown that the operation of the E2P Power Island, will ensure there are no likely significant effects upon the SPA site and the conservation objectives of it.

6. Monitoring

6.1 Infrastructure

Monitoring of all Installation infrastructure is undertaken as part of the Installation's existing management systems, operational protocols and practices.

Regular inspection of the E2P Power Island's infrastructure will be undertaken by the Contractor. Routine operational checks and infrastructure audits are likely to comprise identification of issues relating principally to:

- equipment degradation;
- standing water in bunded/ kerbed areas; and
- storage areas.

Any issues identified during operational checks or inspections are recorded and actions assigned to relevant personnel and closed out once they have been actioned. The management systems will be extended to cover the operation of the E2P Power Island, and all its associated equipment.

Process monitoring will be undertaken at key stages of the process for a suite of parameters, including flow rates, temperatures and pressures.

6.2 Emissions to Air

The requirement to carry out monitoring of emissions from combustion plant is provided in the Refineries BATc (BAT 4). For combustion plant <50 MW, monitoring for NOx, SO_2 and dust can be carried out once per year by periodic extractive monitoring. The requirement for CO emissions is every six months, however the BATc state that this can be changed where monitoring data demonstrates that the emissions are stable. Emissions monitoring will be undertaken in accordance with the EA's recommended guidance.

The Environmental Permit will need to be updated to include the additional point source emissions from the gas engines. The BAT-AELs for the gas engines are shown in Table 6-1, together with the proposed monitoring.

Table 6-1: Proposed Emissions and Monitoring (for insertion into Permit)

Release Points	Parameter	Limit (mg/Nm^3)	Reference Period	Monitoring Frequency	Monitoring Standard or Method
A20 – A35	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	95	Average over the sampling period	Once a year and after significant fuel changes	BS EN 14792
	Carbon monoxide	100			BS EN 15058
	Sulphur dioxide	35			BS EN 14791 or CEN TS 17021

Normalised to dry gas, 0°C, 15% oxygen

6.3 Emissions to Water

Table S3.2 of the existing Environmental Permit provides the emission parameters and associated emission limits and monitoring requirements for the emissions to water from the Installation.

Monitoring of discharges via 24-hour composite sampling is already carried out, to ensure that discharges are meeting the current Environmental Permit conditions.

The operation of E2P Power Island is not considered to result in emissions to water that would either add additional pollutant species within the wastewaters discharged from the site, nor increase existing pollutant species concentrations over the existing Permitted values.

There will be no change to the existing monitoring that is carried out in relation to discharges to water as a result of this Environmental Permit variation.

7. Environmental Risk Assessment (Impact Assessment)

7.1 Introduction

This section discusses the potential impact on sensitive receptors and the surrounding area and shows how the emissions from E2P Power Island have been assessed. The EA document – 'Risk assessments for your environmental permit'[7] ('EA Risk Assessment guidance'), has been used to scope and assess the emissions from E2P Power Island.

Where necessary, baseline impact assessments and appropriate modelling has been completed to ensure that any predicted significant effects on sensitive receptors can be avoided/ mitigated.

The impact assessments are reported in the relevant sections or Appendices of this Main Supporting Document:

- Air Quality Impact Assessment (Appendix E); and
- Qualitative Risk Assessment (Appendix I).

7.2 Installation Location and Sensitive Receptors

7.2.1 Human Receptors

The closest residential receptors to the Installation are situated to the northwest of the site. Table 7-1 lists the human receptors in the vicinity of the Installation.

Table 7-1: Human Receptors in the Vicinity of the Installation

ID	Receptor name	OS grid reference (m)		Receptor type	Distance (km) and direction from the Installation
		X	Y		
R1	Greatham	449625	527150	Residential	3.7km northwest
R2	Seaton Carew	452090	528910	Residential	3.8km north
R3	Dormanston	458030	523805	Residential	5.2km east
R4	Port Clarence	449350	522275	Residential	4.1km southwest
R5	Billingham	447265	524865	Residential	5.3km west
R6	Marsh House Lane	449803	526833	Residential	3.1km northwest
R7	Cowpen Bewley	448280	524820	Residential	4.2km west

7.2.2 Ecological Receptors

EA Risk Assessment guidance requires that the effects of stack emissions on designated ecological sites be assessed where they fall within set distances of the source, up to 10 km (or 15 km for large emitters) for European designated sites and up to 2 km for nationally designated sites.

Statutory designated sites have been identified through a desk study of the Defra Magic mapping[8] website, which identifies Sites of Special Scientific Interest (SSSIs), Ramsar sites, Special Protection Areas (SPAs) and Special Areas for Conservation (SACs). In addition, non-statutory designated receptors have also been

[7] Risk Assessments for your Environmental Permit, DEFRA and EA, Published on: 1st February 2016, Last updated on: 21st November 2023, accessed at: https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit

[8] Defra Magic mapping accessed at http://magic.defra.gov.uk/MagicMap.aspx

identified, including National Nature Reserves (NNR) and Local Wildlife Sites. Table 7-2 lists the ecological receptors in the vicinity of the Installation.

The Environment Agency, in their pre-application advice, provided information on a number of LWS in the vicinity of the Installation including:

- Greetham Creek North Bank Saltmarsh;
- Greenabella Marsh;
- Zinc Works Bird Field;
- Power Station Grassland and Wetland;
- Saltern Saltmarsh;
- Seaton Common;
- Phillips Tank Farm Grassland;
- Brenda Road Sewage Works Grassland;
- Brenda Road Brownfield; and
- Queen's Meadow Wetland.

It is considered that the distance to a number of these sites is greater than the 2km screening distance namely, Brenda Road Sewage Works Grassland, Brenda Road Brownfield and Queen's Meadow Wetland, and therefore these sites have not been included in the assessment. A number of the other LWSs correspond to receptor locations that have been identified as part of the Teesmouth and Cleveland Coast SSSI – this has been indicated in Table 7-2 where relevant.

Table 7-2: Ecological Receptors in the Vicinity of the Installation

ID	Receptor	Designation	OS grid reference (m)		Distance and Direction from Installation (km)
			X	Y	
E1 – E13 E30 – E36 and E40	Teesmouth and Cleveland Coast	SPA, Ramsar, SSSI and NNR	Various	Various	Adjacent north
E14	Northumbria Coast	SPA and Ramsar	448266	537476	12.7km northwest
E15	Durham Coast	SAC and SSSI	448266	537476	12.7km northwest
E16	North York Moors	SPA, SAC, SSSI	461229	513618	13.6km southeast
E17	Lovell Hill Pools	SSSI	459555	519057	8km southeast
E18	Hart Bog	SSSI	445285	535391	12.4km northwest
E19	Langbaurgh Ridge	SSSI	455467	512389	12.5km south
E20	Roseberry Topping	SSSI	457835	512796	13km southeast
E21	Saltburn Gill	SSSI	466990	521253	13.6km east
E22	Whitton Bridge Pasture	SSSI	438679	522285	13.7km west
E23	Briarcroft Pasture	SSSI	439513	519361	13.7km southwest

ID	Receptor	Designation	OS grid reference (m)		Distance and Direction from Installation (km)
			X	Y	
E24	Pike Whin Bog	SSSI	441514	533400	13.7km northwest
E25	Cliff Ridge	SSSI	457266	511728	13.7km southeast
E26	Hulam Fen	SSSI	443898	537392	14.8km northwest
E27	Charity Land	SSSI	437520	534526	15km northwest
E28	Fishburn Grassland	SSSI	436462	532832	15km northwest
E29	Seaton Dunes and Common	LNR	452549	527829	2km north
E37	Power Station Grasslands	LWS	452630	527290	1.8km north
E38	Seaton Common	LWS	453720	527320	1.9km north
E39	Phillips Tank Farm	LWS	451130	526345	1.7km northwest
E1 Is also taken to be representative of Greetham Creek North Bank Saltmarsh LWS E13 Is also taken to be representative Zinc Works Bird Field LWS. E30 Is also taken to be representative of Greenabella Marsh LWS E36 Is also taken to be representative of Saltern Saltmarsh LWS					

7.2.3 Hydrology

The statutory Main Rivers within 1km of the Installation Site boundary include the River Tees (directly adjacent to northeastern boundary) and Greatham Creek (approximately 500m northwest). The Installation Site boundary is approximately 1km from the mouth of a Water Framework Directive (WFD) coastal waterbody named Tees Coastal[9].

The EA Flood Maps for Planning show that the majority of the Installation, including the whole E2P Power Island area, is within a Flood Zone 1. This is defined as land having a *"less than 1 in 1,000 annual probability of river or sea flooding (<0.1%) – very low"*. The northern section of the Installation, which includes the jetties within the River Tees, is within a Flood Zone 3, which is defined as *"land having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year"*.

