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Connah's Quay Low Carbon Power Station

Environmental Permit Application, Volume 2
Supporting Statement

Natural Resource Wales Reference: WPCC15718
Environmental Permitting (England & Wales) Regulations 2016
Document Reference: CQ-WPCC15718-APP-SS

January 2026

Prepared for:
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Glossary

Abbreviation	Term
ADMS	Atmospheric Dispersion Modelling System
AEELs	Associated Energy Efficiency Levels
AELs	Associated Emission Levels
AEP	Annual Exceedance Probability
AGI	Above-Ground Installation
AMP	Accident Management Plan
AN	Absolute Non-hazardous
AoD	Above Ordnance Datum
AQAL	Air Quality Assessment Levels
ASME PTC	American Society of Mechanical Engineers Performance Test Codes
BAT	Best Available Techniques
BAT AEL	Best Available Technique-Associated Emission Level
BAT-AEEL	Best Available Technique Associated Energy Efficiency Level
BATc	Best Available Technique Conclusions
bgl	Below Ground Level
BGS	British Geological Survey
BRef	Best Available Techniques Reference Document
BS ISO	British Standards (BS) Versions of International Organization for Standardization (ISO) Standards
BS EN	British Standard (BS) Implementations of European Standards (EN)
CBM	Condition-Based Maintenance
CCGT	Combined Cycle Gas Turbine
CCP	Carbon Capture Plant
CCS	Carbon Capture Storage
CEMP	Construction Environmental Management Plan
CEMs	Continuous Emissions Monitors
CHP	Combined Heat and Power
C&IEA	Construction and Indicative Enhancement Area
CM	Corrective Maintenance
COO	Chief Operating Officer
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CoPC	Contaminants of Potential Concern
CQPS	Connah's Quay Power Station
CSM	Conceptual Site Model
DAHS	Data Acquisition and Handling System
DCC	Direct Contact Cooling
DCO	Development Consent Order
DCS	Distributed Control System

Abbreviation	Term
DLN	Dry Low-Nox
DPA	Dispatchable Power Agreement
ECP	Environmentally Critical Plant
ELV	Emission Limit Value
EMS	Environmental Management System
ENI	Operator of the CO ₂ transport and storage network.
EPR	Environmental Permitting Regulations
EQS	Environmental Quality Standards
ES	Environmental Statement
ESOS	Energy Savings Opportunity Scheme
FCC	Flintshire County Council
FEED	Front-End Engineering Design
FEH	Flood Estimation Handbook
g	Gram
GC	Gas Chromatograph
GIS	Geographic Information System
GMI	Generation Management Instructions
GT	Gas Turbine
GTP	Gas Treatment Plant
GW	Gigawatt
ha	hectare
HP	High Pressure
HRSGs	Heat Recovery Steam Generators
HSSE	Health, Safety, Security, Environment
HVO	Hydrotreated Vegetable Oil
IED	Industrial Emissions Directive
IP	Intermediate Pressure
ISO	International Organization for Standardization
Keq	Kiliequivalent
kg	Kilogram
km	Kilometre
kV	Kilovolt
kW	Kilowatt
LCP	Large Combustion Plant
LEL	Lower Explosive Limits
LHV	Lower Heating Value
LNB	Low NOx Burners
LoW	List of Waste
LWS	Local Wildlife Sites
LP	Low Pressure
m	Meters
m ³	Cubic Meter