7.2.4 Geology

Made ground is present at the E2P Power Island site, shown on the British Geological Survey's (BGS) GeoIndex (Onshore) online mapping[10]. This is confirmed by a ground investigation carried out by RSK Group in 2008[11] across the Teesside Terminal, which encountered made ground to depths of 0.5m to 1.5m, underlain by re-worked natural material comprising occasionally silty, occasionally gravelly sand. Additionally, the RWE Generation UK PLC's Seal Sands Power Station Application Site Condition Report states the presence of artificial deposits and a Geological Assessment report, undertaken by the British Geological Survey (BGS) (BGS Report No. GR_102606_1, dated 2006), states that the site is located on reclaimed land and made ground.

[9] Environment Agency (No date) Catchment Data Explorer – Tees Coastal. (Online). Available at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB650301500005 (Accessed 25/10/2024)

[10] British Geological Survey (No date) GeoIndex Onshore mapping (Online). Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.147436599.1275366957.1729849405-345094644.1729849405 (Accessed 25/10/2024)

[11] RSK Group (2008). First Phase Reporting, Site Protection and Monitoring Programme

Review of the BGS GeoIndex online mapping[10] suggests that the superficial deposits beneath the Installation are Tidal Flat Deposits of the Quaternary Period. As stated in the Seal Sands Power Station Baseline Report (Appendix B), a historical BGS borehole (Reference NZ52NW 145/C) and 1996 ground investigation results[12] show the presence of loose silty sand and soft organic silty clay, likely to represent Tidal Flat Deposits, to depths between 19.40-24.20m below ground level (bgl). These results also show that the Tidal Flat Deposits are underlain by Glacial Till, comprising stiff to very stiff silty clay with pockets and thin seams of sand and gravel to depths between 25.00-33.00 m bgl.

BGS GeoIndex online mapping[10] further shows that the bedrock geology of the majority of the Installation site is primarily classified as mudstone in the Mercia Mudstone Group, which is underlain by sandstone of the Sherwood Sandstone Group. The BGS borehole encountered red brown siltstone with thin gypsum veins, likely to represent the Mercia Mudstone Group, at 30.05m bgl, proved to a maximum depth of 31.40m bgl.

7.2.5 Hydrogeology

The RWE Generation UK PLC's Seal Sands Power Station Application Site Condition Report suggests there is likely to be water in the made ground beneath the site, the water is expected to be of poor quality due to the industrial nature of the wider area surrounding the Installation and proximity to the Tees Estuary. The report also suggests tidal groundwater will likely be encountered at shallow depths within the Tidal Flat Deposits.

The Geo-Environmental Desk Study contained in the Site Condition Report (Appendix B) states that the Tidal Flat Deposits is designated as a Secondary (Undifferentiated) Aquifer. The EA defines a Secondary Undifferentiated Aquifer as *"where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value"*. The Geo-Environmental Desk-Study also states that the Mercia Mudstone Group has been designated as Secondary B Aquifer, which is described as *"predominantly lower permeability strata which may in part have the ability to store and yield limit amount of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering"*. The groundwater within the Tidal Flat Deposits and the Mercia Mudstone Group is likely to be brackish.

Review of the British Geological Survey's GeoIndex (Onshore)[13] mapping shows that the majority of the Installation is located above a Triassic Rocks (undifferentiated) low productivity aquifer, summarised as *"Largely argillaceous sequence with occasional sandstones yielding less than 0.5l/s of water that can be highly mineralised. Confines the underlying Sherwood Sandstone aquifer"*[13]. To the northeast of the Installation Boundary there is a Triassic Rocks high productivity aquifer, summarised as *"Principal sandstone aquifer up to 600 m thick and yielding up to 125l/s. Quality good but hard and becomes saline beneath confining Mercia Mudstone"*[13].

There are no Source Protection Zones, Drinking Water Safeguard Zones (groundwater and surface water) or Nitrate Vulnerable Zones within the Installation Site Boundary[14,15].

The 2008 ground investigations[11] of the Teesside Terminal site encountered groundwater levels at depths between 0.70m and 5.00m below ground level (bgl) across the site. Of the areas investigated, the boreholes closest to the E2P Power Island (Zone C) encountered groundwater at depths of between 1.35m to 2.40m bgl.

7.3 Pathways for Pollution

In order for a pollution risk to occur, there has to be a source - pathway - receptor (S-P-R) linkage. Pathways to sensitive receptors primarily include, but are not limited to, the following:

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[12] Phillips Petroleum (October 1996). Cogeneration Project - Seal Sand, Teesside - Factual Report on Site Investigation

[13] British Geological Survey (No date) GeoIndex Onshore mapping (Online). Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.147436599.1275366957.1729849405-345094644.1729849405 (Accessed 25/10/2024)

[14] Department of Environment, Food and Rural Affairs (No date). Data Services Platform – Source Protection Zones [Merged]. (Online). Available at: https://environment.data.gov.uk/explore/6fd0120f-d465-11e4-abee-f0def148f590?download=true (Accessed 04/11/2024).

[15] Environment Agency (No date). Check for Drinking Water Safeguard Zones and NVZs. (Online). Available at: https://environment.data.gov.uk/farmers/ (Accessed 04/11/2024).

- Oils required for the operation of E2P Power Island could be accidentally released and leach into the ground and groundwater;
- Oils required for the operation of E2P Power Island could be accidentally released into surface water via Emission Point W2;
- chemicals within the discharged effluent to Emission Point S1; and
- gases released via the gas engines stacks from Emission Points A20 – A35 will be dispersed in the air to sensitive receptors.

In order to prevent and minimise the risk of pollution, the E2P Power Island will be designed and managed to isolate or reduce the effectiveness of these pathways, preventing contaminants from migrating off site other than through properly managed abatement systems.

The detailed description provided in Section 4 demonstrates how BAT in accordance with Refineries BATc has been applied to prevent pollution from the E2P Power Island.

7.4 Impact Assessment

The following sections provide an assessment of the impact of releases from the E2P Power Island, so as to underpin and justify the measures that will be put in place for their control and that will adequately protect the environment.

The risk assessment approach has been based on the following four sequential stages:

- identify risks from the activity;
- assess the risks and check that they are acceptable;
- justify appropriate measures to control the risks, if necessary; and
- present the assessment as detailed in the EA Risk Assessments guidance.

Activities with the potential to impact on the surrounding environment have been identified in line with guidance provided by the EA, and include the following assessments:

- amenity and accidents;
- emissions to air;
- emissions to surface water;
- site waste;
- global warming potential; and,
- site closure.

A short description of the key potential risks from the E2P Power Island is provided in the following subsections.

7.4.1 Amenity and Accidents

A qualitative risk assessment covering potential minor accidents has been undertaken for the E2P Power Island's activities and is included in Appendix I of this Main Supporting Document.

7.4.1.1 Odour

Due to the nature of the activity, it is unlikely that the operation of E2P Power Island will result in the release of odour. If in the unlikely event odour is produced as a result of the operation of the gas engines, procedures outlined in the Installation's existing Odour Management Plan will be implemented.

7.4.1.2 Noise and Vibration

During preapplication discussions with the Environment Agency it was concluded that noise is unlikely to be appreciable at the nearest residential receptors due to distance however the impact on ecological receptors should be considered. The EA noise assessment methodology does not currently consider impacts of noise on ecological receptors however the methodology used to support the Planning assessments should be adequate.

The Noise Assessment accompanying the Planning Application is contained in Appendix F and concluded that the Proposed Development would have a low impact on the nearest human health sensitive receptor and that the operation of the E2P Power Island, will ensure there are no likely significant effects upon the SPA site and the conservation objectives of it (Appendix G).

7.4.1.3 Fugitive Emissions

Based on the various controls placed on the E2P Power Island and equipment, it is expected that fugitive emissions, particularly process emissions to air and water will be negligible.

7.4.1.4 Visible Plumes

Visible vapour plumes are not anticipated to be a significant risk due to the low water content and high temperature of the flue gas. The operation of the E2P Power Island will not include a wet cooling tower or steam cycle, therefore visible condensing plumes are not expected to occur.

7.4.1.5 Accidents

All works at the E2P Power Island will be in accordance with existing Safety Management System Standard for the Teesside Terminal.

The following measures will be in place to mitigate, detect and react to a gas leak in the pipework located on the existing Installation:

- Leak detection which will be maintained by a repair team who will carry out continuous checks of the Installation wide leak detection system.
- Pressure sensing instrumentation will be installed in the gas supply system connected to alarms which would alert operators to a loss of pressure and also trip systems which would initiate appropriate emergency actions such as automatic isolation of the gas supply if the pressure reached a pre-defined limit.
- An Emergency Shutdown System (ESD) will be operated in the event of a significant incident such as an accidental loss of containment of fuel gas. This will isolate sections of pipework to limit the volume of gas which could potentially be released.
- A network of gas detectors will be installed on the E2P Power Island to alert operators to a release of gas, which will initiate the appropriate safety systems including ESD.
- The piping design pressure will be based on the maximum pressure that any associated piece of equipment can generate or the stalling pressure of a reciprocating compressor. An additional 10% safety margin will be added to all pipework.
- The majority of the pipework on site will be designed to the ASME B31.3 standard.