Abbreviation	Term
MCERTs	Monitoring Certification Scheme
MCP	Medium Combustion Plant
MH	Mirror Hazardous
MSDS	Material Safety Data Sheet
MSUL	Minimum Start-Up Load
MW	Megawatt
MWe	Megawatt Electrical
MWth	Megawatt Thermal
N ₂	Nitrogen
NGET	National Grid Electricity Transmission Plc
NH ₃	Ammonia
Nm ³	Normal Cubic Meter
NO _x	Oxides of Nitrogen
NRW	Natural Resources Wales
NTS	National Transmission System
NVZ	Nitrate Vulnerability Zones
O ₂	Oxygen
OEM	Original Equipment Manufacturer
OTNOC	Other Than Normal Operating Conditions
PAH	Polycyclic Aromatic Hydrocarbons
PC	Process Contributions
PCB	Polychlorinated Biphenyls
PCC	Post-combustion Carbon Capture
PdM	Predictive Maintenance
PFA	Paraformaldehyde
PEIR	Preliminary Environmental Information Report
PM	Preventive Maintenance
RAMS	Risk Assessment and Method Statement
SAC	Special Area of Conservation
SAP	Systems, Applications, Products
SCR	Selective Catalytic Reduction
SECR	Streamlined Energy and Carbon Reporting
SO _x	Sulphur Oxides
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
ST	Steam turbine
SuDS	Sustainable Drainage Systems
SVOC	Semi-Volatile Organic Compounds
TBC	To Be Confirmed
Te/Yr	Temperature Element per Year
T&S	Transport and Storage

Abbreviation	Term
TPH	Total Petroleum Hydrocarbons
UK	United Kingdom
VOC	Volatile Organic Compounds
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WTTP	Waste Water Treatment Plant

1. Introduction

1.1 Overview

This document has been prepared by AECOM Limited ('AECOM') on behalf of Uniper UK Limited, referred to as 'the Operator', in support of a new bespoke Environmental Permit application for the proposed Connah's Quay Combined Cycle Gas Turbine (CCGT) with Carbon Capture Plant (CCP), henceforth 'the Proposed Installation'.

Uniper currently operates a 4-unit CCGT, built in the 1990s, at Connah's Quay. This existing power plant (CQPS) is regulated under the Environmental Permit EPR/NP3037AF. Uniper intends to build and operate the new CCGT with a carbon capture plant (CCP) adjacent to the existing CQPS which will be regulated under a separate new Environmental Permit. The Proposed Installation shall consist of two similar trains, which will ultimately replace the existing CQPS..

Construction of the Proposed Installation will be phased to deliver one train at a time, and as such there will be a transition period of parallel operation of the Proposed Installation and the existing CQPS.

1.1.1 Services Provision

To make the Proposed Installation as feasible and environmentally friendly as possible, Uniper aims to reuse as much of the existing infrastructure as possible, while ensuring completely independent operation of the existing CQPS and the Proposed Installation. There will be infrastructure shared between the existing CQPS and the Proposed Installation which is briefly described below and summarised in Table 1:

- Natural gas supply for the Proposed Installation will be through a new 600 mm diameter pipe spur that will tie-in to the existing Connah's Quay AGI. The tie-in would include new natural gas filters, a pressure reduction station (PRS), metering and conditioning equipment, as required for the supply of gas to the CCGT unit(s).
- Export of electricity from the Proposed Installation will require a new connection from the Train(s) within the Proposed Installation to the existing Connah's Quay 400 kV banking compound, which would be used to connect the Proposed Installation to the existing 400 kV NGET substation located south-east of the Installation Boundary.
- Potable water supply for the Proposed Installation will tie-in to the supply line of the existing CQPS and be equipped with its own fiscal meter to allow each site to monitor its own water consumption.
- Cooling water abstraction infrastructure will be shared between the two sites with water abstraction from the Dee Estuary (River Dee) undertaken in accordance with the current abstraction licence (Serial No: 24/67/10/121/V004). No changes to the abstraction licence are proposed although an application to transfer the licence to the Proposed Installation's Operator will be made at a later date when the existing CQPS site has ceased operation.
- Cooling water discharge infrastructure will also be shared between the sites. Through the transition period, during normal operations the Operator will direct permit (EPR/NP3037AF) compliant cooling tower blowdown and some process waters from the Proposed Installation to purge pond A and process water to SDX tank A. Permit compliant blowdown and process waters from the existing CQPS will go to purge pond B and process water to SDX tank B. The Operator will, however, retain the capability to direct the discharges from both sites to the same purge pond/process water tank during abnormal operations with the agreement of both sites. Further details are provided in Section 4.3.9.
- Sludge holding tanks (1 and 2) will receive sludge from different areas of the plant but mainly the settlement pond.
- The purge ponds, process water (SDX) tanks, and sludge holding tanks will discharge through a shared 'common discharge chamber' that has an outflow to the Dee Estuary (River Dee) and is regulated under the existing CQPS permit. Discharge into the common discharge chamber can be controlled via automatic penstock valves and only permit compliant discharge from either site is permitted to enter the common discharge chamber. Discharge from the existing CQPS and the