The following measures will be in place to reduce the risk of fire:

- The layout will be designed such that location of areas and equipment does not contribute to introduce hazardous zones and consequently introduce ignition sources and unacceptable risk related to fire and explosion.
- The facility will be systematically evaluated and classified by hazardous emission/ discharge sources for flammable gases and fluids.
- Selection of electrical apparatus located in outside areas will follow authority regulations, standards, and Company requirements for operation in explosive atmosphere where applicable. All electrical and instrument equipment located outside in natural ventilated areas will be certified safe type apparatus for the applicable level of hazardous areas.
- The facility will be equipped with a fire and gas detection system, which ensures rapid and reliable detection of outbreak of fires and gas leakages. The system will be able to perform the intended functions

independently of other systems. Location of detectors shall be based on relevant scenarios, simulations, and tests.

- Isolation of ignition sources and power supply to electrical equipment in areas will be performed in order to limit the probability for ignition of a gas leak.
- All valves used for emergency isolations will be of Fire Safe design, Anti-Static and will conform to BS EN ISO 10497:2004, API 607 4th Edition or the equivalent.

Fire water would be manged using existing procedures and would be contained, as far as practicable, and either disposed off-site in compliance with waste management legislation (if contaminated) or discharged to sewer in accordance with the Environmental Permit.

A number of environmental protection measures will be implemented onsite via the EMS to prevent and control spill events, including but not limited to:

- Procedures to deal with accidental pollution, along with any necessary equipment required by the procedures (e.g. spillage kits), will be held on the E2P Power Island and all personnel will be trained in their use. The Installation benefits from existing procedures for dealing with a loss of containment which will be implemented on the E2P Power Island, as required in the EMS. The procedures have been designed to ensure spillages are not released into any surface water system.
- Implementation of containment measures, including bunding or double-skinned tanks for fuels and oils. All chemicals will be stored in accordance with their COSHH guidelines.

The only abnormal operating conditions that will exist for the E2P Power Island will include events of emergency shutdowns, or failure of plant. These events will be managed within the EMS in order to reduce emissions to air and/ or to water during other than normal operating conditions from the E2P Power Island including the following elements:

- set-up and implementation of a specific preventive maintenance plan for these relevant systems;
- review and recording of emissions caused by abnormal events and associated circumstances and implementation of corrective actions if necessary; and
- periodic assessment of the overall emissions during abnormal events (e.g. frequency of events, duration, emissions quantification/ estimation) and implementation of corrective actions if necessary.

This plan would be regularly reviewed and amended as required to reflect the operation of the E2P Power Island.

As such, the appropriate design of the systems, including low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation, will be implemented at the Installation.

7.4.1.6 Flood Risk Assessment

The EA's Flood Maps for Planning show that the majority of the Installation Site Boundary, including the whole E2P Power Island area, is within a Flood Zone 1. This is defined as land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%) – very low. The northern section of the Installation that includes the jetties within the River Tees is within a Flood Zone 3, which is defined as land having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

In the unlikely event of a flood, the following flood resilience measures will be in place to reduce damage to the Installation and improve recovery times:

- Pipelines and storage tanks used for the E2P Power Island will be designed to withstand the water pressures associated with high return period event flooding;
- Tanks will be securely tethered and bunded to level as high as reasonably practicable; and
- Pollution control measures will be used to prevent/ reduce the chance of any fuel stored onsite leaking. This will also assist with reducing the recovery time and costs at the E2P Power Island following flooding, by minimising the risk of possible contamination of the fuel stores by water ingress.

7.4.2 Emissions to Air

Each gas engine will be fitted with an individual stack which will release emissions to air when is use. An Air Quality Impact Assessment (Appendix E) has been carried out based on the maximum number of engines that could be installed for E2P Power Island to support the Environmental Permit variation. The assessment indicated that there is unlikely to be any exceedances of Air Quality Standards (AQS) or Environmental Assessment Levels (EAL) at the identified human receptors.

For the Teesmouth and Cleveland Coast SPA, Ramsar and SSSI, the long term predicted environmental concentration (process contribution in addition to background concentration) for the annual average and 24-hour NOx are up to 130% and 97% of the respective Critical Levels. This suggests there will be a potential significant impact on ecological receptors in the designated sites in close proximity to the E2P Power Island. However, Critical Levels are defined for the protection of vegetation, and the area under concern is mud flats that undergo regular tidal inundation, with no vegetation present. It is therefore considered that the Critical Levels are not directly applicable to this location. In addition, the area over which the peak impacts occur represents a very small proportion of the habitat site as a whole, as predicted concentrations reduce rapidly with distance from the E2P Power Island. It is therefore considered that the impacts from NOx on the Teesmouth and Cleveland Coast designated site as a result of the operation of the E2P Power Island, are unlikely to result in any significant impact.

The nutrient nitrogen deposition impacts were insignificant at all but 3 of the ecological habitats locations for the 16 engine scenario, however when modelling the more realist operational scenario of 12 engines and considering average impacts over 5 years of meteorological data rather than the maximum year of impact, the impacts were <1% of the Critical Load for all but one receptor (E13 – the closest area of dunes).

Due to the high background concentrations, and the historic trends of nitrogen deposition at the receptor sites, it is considered that the very small proportion of additional nitrogen deposition that would result from the operation of the E2P Power Island would not have a significant effect on the relevant habitats.

It is expected that overtime with the decline in throughput at the Installation, the production of fuel gas for use in the gas engines will also decrease over time. The number of gas engines will therefore reduce in line with the reduction in fuel gas and emissions to air and their corresponding impacts will also reduce. In addition, as the E2P Power Island project will enable the Teesside Terminal to embark on a range of electrification measures across the Installation, combustion emissions from other sources across the Installation will be significantly reduced, and therefore it is considered that the actual change in impacts as a result of the project will be minimal and , in fact, will lead to significant overall reductions in the longer term. To reiterate, the E2P Power Island project is an enabler for overall decarbonisation of the Terminal and therefore if it were not to go ahead, an overall reduction in overall site emissions would not be achieved.

7.4.3 Emissions to Water

There will be no process emissions discharges to water. Uncontaminated site surface water will drain to the existing Effluent Treatment Plant. It is considered that uncontaminated surface water will have a negligible impact and as such, no impact assessment is deemed necessary.

7.4.4 Site Waste

The details of anticipated waste streams generated by E2P Power Island are provided in Section 4.8.

The key process waste is anticipated to be waste lubricating oil, occasional waste glycol and filters, which will be collected and transported offsite to be disposed of via licensed 3rd party waste contractors, in line with regulatory requirements and existing Installation procedures.

It is therefore considered that further assessment of the waste from E2P Power Island operation is not required.

7.4.5 Global Warming Potential

The EA's guidance 'Assess the impact of air emissions on global warming' was withdrawn on 23 July 2024 and therefore the Government conversion factors for company reporting of greenhouse gas emissions[16] have been used to assess the Global Warming Potential of the E2P Power Island, as advised by the EA.

The operation of the E2P Power Island will replace the requirement for the Teesside Terminal to use electrical power from the grid, thereby reducing Scope 2 emissions[17]. Using the fuel gas in this way means that, rather than the fuel gas being flared and essentially wasted and generating additional CO_2 emissions, it will transfer the CO_2 emissions associated with the generation of grid power to the Teesside Terminal (thereby becoming Scope 1[18] emissions). The parasitic power associated with the operation of the engines will be provided by the operation of the engines themselves.

It is therefore considered that the increase in Global Warming Potential from the E2P Power Island would only be associated with the difference between the fuel gas CO_2 emission factors compared to grid electricity CO_2 emission factors.

As the fuel gas volumes will reduce over time, the CO_2 emissions will change correspondingly. This is demonstrated in Table 7-3, with fuel gas volumes for selected years shown. As the fuel gas usage will result in a reduction in the electricity required from the grid imported to the Installation, these CO_2 emissions have been shown as a minus value in Table 7-3. The overall increase in CO_2 emissions shown in Table 7-3 and takes into account the fuel gas flows for all years.

Table 7-3: Additional Annual Energy Consumption

Energy Source	Energy Consumption Primary		
	At Primary Source	CO_2 Emission Factor (CO_2e/unit)	Annual CO_2 Emissions (tonnes)
Fuel gas[1]			
2027	32,090 tonnes	2.89691[2]	92,960
2031	22,870 tonnes		66,260
2035	17,730 tonnes		51,365
2040	6,380 tonnes		18,475
2044	3,840 tonnes		11,115
Total			**877,739**
Electricity from the Grid			
2027	-426,530	0.20705[3]	-35,325
2031	-304,032		-25,180
2035	-235,680		-19,520
2040	-84,770		-7,020
2044	-51,002		-4,225

[16] Government conversion factors for company reporting of greenhouse gas emissions - GOV.UK

[17] Scope 2 are emissions that a company causes indirectly and come from where the energy it purchases and uses is produced.

[18] Scope 1 covers emissions from sources that an organisation owns or controls directly.

Energy Source	Energy Consumption Primary		
	At Primary Source	CO_2 Emission Factor (CO_2e/unit)	Annual CO_2 Emissions (tonnes)
Total			**333,550**
Overall change in CO_2 Emissions			**+544,189**

[1] Based on average fuel gas flows

[2] Provided by ConocoPhillips for their fuel gas based on tonnes of CO_2 produced from the fuel gas in 2023 as calculated and reported for UK ETS

[3] Does not include the emissions associated with the transmission and distribution of electricity

Although Table 7-3 shows an increase in CO_2 emissions as a result of using fuel gas to replace imported electricity, it should be noted that if the fuel gas was not utilised in the E2P Power Island this would be flared and essentially wasted, which would result in additional CO_2 emissions of 877,740 tonnes over the lifetime of the E2P Project. Therefore, it is considered that the E2P Power Island actually results in a significant reduction (-333,500) in CO_2 emissions overall.

In addition, by using the ethane by-product to produce electrical power onsite, rather than this being tankered from site, Scope 3[19] emissions are reduced through the cessation of ocean-going tanker exports of ethane.

7.5 Site Closure

The existing Site Closure plan will be amended to incorporate the decommissioning and closure of the E2P Power Island at the end of its operating life.

[19] Scope 3 encompasses emissions that are not produced by the company itself and are not the result of activities from assets owned or controlled by them, but by those that it is indirectly responsible for up and down its value chain.

Appendix A – Figures

Figure 1: Installation Permit Boundary

Figure 2: Emission Points

Figure 3: E2P Plant Location within the Installation Boundary

Figure 4: E2P Power Island Indicative Layout

Figure 5: Drainage Plan

Appendix B – Site Condition Report

See accompanying report.

Appendix C – Refineries BAT Assessment

C.1 BAT Conclusions for Refineries[5]

Table C-1: General BAT conclusions for the refining of mineral oil and gas

BAT Reference	BAT Description	BAT Response
BAT 1	In order to improve the overall environmental performance of plants for the refining of mineral oil and gas, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features: (i) commitment of the management, including senior management; (ii) definition of an environmental policy that includes the continuous improvement for the installation by the management; (iii) planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; (iv) implementation of the procedures paying particular attention to: (a) structure and responsibility (b) training, awareness and competence (c) communication (d) employee involvement (e) documentation (f) efficient process control (g) maintenance programmes (h) emergency preparedness and response (i) safeguarding compliance with environmental legislation. (v) checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (see also the reference document on the General Principles of Monitoring) (b) corrective and preventive action (c) maintenance of records (d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; (vi) review of the EMS and its continuing suitability, adequacy and effectiveness by senior management; (vii) following the development of cleaner technologies;	ConocoPhillips have an existing EMS accredited to ISO14001. Though the operation of E2P Power Island will be subcontracted to a third party, it will still be audited for compliance with ISO14001. Compliant.

BAT Reference	BAT Description	BAT Response
	(viii) consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life; (ix) application of sectoral benchmarking on a regular basis.	
BAT 2	In order to use energy efficiently, BAT is to use an appropriate combination of the techniques given below.	The operation of the E2P Power Island will enable ConocoPhillips to utilise waste gases which would otherwise be flared, by combusting them within gas engines to generate electrical power for the Installation. There are no BAT requirements for the energy efficiency of the gas engines specifically within the Refineries BATc, however the gas engines meet the BAT-AEELs for such plant detailed within the LCP BATc. The gas engines will be designed in accordance with current compliance and design standards. A CHP assessment has been carried out at determined that CHP would not be economically viable. Compliant.

Techniques	Description
(1) Design techniques	
a) Pinch analysis	Methodology based on a systematic calculation of thermodynamic targets for minimising energy consumption of processes. Used as a tool for the evaluation of total systems designs
b) Heat integration	Heat integration of process systems ensures that a substantial proportion of the heat required in various processes is provided by exchanging heat between streams to be heated and streams to be cooled
c) Heat and power recovery	Use of energy recovery devices e.g.: - waste heat boilers - expanders/power recovery in the FCC unit - use of waste heat in district heating
(ii) Process control and maintenance techniques	
a) Process optimisation	Automated controlled combustion in order to lower the fuel consumption per tonne of feed processed, often combined with heat integration for improving furnace efficiency
b) Management and reduction of steam consumption	Systematic mapping of drain valve systems in order to reduce steam consumption and optimise its use
c) Use of energy benchmark	Participation in ranking and benchmarking activities in order to achieve continuous improvement by learning from best practice
(iii) Energy-efficient production techniques	
a) Use of combined heat and power	System designed for the co-production (or the cogeneration) of heat (e.g. steam) and electric power from the same fuel

BAT Reference	BAT Description		BAT Response
	b) Integrated gasification combined cycle (IGCC)	Technique whose purpose is to produce steam, hydrogen (optional) and electric power from a variety of fuel types (e.g. heavy fuel oil or coke) with a high conversion efficiency	
BAT 3	BAT 3. In order to prevent or, where that is not practicable, to reduce dust emissions from the storage and handling of dusty materials, BAT is to use one or a combination of the techniques given below: (i) store bulk powder materials in enclosed silos equipped with a dust abatement system (e.g. fabric filter); (ii) store fine materials in enclosed containers or sealed bags; (iii) keep stockpiles of coarse dusty material wetted, stabilise the surface with crusting agents, or store under cover in stockpiles; (iv) use road cleaning vehicles.		Due to the nature of the operations, it is unlikely that dust will be generated. BAT not applicable.

BAT 4	BAT is to monitor emissions to air by using the monitoring techniques with at least the minimum frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	The E2P Power Island will comprise up to 16 individual gas engines. Each engine has a rated thermal capacity of < 50 MWth. Each engine will be fitted with an individual stack. In accordance with BAT for NO_x and SO_x the engines will be monitored once a year and after significant fuel changes either directly or indirectly. For CO, direct monitoring once every 6 months is required however monitoring frequencies may be adapted if, after a period of one year, the data series clearly demonstrate a sufficient stability. Compliant.

Description	Unit	Minimum frequency	Monitoring technique
(i) SO_x, NO_x, and dust emissions	Catalytic cracking	Continuous (1)(2)	Direct measurement
	Combustion units ≥ 100 MW (3) and calcining units	Continuous (1)(2)	Direct measurement (4)
	Combustion units of 50 to 100 MW (3)	Continuous (1)(2)	Direct measurement or indirect monitoring
	Combustion units < 50 MW (3)	Once a year and after significant fuel changes (5)	Direct measurement or indirect monitoring
	Sulphur recovery units	Continuous for SO_2 only	Direct measurement or indirect monitoring
(ii) NH_3 emissions	All units equipped with SCR or SNCR	Continuous	Direct measurement
(iii) CO emissions	Catalytic cracking and combustion units ≥ 100 MW (3)	Continuous	Direct measurement
	Other combustion units	Once every 6 months (5)	Direct measurement
(iv) Metals emissions: Nickel (Ni), Antimony (Sb) (7), Vanadium (V)	Catalytic cracking	Once every 6 months and after significant changes to the unit (5)	Direct measurement or analysis based on metals content in the catalyst fines and in the fuel.
	Combustion units (8)		
(v) Polychlorinated dibenzodioxins/ furans (PCDD/F) emissions	Catalytic reformer	Once a year or once a regeneration, whichever is longer	Direct measurement

(1) Continuous measurement of SO_2 emissions may be replaced by calculations based on measurements of the sulphur content of the fuel or the feed; where it can be demonstrated that this leads to an equivalent level of accuracy.

(2) Regarding SO_X, only SO_2 is continuously measured, while SO_3 is only periodically measured (e.g. during calibration of the SO2 monitoring system).

(3) Refers to the total rated thermal input of all combustion units connected to the stack where emissions occur.

(4) Or indirect monitoring of SO_X.

(5) Monitoring frequencies may be adapted if, after a period of one year, the data series clearly demonstrate a sufficient stability.

(6) SO_2 emissions measurements from SRU may be replaced by a continuous material balance or other relevant process parameter monitoring, provided appropriate measurements of SRU efficiency are based on periodic (e.g. once every 2 years) plant performance tests.

(7) Antimony (Sb) is monitored only in catalytic cracking units when Sb injection is used in the process (e.g. for metals passivation).

(8) With the exception of combustion units firing only gaseous fuels.