Proposed Installation to the common discharge chamber will be coordinated based on level measurement to prevent mixing of waters and discharges to the Dee Estuary will be in accordance with the current CQPS permit. After the deconstruction of the existing CQPS, the Proposed Installation will have full operational flexibility and will be able to use the purge ponds and process water (SDX) tanks in a similar way to the current operations at the existing CQPS. Arrangements will be made to transfer the existing CQPS permit to the Proposed Installation, allowing discharges via W1 to continue.

- CO₂ export will be facilitated through a pipeline which is a combination of an existing repurposed pipeline and a small section of new pipeline. A new CO₂ interface facility known as the CO₂ AGI will be constructed within the Operator's land holding but outside the Proposed Installation boundary. The Proposed CO₂ AGI shall connect to the Repurposed CO₂ Connection at an intermediary point of the existing pipeline. The repurposed existing pipeline forms part of a cross-country pipeline from Point of Ayr to Connah's Quay. A short new section of pipeline (proposed CO₂ connection) of approximately 610mm diameter and 422m in length will be used to connect the repurposed CO₂ connection to the Liverpool Bay CCS Limited's Flint AGI which is the final connection point into the HyNet CO₂ pipeline.

Where elements of shared infrastructure are identified as requiring upgrade or renewal, the Proposed Installation's Operator will fund the necessary equipment. The equipment will be operated and controlled by the existing CQPS Operator until such time as the existing CQPS ceases to operate, at which point it will be transferred to the Proposed Installation's Operator.

A summary table of the services supply requirements is presented in Table 1 on the following page.

Table 1. Proposed Installation Services Requirements

Service/Utility	Supplier	Current Infrastructure	Existing CQPS	Proposed Installation	Additional Notes
Natural gas	National Gas Transmission plc (NGT)	Burton Point AGI with connection pipeline to Connah's Quay AGI.	Existing metered spur from the Connah's Quay AGI which incorporates relevant conditioning, PRS, pumping and metering system.	New metered spur which ties in to the existing Connah's Quay AGI. Includes new natural gas filters, a PRS, metering and conditioning equipment,	
Electricity	National Grid Electricity Transmission plc (NGET)	Connah's Quay Banking Station connected via 400 kilovolt (kV) and 132 kV overhead lines and underground cables and apparatus to the existing NGET 400 kV substation.	Existing export connection to the Connah's Quay banking station	New export connection to the existing Connah's Quay banking station.	Other upgrades to existing infrastructure to be agreed with NGET once final technology is confirmed.
CO ₂ export	From the Proposed Installation	Existing cross-country pipeline from Point of Ayr to Connah's Quay. Existing Flint AGI	None	Export from CO ₂ from the CO ₂ compression plant into a New CO ₂ AGI (operated by ENI) before export to the Flint AGI via repurposed and new pipeline	CO ₂ AGI and pipeline both lie outside the Proposed Installation Boundary
Potable Water	Welsh Water	Existing pipeline from transfer pipe to existing CQPS	Existing spur from incoming pipeline with own fiscal meter	New pipeline spur from existing intake pipeline with own fiscal meter	
Cooling Water	From the River Dee	Existing abstraction Point	Existing abstraction (Licence 24/67/10/121/V004)	Via existing abstraction point with new pumps and pipework to distribute to new Installation.	Abstraction point upgrades to comply with Eel Regulations to be completed. Abstraction Licence to transfer to the Proposed Installations Operator once the existing CQPS has ceased operations
Surface Discharges	To the Dee Estuary (River Dee)	Surface water drainage at the existing CQPS	Surface water drainage currently discharges via W2 and W3. Following transfer of the GTP and storage areas to the Proposed Installation, W2 will continue to serve the existing CQPS, and W3 will cease to be used.	Surface water drainage from the Proposed Installation will discharge via a new drainage system (W4). W2 and W3 will not be used by the Proposed Installation.	Within the Proposed Installation boundary, the existing drainage will become defunct, remediated or capped to be determined at detailed design stage. The Operator will confirm the cessation of use of W3 to NRW at the time of transfer.