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td>BAT 5</td><td>BAT is to monitor the relevant process parameters linked to pollutant emissions, at catalytic cracking and combustion units by using appropriate techniques and with at least the frequency given below.
<table>
<tr><th>Description</th><th>Minimum frequency</th></tr>
<tr><td>Monitoring of parameters linked to pollutant emissions, e.g. O_2 content in flue-gas, N and S content in fuel or feed ([1])</td><td>Continuous for O_2 content. For N and S content, periodic at a frequency based on significant fuel/feed changes</td></tr>
<tr><td colspan="2">(1) N and S monitoring in fuel or feed may not be necessary when continuous emission measurements of NO_X and SO_2 are carried out at the stack.</td></tr>
</table></td><td>The proposed approach to monitoring will be to undertake periodic monitoring for NO_x, SO_2 and CO produced by the gas engines at the stack.
Compliant.</td></tr>
<tr><td>BAT 6</td><td>BAT is to monitor diffuse VOC emissions to air from the entire site by using all of the following techniques:
(i) sniffing methods associated with correlation curves for key equipment;
(ii) (ii) optical gas imaging techniques;
(iii) (iii) calculations of chronic emissions based on emissions factors periodically (e.g. once every two years) validated by measurements.
The screening and quantification of site emissions by periodic campaigns with optical absorption-based techniques, such as differential absorption light detection and ranging (DIAL) or solar occultation flux (SOF) is a useful complementary technique.</td><td>The monitoring of emissions at the existing Installation will remain unchanged. There is an existing requirement to report on the total mass release of volatile organic carbon to air.
The operation and emissions produced from the gas engines will be reported as required under the Permit.
Compliant.</td></tr>
<tr><td>BAT 7</td><td>In order to prevent or reduce emissions to air, BAT is to operate the acid gas removal units, sulphur recovery units and all other waste gas treatment systems with a high availability and at optimal capacity.</td><td>At present the fuel gas is already treated in the existing Diethanol Amine (DEA) system to remove H_2S. The amines are recovered and recirculated within the closed loop system. The resulting H_2S gas and CO_2 is flared. This BAT would have been considered under the last Refineries BAT review.
As such this BAT is not applicable to the proposed regulated activity changes under this permit variation.</td></tr>
</table>

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td></td><td></td><td>BAT not applicable.</td></tr>
<tr><td>BAT 8</td><td>In order to prevent and reduce ammonia (NH_3) emissions to air when applying selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) techniques, BAT is to maintain suitable operating conditions of the SCR or SNCR waste gas treatment systems, with the aim of limiting emissions of unreacted NH_3.
BAT-associated emission levels for ammonia (NH_3) emissions to air for a combustion process or process unit where SCR or SNCR techniques are used.
<table>
<tr><th>Parameter</th><th>BAT-AEL (monthly average) mg/Nm^3</th></tr>
<tr><td>Ammonia expressed as NH_3</td><td>< 5 – 15 (1) (2)</td></tr>
<tr><td colspan="2">(1) The higher end of the range is associated with higher inlet NOX concentrations, higher NOx reduction rates and the ageing of the catalyst
(2) The lower end of the range is associated with the use of the SCR technique.</td></tr>
</table></td><td>No SCR or SNCR are proposed to be installed, as discussed in Section 5.1and the Site-specific BAT Assessment (Appendix D).
BAT not applicable.</td></tr>
<tr><td>BAT 9</td><td>In order to prevent and reduce emissions to air when using a sour water steam stripping unit, BAT is to route the acid off-gases from this unit to an SRU or any equivalent gas treatment system.
It is not BAT to directly incinerate the untreated sour water stripping gases.</td><td>The fuel gas to be used has already been subjected to existing onsite treatment processes which would have been assessed in the previous Refineries BAT review assessment. No additional treatment processes are proposed under this application.
As such this BAT is not applicable to the proposed regulated activity changes under this permit variation.
Not applicable.</td></tr>
<tr><td>BAT 10</td><td>Monitoring of emissions to water
BAT is to monitor emissions to water by using the monitoring techniques with at least the frequency given in Table 3 (see BAT 13) and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</td><td>There are no additional point source emissions to water as a result of this variation application.
BAT not applicable.</td></tr>
</table>

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td>BAT 11</td><td>Emissions to water
In order to reduce water consumption and the volume of contaminated water, BAT is to use all of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(i) Water stream integration</td><td>Reduction of process water produced at the unit level prior to discharge by the internal reuse of water streams from e.g. cooling, condensates, especially for use in crude desalting</td><td>Generally applicable for new units. For existing units, applicability may require a complete rebuilding of the unit or the installation</td></tr>
<tr><td>(ii) Water and drainage system for segregation of contaminated water streams</td><td>Design of an industrial site to optimise water management, where each stream is treated as appropriate, by e.g. routing generated sour water (from distillation, cracking, coking units, etc.) to appropriate pretreatment, such as a stripping unit</td><td>Generally applicable for new units. For existing units, applicability may require a complete rebuilding of the unit or the installation</td></tr>
<tr><td>(iii) Segregation of noncontaminated water streams (e.g. once through cooling, rainwater)</td><td>Design of a site in order to avoid sending non-contaminated water to general waste water treatment and to have a separate release after possible reuse for this type of stream</td><td>Generally applicable for new units. For existing units, applicability may require a complete rebuilding of the unit or the installation</td></tr>
<tr><td>(iv) Prevention of spillages and leaks</td><td>Practices that include the utilisation of special procedures and/or temporary equipment to maintain performances when necessary to manage special circumstances such as spills, loss of containment, etc.</td><td>Generally applicable</td></tr>
</table></td><td>There is no significant water consumption from the use of the gas engines.
BAT not applicable.</td></tr>
<tr><td>BAT 12</td><td>In order to reduce the emission load of pollutants in the waste water discharge to the receiving water body, BAT is to remove insoluble and soluble polluting substances by using all of the techniques given below
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(i) Removal of insoluble substances</td><td>See Section 1.21.2</td><td>Generally applicable</td></tr>
<tr><td>(ii) Removal of insoluble substances by recovering suspended solids and dispersed oil</td><td>See Section 1.21.2</td><td>Generally applicable</td></tr>
<tr><td>(iii) Removal of soluble substances including biological treatment and clarification</td><td>See Section 1.21.2</td><td>Generally applicable</td></tr>
</table></td><td>Surface water discharge from the E2P Power Island will be sent to the existing Installation Effluent Treatment Plant (ETP) before being discharged to Bran Sands Wastewater Treatment Works.
Compliant.</td></tr>
</table>

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td>BAT 13</td><td>When further removal of organic substances or nitrogen is needed, BAT is to use an additional treatment step as described in Section 1.21.2.
Table 3 - BAT-associated emission levels for direct waste water discharges from the refining of mineral oil and gas and monitoring frequencies associated with BAT (1)
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT-AEL</th><th>Monitoring (2) frequency and analytical method (standard)</th></tr>
<tr><td>Hydrocarbon oil index (HOI)</td><td>mg/l</td><td>0,1-2,5</td><td>Daily EN 9377- 2 (3)</td></tr>
<tr><td>Total suspended solids (TSS)</td><td>mg/l</td><td>5 - 25</td><td>Daily</td></tr>
<tr><td>Chemical oxygen demand (COD) (4)</td><td>mg/l</td><td>30 - 125</td><td>Daily</td></tr>
<tr><td>BOD</td><td>mg/l</td><td>No BAT-AEL</td><td>Weekly</td></tr>
<tr><td>Total nitrogen (5), expressed as N</td><td>mg/l</td><td>1-25 (6)</td><td>Daily</td></tr>
<tr><td>Lead, expressed as Pb</td><td>mg/l</td><td></td><td>Quarterly</td></tr>
<tr><td>Cadmium, expressed as Cd</td><td>mg/l</td><td>0,002-0,008</td><td>Quarterly</td></tr>
<tr><td>Nickel, expressed as Ni</td><td>mg/l</td><td>0,005-0,100</td><td>Quarterly</td></tr>
<tr><td>Mercury, expressed as Hg</td><td>mg/l</td><td>0,0001-0,001</td><td>Quarterly</td></tr>
<tr><td>Vanadium</td><td>mg/l</td><td>No BAT-AEL</td><td>Quarterly</td></tr>
<tr><td>Phenol Index</td><td>mg/l</td><td>No BAT-AEL</td><td>Monthly
EN 14402</td></tr>
<tr><td>Benzene, toluene, ethyl benzene, xylene (BTEX)</td><td>mg/l</td><td>Benzene: 0,001-0,050
No BAT-AEL for T, E, X</td><td>Monthly</td></tr>
<tr><td colspan="4">(1) Not all parameters and sampling frequencies are applicable to effluent from gas refining sites.
(2) Refers to a flow-proportional composite sample taken over a period of 24 hours or, provided that sufficient flow stability is demonstrated, a time-proportional sample.
(3) Moving from the current method to EN 9377-2 may require an adaptation period.
(4) Where on-site correlation is available, COD may be replaced by TOC. The correlation between COD and TOC should be elaborated on a case-by-case basis. TOC monitoring would be the preferred option because it does not rely on the use of very toxic compounds.
(5) Where total-nitrogen is the sum of total Kjeldahl nitrogen (TKN), nitrates and nitrites.
(6) When nitrification/denitrification is used, levels below 15 mg/l can be achieved.</td></tr>
</table></td><td>Liquid wastes such as waste lubrication oil and glycol will be transported offsite for disposal. Surface water from the E2P Power Island will be treated within the ETP at the Teesside Terminal and will be subjected to existing monitoring requirements.