Service/Utility	Supplier	Current Infrastructure	Existing CQPS	Proposed Installation	Additional Notes
Process Water Discharge	To the Dee Estuary (River Dee)	SDX tanks (A & B) Discharge Point W1	Via SDX B for discharge at W1	Via SDX A for discharge at W1 – discharges to be monitored to ensure compliance with EPR/NP3037AF discharge limits	Will retain capability to direct the discharges from both sites to the same purge pond/SDX tank during abnormal operations with the agreement of both Operators.
Cooling purge discharge	To the Dee Estuary (River Dee)	Purge ponds, pumping infrastructure and common discharge	Existing pumps and pipework to purge pond B for discharge through common discharge chamber at W1	Existing pumps and pipework to purge pond A for discharge through common discharge chamber at W1. Discharges to be monitored to ensure compliance with discharge limits in EPR/NP3037AF	Transfer of EPR permit (EPR/NP3037AF) to the Proposed Installation once the existing CQPS has ceased operations, to allow discharge via W1.
Management System	Existing Uniper ISO 14001 certified environmental management system (EMS)	Planning, operational and management procedures, monitoring and review systems.	Managed in accordance with the existing EMS. Current plant control via an automated distributed control system (DCS) with continuous emission monitoring (CEM) systems.	To be managed in accordance with the existing EMS. New DCS and CEMs for the Proposed Installation.	

1.1.2 Programme

The current programme for the delivery of the Proposed Installation, indicates mobilisation to site for enabling works at the end of quarter 2 of 2027 and construction is anticipated to commence by the end of quarter 1 of 2028. Hot commissioning of the plant and equipment is anticipated to commence during quarter 1 of 2030. This programme is subject to change and refinement as FEED, detailed design and procurement progresses.

Construction of the Proposed Installation will progress in line with the release of areas associated with the existing CQPS. There will be three main area releases, the first of these is situated at the western end of the Proposed Installation and will facilitate enabling works commencement. The second area is associated with the existing Gas Treatment Plant (GTP) and stores area which is anticipated to be released at the end of 2027. The final area is the purge pond and SDX tank which is anticipated to be released to the Proposed Installation at the start of Quarter 4 of 2029, following the expiry of a commercial power supply contract.

The GTP, stores, and purge pond areas are currently part of the existing CQPS installation boundary associated with permit EPR/NP3037AF, this is shown in Figure 11 (Environmental Application, Volume IV). The Proposed Installation boundary and associated phased release areas are shown on Figure 12 (Environmental Application, Volume IV).

As the existing CQPS Operator needs to ensure it continues to meet its current power supply contract, and detailed design is on-going, the transfer dates for the release of the GTP, stores and purge pond areas may be subject to change, and the transfer of the areas may need to be divided into smaller packages and transferred in stages.

The installation boundary for the operational Proposed Installation is shown in Figure 2 (Environmental Application, Volume IV).

1.1.3 Document Structure

This document is the main Supporting Statement for the Proposed Installation's permit application and is structured as follows:

- Section 1 presents general background to the overall project, summarises the purpose of the facility, and describes the legislative context of the development. This section is supported by a number of drawings and plans presented in Volume IV of the permit application.
- Section 2 summarises the environmental setting of the Proposed Installation and the current site conditions. It is supported by a Site Condition Report in the permit application Volume III, Appendix A.
- Section 3 presents a summary of the management arrangements to be employed at the proposed installation. Uniper Policy Statements and ISO 14001 certificates are presented in permit application Volume III, Appendix B.
- Section 4 describes the Proposed Installation in more detail explaining the technical standards to be met and the proposed CCGT and CCP technology to be employed and associated design philosophies. This section also summarises compliance with the relevant regulatory standards to demonstrate the proposed installation will comply with the relevant Best Available Techniques (BAT). This section is supported detailed assessments of BAT presented in permit application Volume III, Appendix C.
- Section 5 summarises emissions to air, land and water associated with the operation of the Proposed Installation.
- Section 6 presents the proposed arrangements for monitoring and control of the proposed processes.
- Section 7 presents the conclusions of the environmental impact assessment of the Proposed Installation and is supported by a number of separate assessments in permit application Volume III, Appendices E-I.
- Section 8 presents an overview of the approach to commissioning, decommissioning and closure.

1.2 The Operator

The Proposed Installation will be operated by Uniper UK Limited.

The Operator is a UK-based company, wholly owned by Uniper SE (Uniper) through Uniper Holding GmbH.

Uniper is a European energy company with global reach and operations in more than 40 countries. It has about 7,500 employees and plays a key role in ensuring a secure energy supply in Europe, particularly in its core markets of Germany, the United Kingdom, Sweden, and the Netherlands. Uniper's 14 gigawatts of flexible power generating capacity make it a mainstay of reliable power production. Uniper is a leading gas trader and one of Northwestern Europe's most important LNG importers, and its broad procurement portfolio enhances supply security.

Uniper is committed to investing around €8 billion (~£6.9 billion) in growth and transformation projects between 2023 until the early 2030s. This includes developing new renewables projects, investing in renewable and low-carbon gases such as hydrogen, and new CCS or hydrogen ready power plants and by progressively transforming its existing fleet into Europe's leading source of decarbonised power. Together, these steps will enable the Uniper Group's Scope 1, 2, and 3 emissions to be carbon-neutral by 2040¹.

In the UK, Uniper owns and operates a flexible generation portfolio of six power stations, a fast-cycle gas storage facility, two high pressure gas pipelines, and regasification capacity at the Grain LNG terminal in Kent. Uniper makes its power production available to the market through its trading activities and provides balancing customised services to the UK system operator. Uniper are also progressing CCS and hydrogen projects, and expanding our onshore wind and solar portfolio, to further support energy security in the UK.

The design of the Proposed Installation demonstrates Uniper's commitment to deliver on its aim to accelerate the transition to a decarbonised future. The Proposed Installation will be built with a clear route to decarbonisation, being equipped with post-combustion carbon capture technology, consistent with Uniper's commitments to low-carbon power. It is intended that the Proposed Installation will connect to infrastructure that will be delivered by the Hynet Cluster for the transport and offshore geological storage of carbon dioxide.

1.3 Proposed Installation

The design of the proposed installation is subject to ongoing technical studies, to provide flexibility and to align with the current grid connection, but it is expected to comprise the development of two CCGT units achieving a net electrical output capacity of up to 1,380 megawatts (MW; referred to as MWe for electrical output) (with CCP operational) onto the national electricity transmission network.

The proposed installation will generate electricity from combustion of natural gas within a combined cycle gas turbine (CCGT). Hot exhaust gas from the combustion process will be used to drive the gas turbine (GT), and steam, which will be generated from the heat of the exhaust gas, in the heat recovery steam generator (HRSG), which will be used to drive the steam-turbine (ST). The exhaust gas will then pass through pre-treatment stages, including selective catalytic reduction (SCR) using ammonia (NH₃) to reduce Oxides of Nitrogen (NO_x) in the gas and subsequently cooled using water via a direct contact cooler (DCC), in the CCP. The CCP will use an amine-based solvent to absorb carbon dioxide (CO₂) from the exhaust gas within a packed column (absorber), via a weak acid-base reaction. The CO₂-depleted exhaust gas then passes through water wash and acid wash sections and is released to atmosphere via an absorber stack. Continuous emissions Monitoring (CEMS) equipment will be located within the stack to monitor pollutants to air.