Compliant.</td></tr>
<tr><td>BAT 14</td><td>In order to prevent or, where that is not practicable, to reduce waste generation, BAT is to adopt and implement a waste management plan that, in order of priority, ensures that waste is prepared for reuse, recycling, recovery or disposal</td><td>A Waste Management Plan specific to E2P Power Island will be developed by the Contractor</td></tr>
</table>

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td></td><td></td><td>which will be in accordance with CoP existing Waste Management Plan for the wider Teesside Terminal.
Compliant.</td></tr>
<tr><td>BAT 15</td><td>In order to reduce the amount of sludge to be treated or disposed of, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(i) Sludge pre-treatment</td><td>Prior to final treatment (e.g. in a fluidised bed incinerator), the sludges are dewatered and/or de-oiled (by e.g. centrifugal decanters or steam dryers) to reduce their volume and to recover oil from slop equipment.</td><td>Generally applicable</td></tr>
<tr><td>(ii) Reuse of sludge in process units</td><td>Certain types of sludge (e.g. oily sludge) can be processed in units (e.g. coking) as part of the feed due to their oil content.</td><td>Applicability is restricted to sludges that can fulfil the requirements to be processed in units with appropriate treatment</td></tr>
</table></td><td>No sludge will be produced from the process.
BAT not applicable.</td></tr>
<tr><td>BAT 16</td><td>In order to reduce the generation of spent solid catalyst waste, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th></tr>
<tr><td>(i) Sludge pre-treatment</td><td>Scheduled and safe handling of the materials used as catalyst (e.g. by contractors) in order to recover or reuse them in off-site facilities. These operations depend on the type of catalyst and process.</td></tr>
<tr><td>(ii) Reuse of sludge in process units</td><td>Decanted oil sludge from process units (e.g. FCC unit) can contain significant concentrations of catalyst fines. These fines need to be separated prior to the reuse of decant oil as a feedstock.</td></tr>
</table></td><td>No spent solid catalyst waste will be produced from the process.
BAT not applicable.</td></tr>
<tr><td>BAT 17</td><td>BAT 17. In order to prevent or reduce noise, BAT is to use one or a combination of the techniques given below:
(i) make an environmental noise assessment and formulate a noise management plan as appropriate to the local environment;
(ii) enclose noisy equipment/operation in a separate structure/unit;
(iii) use embankments to screen the source of noise;
(iv) use noise protection walls.</td><td>A noise assessment for the plant on E2P Power Island has been completed and submitted with this application (Appendix F).</td></tr>
</table>

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td>BAT 18</td><td>In order to prevent or reduce diffuse VOC emissions, BAT is to apply the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(i) Techniques related to plant design</td><td>(i) limiting the number of potential emission sources
(ii) maximising inherent process containment features
(iii) selecting high integrity equipment
(iv) facilitating monitoring and maintenance activities by ensuring access to potentially leaking components</td><td>Applicability may be limited for existing units</td></tr>
<tr><td>(ii) Techniques related to plant installation and commissioning</td><td>(i) well-defined procedures for construction and assembly
(ii) robust commissioning and hand-over procedures to ensure that the plant is installed in line with the design requirements</td><td>Applicability may be limited for existing units</td></tr>
<tr><td>(iii) Techniques related to plant operation</td><td>Use of a risk-based leak detection and repair (LDAR) programme in order to identify leaking components, and to repair these leaks. See Section 1.20.6</td><td>Generally applicable</td></tr>
</table></td><td>The BAT measures will be considered in the design, construction and commissioning of the E2P Power Island.
Existing leak detection and alarms are in place around the Teesside Terminal which will be reviewed and supplemented if required to ensure the detection of the fuel gas stream.
Compliant.</td></tr>
</table>

Table C-2: BAT conclusions for the combustion units at Refineries

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td>BAT 34</td><td>In order to prevent or reduce NOx emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="3">I. Primary or process-related techniques, such as</td></tr>
<tr><td colspan="3">i) Selection or treatment of fuel</td></tr>
<tr><td>a) Use of gas to replace liquid fuel</td><td>Gas generally contains less nitrogen than liquid and its combustion leads to a lower level of NOx emissions. See Section 1.20.3</td><td>The applicability may be limited by the constraints associated with the availability of low sulphur gas fuels, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>b) Use of low nitrogen refinery oil (RFO) e.g. by RFO selection or by hydrotreatment of RFO</td><td>Refinery fuel oil selection favours low nitrogen liquid fuels among the possible sources to be used at the unit. Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the fuel. See Section 1.20.3</td><td>Applicability is limited by the availability of low nitrogen liquid fuels, hydrogen production and hydrogen sulphide (H2S) treatment capacity (e.g. amine and Claus units)</td></tr>
</table></td><td>The gas engines will be fired exclusively on the fuel gas from the Teesside Terminal and not liquid fuel.

Burners to meet the required NOx emission limits will be applied.

Further discussion of the application of SCR is provided in Section 5.1 and in the Site-specific BAT assessment (Appendix D).

Low temperature oxidation and SNOx are not considered to be applicable.</td></tr>
</table>

BAT Reference	BAT Description			BAT Response
	ii) Combustion modifications			BAT not applicable.
	a) Staged combustion: - Air staging - Fuel staging	See Section 1.20.2	Fuel staging for mixed or liquid firing may require a specific burner design	
	b) Optimisation of combustion	See Section 1.20.2	Generally applicable	
	c) Flue-gas recirculation	See Section 1.20.2	Applicable through the use of specific burners with internal recirculation of the flue-gas. The applicability may be restricted to retrofitting external flue-gas recirculation to units with a forced/induced draught mode of operation	
	d) Diluent injection	See Section 1.20.2	Generally applicable for gas turbines where appropriate inert diluents are available	
	e) Use of low-NOx burners (LNB)	See Section 1.20.2	Generally applicable for new units taking into account, the fuel-specific limitation (e.g. for heavy oil). For existing units, applicability may be restricted by the complexity caused by site-specific conditions e.g. furnaces design, surrounding devices. In very specific cases, substantial modifications may be required. The applicability may be restricted for furnaces in the delayed coking process, due to possible coke generation in the furnaces. In gas turbines, the applicability is restricted to low hydrogen content fuels (generally < 10 %)	
	II. Secondary or end-of-pipe techniques, such as:			
	i) Selective catalytic reduction (SCR)	See Section 1.20.2	Generally applicable for new units. For existing units, the applicability may be constrained due to the requirements for significant space and optimal reactant injection	
	ii) Selective non-catalytic reduction (SNCR)	See Section 1.20.2	Generally applicable for new units. For existing units, the applicability may be constrained by the requirement for the temperature window and the residence time to be reached by reactant injection	
	iii) Low temperature oxidation	See Section 1.20.2	The applicability may be limited by the need for additional scrubbing capacity and by the fact that ozone generation and the associated risk management need to be properly addressed. The applicability may be limited by the need for additional waste water treatment and related cross-media effects (e.g. nitrate emissions) and by an insufficient supply of liquid oxygen (for ozone generation).	

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td></td><td>
<table>
<tr><td>iv) SNOx combined technique</td><td>See Section 1.20.4</td><td>Applicable only for high flue-gas (e.g. > 800 000 Nm^3/h) flow and when combined NOX and SOX abatement is needed</td></tr>
</table>
</td><td></td></tr>
<tr><td>BAT 35</td><td>
In order to prevent or reduce dust and metal emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below:
I. Primary or process-related techniques, such as:
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="3">(i) Selection or treatment of fuel</td></tr>
<tr><td>(a) Use of gas to replace liquid fuel</td><td>Gas instead of liquid combustion leads to lower level of dust emissions
See Section 1.20.3</td><td>The applicability may be limited by the constraints associated with the availability of low sulphur fuels such as natural gas, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>(b) Use of low sulphur refinery fuel oil (RFO) e.g. by RFO selection or by hydrotreatment of RFO</td><td>Refinery fuel oil selection favours low sulphur liquid fuels among the possible sources to be used at the unit.
Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the fuel.
See Section 1.20.3.</td><td>The applicability may be limited by the availability of low sulphur liquid fuels, hydrogen production and the hydrogen sulphide (H_2S) treatment capacity (e.g. amine and Claus units).</td></tr>
<tr><td colspan="3">(ii) Combustion modifications</td></tr>
<tr><td>(a) Optimisation of combustion</td><td>See Section 1.20.2</td><td>Generally applicable to all types of combustion</td></tr>
<tr><td>(b) Atomisation of liquid fuel</td><td>Use of high pressure to reduce the droplet size of liquid fuel.