The CO₂-rich solvent exits the absorber, and passes through a lean/rich heat exchanger, and then into the desorber. The CO₂ is liberated from the solvent by heat, supplied by low pressure steam from the HRSG in normal operation. This steam is supplied to the desorber-reboiler. The now lean/rich solvent will be recirculated within the plant. The CO₂ rich vapour exits the top of the desorber, and passes

¹ Group wide scope for 1, 2 and 3 emissions including offsetting, where economically viable. Scope 1 and 2 emissions are heading towards neutrality by 2040 as part of the EU Emissions Trading System (EU ETS). Scope 3 emissions will decrease in time with market developments, customer behaviour and political goals.

through a reflux stage to maximise solvent-CO₂ separation. The CO₂ vapour is conditioned to remove water and oxygen to the transport and storage network's specifications after entering a low pressure compressor to compress the gas to export pipeline pressure (8-43 Bara). The CO₂ is then metered and exported to the transport and storage network's CO₂ pipeline which is operated by ENI. The solvent will accumulate impurities over time, and these will be removed via a solvent reclaiming process which will be a thermal process, either continuously via a slipstream or as a batch process.

The CCP stack emissions will be residual pollutants from the combustion and treatment processes, including NO_x, NH₃, and Carbon Monoxide (CO). The CCP will be designed to capture a minimum of 95% of the CO₂ emissions from the CCP as an annual average of all normal operating conditions. There may also be trace pollutants within the flue gas, including trace levels of solvent and solvent break-down products from within the process. Emissions will be minimised using the water and acid wash steps on the absorber and monitored at the emission point within the abated flue gas stack prior to release. In addition to the CCP emission point, there will be an intermittent-use emission point serving the HRSG exhaust. Emissions from the CCP, and HRSG stack are expected to meet the emission limits for LCP under the Industrial Emissions Directive (IED).

Other supporting infrastructure and plant to the proposed installation will include the storage of solvent, caustic soda, sulphuric acid and water-treatment chemicals, demineralisation water treatment plant to produce high-purity water for use in boilers, blending, closed loop cooling, and other processes. It will include an electric auxiliary boiler for start-up and dispatchability support, emergency diesel generators for safe-shutdown during a power failure scenario, closed surface water drainage and appropriate treatment facilities, and infrastructure for natural gas import and conditioning and CO₂ conditioning and export. The number and thermal rating of the emergency generator(s) will be confirmed during FEED and will be classed as medium combustion plant (MCP).

The Proposed Installation will also be supported by natural gas supply, existing potable water supply, existing water abstraction and discharge, electrical connections, utilities, access works and CO₂ export connection. The water abstraction for the Proposed Installation's cooling system will be in line with the extraction at the existing CQPS and is not expected to exceed the current abstraction permit requirements. Process water and/or waste water from the site will also be discharged to the existing sites lagoon before being purged into the River Dee.

The proposed installation will make use of CO₂ transport and storage network owned and operated by Liverpool Bay CCS Limited, currently under development as part of the HyNet Carbon Dioxide Pipeline Project (referred to as the 'HyNet CO₂ Pipeline Project'), which will transport CO₂ captured from existing and new industries in North Wales and North-West England, as well as from new hydrogen production facilities that are proposed as part of HyNet North West Project. The captured CO₂ will be stored in depleted offshore gas reservoirs in Liverpool Bay.

A high-level process flow diagram for the Proposed Installation is provided in Volume IV of the permit application.

The Proposed Installation will be designed to optimise the capture of CO₂ operating in dispatchable mode, while minimising emissions and waste generation and maximising energy efficiency. BAT assessments have been prepared to demonstrate the Proposed Installation will be designed and operated in accordance with BAT for LCP, Energy Efficiency, Post-Combustion Carbon Capture (PCC) plant design and Cooling.

1.4 Regulatory Framework

The proposed installation is listed under Schedule 1 of Environmental Permitting (England and Wales) Regulations (EPR) 2016, as amended.