Recent optimal burner designs generally include steam atomisation</td><td>Generally applicable to liquid fuel firing</td></tr>
</table>
II. Secondar or end-of-pipe techniques, such as:
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(i) Electrostatic precipitator (ESP)</td><td>See Section 1.20.1</td><td>For existing units, the applicability may be limited by space availability</td></tr>
</table>
</td><td>The proposed process will be using fuel gas produced at the Teesside Terminal which has been subject to pre-treatment using existing on-site processes.
For optimisation of the combustion process see site specific BAT.
Compliant.</td></tr>
</table>

BAT Reference	BAT Description: Technique	Description	Applicability	BAT Response
	(ii) Third stage blowback filter	See Section 1.20.1	Generally applicable	
	(iii) Wet scrubbing	See Section 1.20.3	The applicability may be limited in arid areas and in the case where the by-products from treatment (including e.g. waste water with a high level of salt) cannot be reused or appropriately disposed of. For existing units, the applicability of the technique may be limited by space availability	
BAT 36	In order to prevent or reduce SOX emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below.			The gas engines will be fired exclusively on the fuel gas from the Teesside Terminal and not liquid fuel. There is sufficient capacity within the existing DEA unit to remove H_2S to <5ppm within the fuel gas. The BAT-AELs can be met by primary techniques, and therefore it is not considered necessary to use secondary techniques. SNOX combined techniques are not applicable due to the low flow rates of the individual gas engines. Compliant.
	Technique	**Description**	**Applicability**	
	I. Primary or process-related techniques, such as			
	i) Use of gas to replace liquid fuel	See Section 1.20.3	The applicability may be limited by the constraints associated with the availability of low sulphur gas fuels, which may be impacted by the energy policy of the Member State	
	ii) Use of low sulphur refinery oil (RFO) e.g. by RFO selection or by hydrotreatment of RFO	Refinery fuel oil selection favours low sulphur liquid fuels among the possible sources to be used at the unit. Hydrotreatment aims at reducing the sulphur, nitrogen and metal contents of the fuel. See Section 1.20.3	Applicability is limited by the availability of low sulphur liquid fuels, hydrogen production and hydrogen sulphide (H_2S) treatment capacity (e.g. amine and Claus units)	
	II. Secondary or end-of-pipe techniques:			
	i) Non-regenerative scrubbing	See Section 1.20.2	The applicability may be limited in arid areas and in the case where the by-products from treatment (including e.g. waste water with high level of salts) cannot be reused or appropriately disposed of.	
	ii) Regenerative scrubbing	Use of a specific SOx absorbing reagent (e.g. absorbing solution) which generally enables the recovery of sulphur as a byproduct during a	The applicability is limited to the case where regenerated by-products can be sold. Retrofitting to existing units may be	

BAT Reference	BAT Description	BAT Response

	regenerating cycle where the reagent is reused. See Section 1.20.3	limited by the existing sulphur recovery capacity.
iii) SNOX combined technique	See Section 1.20.4	Applicable only for high flue-gas (e.g. > 800 000 Nm3/h) flow and when combined NOx and SOx abatement is required

BAT-associated emission levels:

BAT-associated emission levels for SO_2 emissions to air from a combustion unit firing refinery fuel gas (RFG), with the exception of gas turbines:

Parameter	BAT-AEL (monthly average) mg/Nm^3
SO_2	5 - 35

C.2 BAT Conclusions for Achieving Energy Efficiency at an Installation Level [20]

BAT Reference	BAT Description	BAT Response
BAT 1	**Energy Efficiency Management** Energy efficiency management BAT is to implement and adhere to an energy efficiency management system (ENEMS) that incorporates, as appropriate to the local circumstances, all of the following features (see Section 2.1. The letters (a), (b), etc. below, correspond those in Section 2.1): a. commitment of top management (commitment of the t op management is regarded as a precondition for the successful application of energy efficiency management). b. definition of an energy efficiency policy for the installation by top management	The selected operational contractor will development a site-specific management system for the operation of E2P Power Island which will be in accordance with the requirements set out in the existing Teesside Terminal EMS. This will be developed and in place prior to the commencement of operations.

[20] European Commission, Reference document on Best Available techniques for Energy Efficiency (2009). Available at: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/ENE_Adopted_02-2009.pdf

BAT Reference	BAT Description	BAT Response
	c. planning and establishing objectives and targets (see BAT 2, 3 and 8) d. implementation and operation of procedures paying particular attention to: i. structure and responsibility ii. training, awareness and competence (see BAT 13) iii. communication iv. employee involvement v. documentation vi. effective control of processes (see BAT 14) vii. maintenance (see BAT 15) viii. emergency preparedness and response ix. safeguarding compliance with energy efficiency-related legislation and agreements (where such agreements exist). e. benchmarking: the identification and assessment of energy efficiency indicators over time (see BAT 8), and the systematic and regular comparisons with sector, national or regional benchmarks for energy efficiency, where verified data are available (see Sections 2.1(e), 2.16 and BAT 9) f. checking performance and taking corrective action paying particular attention to: i. monitoring and measurement (see BAT 16) ii. corrective and preventive action iii. maintenance of records iv. independent (where practicable) internal auditing in order to determine whether or not the energy efficiency management system conforms to planned arrangements and has been properly implemented and maintained (see BAT 4 and 5) g. review of the ENEMS and its continuing suitability, adequacy and effectiveness by top management For (h) and (i), see further features on an energy efficiency statement and external verification, below - when designing a new unit, taking into account the environmental impact from the eventual decommissioning of the unit - development of energy efficient technologies, and to follow developments in energy efficiency techniques.	Compliant.
BAT 2	**Continuous environmental improvement** BAT is to continuously minimise the environmental impact of an installation by planning actions and investments on an integrated basis and for the short, medium and long term, considering the cost benefits and cross-media effects.	The E2P Power Island will be designed to current compliance and design standards. It will be operated in accordance with an

BAT Reference	BAT Description	BAT Response
		EMS specifically for E2P Power Island which will align with the requirements for the Installation wide EMS, with regular appraisal of the plant and equipment in use at the Installation. Compliant.

BAT 3	**Identification of energy efficiency aspects of an installation and opportunities for energy saving**
	- BAT is to identify the aspects of an installation that influence energy efficiency by carrying out an audit. It is important that an audit is coherent with a systems approach.
	This is applicable to all existing installations and prior to planning upgrades or rebuilds. An audit may be external or internal.
	- When carrying out an audit, BAT is to ensure that an audit identifies the following aspects:
	  - energy use and type in the installation and its component systems and processes ◦ energy-using equipment, and the type and quantity of energy used in the installation
	  - possibilities to minimise energy use, such as:
	    - controlling/reducing operating times, e.g. switching off when not in use
	    - ensuring insulation is optimised
	    - optimising utilities, associated systems and processes (see BAT for energy using systems)
	    - possibilities to use alternative sources or use of energy that is more efficient, in particular energy surplus from other processes and/or systems
	  - possibilities to apply energy surplus to other processes and/or systems
	  - possibilities to upgrade heat quality.
	- BAT is to use appropriate tools or methodologies to assist with identifying and quantifying energy optimisation, such as:
	  - energy models, databases and balances
	  - a technique such as pinch methodology, exergy or enthalpy analysis or thermoeconomics
	  - estimates and calculations.
	The choice of the appropriate tools depends on the sector and complexity of the site, and is discussed in the relevant sections.
	- BAT is to identify opportunities to optimise energy recovery within the installation, between systems within the installation and/or with a third party (or parties).
		The operation of E2P Power Island will be subject to the auditing requirements in line with the wider Teesside Terminal. This includes a review of energy efficiency.
		Compliant

<table>
<tr><th>BAT Reference</th><th>BAT Description</th><th>BAT Response</th></tr>
<tr><td>BAT 4</td><td>A system approach to energy management
BAT is to optimise energy efficiency by taking a systems approach to energy management in the installation. Systems to be considered for optimising as a whole are, for example:
- process units (see sector BREFs)
- heating systems such as:
  - steam
  - hot water
- cooling and vacuum (see the ICS BREF)
- motor driven systems such as:
  - compressed air
  - pumping
- lighting
- drying, separation and concentration.</td><td>The approach to energy management is outlined in Section 4.9.2 of this Main Supporting Document.
Compliant.</td></tr>
<tr><td>BAT 5</td><td>Establishing and reviewing energy efficiency objectives and indicators
- BAT is to establish energy efficiency indicators by carrying out all of the following:
  - identifying suitable energy efficiency indicators for the installation, and where necessary, individual processes, systems and/or units, and measure their change over time or after the implementation of energy efficiency measures
  - identifying and recording appropriate boundaries associated with the indicators
  - identifying and recording factors that can cause variation in the energy efficiency of the relevant processes, systems and/or units.</td><td>Objectives will be developed by the E2P Power Island operational team following commissioning of the plant to ensure compliance with this BAT conclusion.
Compliant.</td></tr>
<tr><td>BAT 6</td><td>Benchmarking
- BAT is to carry out systematic and regular comparisons with sector, national or regional benchmarks, where validated data are available.
The period between benchmarking is sector-specific and is usually several years, as benchmark data rarely change rapidly or significantly in a short time period.</td><td>There are no specific energy efficiency levels detailed in the Refineries BATc.
As required under the existing permit the Operator will review and record at least every four years whether there are suitable opportunities to improve the energy efficiency of the activities.</td></tr>
</table>