It was confirmed during pre-application discussions with the Natural Resource Wales (NRW), that the application will include the listed activities and directly associated activities as shown in Table 2 below:

Table 2 Listed Activities and Directly Associate Activities

Activity Ref No	Activity under EPR 2016 Schedule 1	Description of specified activity	Limits of specified activity
A1	Section 1.1 A(1) (a): Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more	Operation of two CCGT plants, each comprising one gas turbine, fired on natural gas, with a Heat Recovery Steam Generator (HRSG), steam turbine and generators for the production of electricity. Emergency backup generators	Combustion of natural gas in a CCGT. From receipt of natural gas to discharge of exhaust gases and wastes, raw materials to and supply of electricity, and from water intake to water discharge. Permitted to operate in single or double two-shifting mode. From fuel supply to the generator to flue gas emissions.
A2	Schedule 1, Part 1, Chapter 6, Section 6.10, Part A Carbon capture and storage: Capture of carbon dioxide streams from an installation for the purposes of geological storage.	Operation of a carbon capture plant involving the treatment of exhaust gas from the HRSG into the capture plant using an amine-based solvent to extract CO ₂ followed by compression, oxygen removal and dehydration of the CO ₂ for off-site transportation and long-term storage, and release of CO ₂ -abated flue gas to atmosphere.	From receipt of exhaust gases from the HRSG in the carbon capture plant to the treatment of exhaust gas prior to export of CO ₂ from the installation or release to atmosphere of CO ₂ .

Directly Associated Activity

A3	Directly Associated Activity	Surface water drainage. Handling and storage of site drainage until discharge to the site surface water system.	Generation and handling of water to the point of discharge at new discharge point W4.
A4	Directly Associated Activity	Raw water treatment, storage and delivery. De-ionising and/or other treatment of cooling water	From receipt of abstracted water to point of use, handling, to dispatch to cooling water purge system.
A5	Directly Associated Activity	Raw materials handling and storage - receipt, storage and handling of amine solvent, water treatment chemicals, ammonia, fuel and lubricating oils, turbine cleaning chemicals and all other raw materials.	From receipt of raw materials to their point of use.
A6	Directly Associated Activity	Solvent reclaiming or regeneration	TBC
A7	Directly Associated Activity	Operation of a Wastewater Treatment Plant. Treatment of wastewater (e.g. cooling water, etc)	From receipt of effluent from process to the point of release to discharge point.
A8	Directly Associated Activity	Effluent Discharge. Discharge to existing final discharge purge pond of cooling water blow-down, steam condensate, and treated direct contact cooler effluent.	From release of effluents from process and/or wastewater treatment plant to discharge into purge pond A prior to final release at emission point W1 (at the existing permitted CQPS (EPR/NP3037AF).
A9	Directly Associated Activity	Waste Management. Waste generation and handling.	From generation of waste to dispatch from the installation.

Activity Ref No	Activity under EPR 2016 Schedule 1	Description of specified activity	Limits of specified activity
A10	Directly Associated Activity	<p>Operation of electrical transformers to support the installation.</p> <p>Generator step-up transformer: one per generating unit.</p> <p>Station transformers: multiple smaller units for local distribution.</p> <p>Unit auxiliary transformer: one per generating unit supplying auxiliaries.</p>	<p>Transformers and associated equipment contain insulating oil and potentially gas insulation stored within secondary containment systems sized to hold at least 110% of the largest volume</p> <p>Operation maintained within manufacturer's limits for voltage, load, and temperature</p> <p>Regular inspections and maintenance to prevent oil or gas leaks or spills</p>
A11	Directly Associated Activity	Electric auxiliary boiler providing steam/heat for use within the CCP.	TBC

2. Environmental Setting and Site Condition

2.1 Site Location

The proposed installation is located approximately 0.6 kilometres ('km') north-west of the town of Connah's Quay in Flintshire, north-east Wales. The site location is shown in Figure 1 below.

Plate 1. Site Location



The Proposed Installation is situated at grid reference SJ 27347 71374 and covers an area of approximately 36.2 hectares (ha)..