BAT Reference	BAT Description	BAT Response
		The operation of the E2P Power Island will be considered in this review. Compliant.
BAT 7	**Energy-efficient design (EED)** BAT is to optimise energy efficiency when planning a new installation, unit or system or a significant upgrade by considering all of the following: - energy-efficient design (EED) should be initiated at the early stages of the conceptual design/basic design phase, even though the planned investments may not be well-defined, and should be taken into account in the tendering process - the development and/or selection of energy-efficient technologies - additional data collection may need to be carried out as part of the design project or separately to supplement the existing data or fill gaps in knowledge - the EED work should be carried out by an energy expert - the initial mapping of energy consumption should also address which parties in the project organisations influence the future energy consumption and optimise the EED of the future plant with them. For example, the staff in the existing installation who may be responsible for specifying operational parameters. Where relevant in-house expertise on energy efficiency is not available (e.g. non-energy intensive industries), external ENE expertise should be sought.	There are no specific energy efficiency levels detailed in the Refineries BATc. However, energy efficiency has been considered in the design of E2P Power Island. Compliant.
BAT 8	**Increased process integration** BAT is to seek to optimise the use of energy between more than one process or system within the installation or with a third party.	Details of process integration are outlined in Section 4.4 of this Main Supporting Document. Compliant.
BAT 9	**Maintaining the impetus of energy efficiency initiatives** BAT is to maintain the impetus of the energy efficiency programme by using a variety of techniques, such as: - implementing a specific energy management system - accounting for energy based on real (metered) values, which places the obligation and credit for energy efficiency on the user/bill payer - the creation of financial profit centres for energy efficiency - benchmarking - a fresh look at existing management systems	The E2P Power Island will be subject to regular preventative maintenance cycles to ensure the efficiency of plant and equipment is maintained. Compliant.

BAT Reference	BAT Description	BAT Response
	- using techniques to manage organisational change. Techniques such as the first three are applied according to the data in the relevant sections. Techniques such as the last three should be applied far enough apart for the progress of the ENE programme to be assessed, i.e. several years.	
BAT 10	**Maintaining expertise** BAT is to maintain expertise in energy efficiency and energy-using systems by using techniques such as: - recruitment of skilled staff and/or training of staff. Training can be delivered by inhouse staff, by external experts, by formal courses or by self-study/development - taking staff off-line periodically to perform fixed term/specific investigations (in their original installation or in others) - sharing in-house resources between sites - use of appropriately skilled consultants for fixed term investigations - outsourcing specialist systems and/or functions.	The E2P Power Island will be operated by suitably qualified personnel. As part of the operational contractor selection process, the Operator will assess the level of experience of each potential vendor at a company level and the individual employees. ConocoPhillips will require that the operational contractor ensure ongoing training is provided. Compliant.
BAT 11	**Effective control of processes** BAT is to ensure that the effective control of processes is implemented by techniques such as: - having systems in place to ensure that procedures are known, understood and complied with - ensuring that the key performance parameters are identified, optimised for energy efficiency and monitored - documenting or recording these parameters.	Details of process control are outlined in Section 4.4 of this Main Supporting Document. Compliant.
BAT 12	**Maintenance** BAT is to carry out maintenance at installations to optimise energy efficiency by applying all of the following: - clearly allocating responsibility for the planning and execution of maintenance - establishing a structured programme for maintenance based on technical descriptions of the equipment, norms, etc. as well as any equipment failures and consequences. Some maintenance activities may be best scheduled for plant shutdown periods - supporting the maintenance programme by appropriate record keeping systems and diagnostic testing - identifying from routine maintenance, breakdowns and/or abnormalities, possible losses in energy efficiency, or where energy efficiency could be improved - identifying leaks, broken equipment, worn bearings, etc. that affect or control energy usage, and rectifying them at the earliest opportunity.	The E2P Power Island will be subjected to regular maintenance to ensure the plant can operate efficiently. Compliant.

BAT Reference	BAT Description	BAT Response
	Carrying out repairs promptly has to be balanced with maintaining the product quality and process stability, as well as with health and safety issues.	
BAT 13	**Monitoring and measurement** BAT is to establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of operations and activities that can have a significant impact on energy efficiency. Some suitable techniques are given in this document.	As required under the existing permit ConocoPhillips will review and record at least every four years whether there are suitable opportunities to improve the energy efficiency of the activities. The operation of the E2P Power Island will be considered in this review. Compliant.
BAT 14	**Best available techniques for achieving energy efficiency in energy-using systems, processes, activities or equipment** The general BAT, above, identify the importance of seeing the installation as a whole, and assessing the needs and purposes of the various systems, their associated energies and their interactions. They also include: - analysing and benchmarking the system and its performance - planning actions and investments to optimise energy efficiency considering the cost benefits and cross-media effects - for new systems, optimising energy efficiency in the design of the installation, unit or system and in the selection of processes - for existing systems, optimising the energy efficiency of the system through its operation and management, including regular monitoring and maintenance.	Monitoring of all Installation infrastructure is undertaken as part of the Installation's existing management systems, operational protocols and practices. Regular inspection of the E2P Power Island's infrastructure will be undertaken by the contractor. Compliant.
BAT 15	**BAT for ENE for the commonly found associated activities, systems and processes in IPPC installations can be summarised as:** BAT is to optimise: - combustion - steam systems by using relevant techniques such as: - those specific to sectors given in vertical BREFs - those given in the LCP BREF and this (ENE) document. BAT is to optimise the following, using techniques such as those described in this document:	See Section 4.9 and Appendix C1 of this Main Supporting Document. Compliant.

BAT Reference	BAT Description	BAT Response
	- compressed air systems - pumping systems - heating, ventilation and air conditioning (HVAC) systems - lighting - drying, concentration and separation processes. For these processes, it is also BAT to seek opportunities to use mechanical separation in conjunction with thermal processes.	
BAT 16	**Heat recovery** BAT is to maintain the efficiency of heat exchangers by both: - monitoring the efficiency periodically - preventing or removing fouling. Techniques for cooling and associated BAT can be found in the ICS BREF, where the primary BAT is to seek to use surplus heat, rather than dissipate it through cooling. Where cooling is required, the advantages of free cooling (using ambient air) should be considered.	BAT not applicable.
BAT 17	**Cogeneration** - BAT is to seek possibilities for cogeneration, inside and/or outside the installation (with a third party). In many cases, public authorities (at local, regional or national level) have facilitated such arrangements or are the third party.	BAT not applicable.
BAT 18	**Electrical power supply** - BAT is to increase the power factor according to the requirements of the local electricity distributor by using techniques such as those described in this document, according to applicability - BAT is to check the power supply for harmonics and apply filters if required - BAT is to optimise the power supply efficiency by using techniques described in this document, according to applicability.	BAT not applicable.
BAT 19	**Electric-motor-driven subsystems** Replacement by electrically efficient motors (EEMs) and variable speed drives (VSDs) is one of the easiest measures when considering energy efficiency. However, this should be done in the context of considering the whole system the motor sits in, otherwise there are risks of: - losing the potential benefits of optimising the use and size of the systems, and subsequently optimising the motor drive requirements - losing energy if a VSD is applied in the wrong context.	BAT not applicable.

BAT Reference	BAT Description	BAT Response
	- BAT is to optimise electric motors in the following order: - optimise the entire system the motor(s) is part of (e.g. cooling system) - then optimise the motor(s) in the system according to the newly-determined load requirements, by applying one or more of the techniques described, according to applicability - when the energy-using systems have been optimised, then optimise the remaining (non-optimised) motors according the techniques described and criteria such as: i) prioritising the remaining motors running more than 2000 hrs per year for replacement with EEMs ii) electric motors driving a variable load operating at less than 50 % of capacity more than 20 % of their operating time and operating for more than 2000 hours a year should be considered for equipping with variable speed drives.	

Appendix D – Site Specific BAT

See accompanying report.

Appendix E - Air Impact Assessment

See accompanying report.

Appendix F – Noise Impact Assessment

See accompanying report.

Appendix G – HRA for Planning

See accompanying report.

Appendix H – Combined Heat and Power (CHP) Cost Benefit Analysis (CBA) and CHP Readiness

See accompanying report.

Appendix I - Qualitative Risk Assessment

See accompanying report.

Appendix J - Company Information and Directors

Company name – ConocoPhillips (U.K.) Teesside Operator Limited

Registered office address – 20th Floor 1 Angel Court, London, United Kingdom, EC2R 7HJ

Company number – 11760664

Details of Company Secretaries

Secretary Name (Last name, First name)	Appointed on
Pepin, Jean-Francois	29 July 2024

Details of Directors (Active only)

Director Name (Last name, First name)	Date of Birth	Appointed on
Lelarge, Vincent	[redacted]	1 July 2024
Murray, Lee	[redacted]	19 November 2023
Murray, Shaun Patrick	[redacted]	29 September 2020