2.2 History of the Wider Connah's Quay Power Station Site

The site was formerly occupied by saltings, areas of coastal land that are regularly covered by the tide. Reclamation commenced in 1950 and included the dredging and pumping of 800,000 tons of sand from the river to lift the ground level to around 2.5 m above ordnance datum (AOD), thereby creating the development platform for the original coal-fired power station (CQ-A) to the south-east of the current CQPS . It was constructed in three 60 MW phases over eight years, with completion in 1958.

Embankments were created on land currently occupied by the site to provide settlement lagoons and storage for the slurried pulverised fuel ash (PFA) arising from the coal station. As well as three cooling towers, the original station was also served by a dedicated railhead, running from the North Wales coastline to the west of the Site.

The original CQ-A coal-fired station ceased operating in 1984. Demolition started in 1992, and the proposed Indicative Enhancement Area was cleared of all standing structures. Subsurface holes and pits were filled in and wastes were disposed of to landfill.

The current four-unit combined CCGT and associated infrastructure (including Gas Treatment Plant) at the existing CQPS was constructed between 1993 and 1996 in the south-east of the Site. The plant

was constructed on the former PFA settlement lagoons which raised the existing CQPS site to its current height (maximum 7 m AOD) with the former CQ-A station site forming part of the laydown area. The station was initially owned by Powergen (now E.ON UK), and transferred to the Uniper UK Limited in 2016

2.3 Current Setting

The Proposed Installation is surrounded by the existing CQPS to the south-east and agricultural fields to the north-west. The Proposed Installation is bordered to the north and north-east by the River Dee and its Estuary, including peripheral floodplain marshland. The Proposed Installation has flat, low-lying coastal topography with typical ground levels ranging between approximately 6 to 8 m AOD.

The existing CQPS is owned and operated by the Applicant and accessed from the A548 via Kelsterton Road. The existing CQPS is a four-unit combined cycle gas turbine (CCGT) plant capable of providing 1,380 megawatts (MW; referred to as MWe for electrical output) of dispatchable power exported to the National Grid.

The Proposed Installation is also bordered to the east and south-east by the existing National Grid 400 kilovolt ('kV') Deeside Substation, and to the south and south-west by the North Wales Main Line railway. Land to the south and south-west is predominantly rural in nature, with interspersed residential properties and agricultural land.

The Dee Estuary is designated as a Ramsar site, Special Area of Conservation (SAC) (River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC), Special Protection Area (SPA) (Dee Estuary / Aber Afon Dyfrdwy SPA) and Site of Special Scientific Interest (SSSI) (Afon Dyfrdwy (River Dee) SSSI) due to its size and topography, its assemblage of diverse marine, coastal, and intertidal habitats, and its importance for passage and wintering waterfowl and intertidal plant species.

The nearest residential receptors to the site are located along Kelsterton Road, with the closest receptor being approximately 20 m from the site.

The Proposed Installation will be accessed via Kelsterton Road from the A548 Chester Road leading to internal access roads around the site. These internal access roads are located between the structures of the existing CQPS, between the agricultural fields to the north-west of the site, and along the north-east boundary of the site to give access to the existing wildlife hides and are comprised of tarmac/asphalt.

2.4 Site Condition

A Site Condition and Baseline Report for the Proposed Installation is presented in Permit Application, Volume III, Appendix A, characterising the condition of the ground and groundwater across the Proposed Installation site.

The area is predominantly industrial in nature, as described above. The environmental sensitivity of the site is considered to be as follows:

- Ground water – Low sensitivity- The bedrock geology of Gwespys Sandstone, Pennine Lower Coal Measures Formation and Etruria Formation are classified as a Secondary A aquifer. The superficial geology consisting of Tidal Flat Deposits are present on site and are classified as Secondary (Undifferentiated) Aquifers. Glaciofluvial Deposits at the site are classified as a Secondary A Aquifer. The Site does not lie within a Source Protection Zone (SPZ) and there are no SPZ or groundwater abstractions within 1 km of the Site.
- Surface water – Medium to Very High sensitivity – The Dee Estuary, located approximately 120 m northeast at the closest point, Kelsterton Brook running parallel to the northern boundary of the site, crossing south of the site and discharging into the River Dee/Dee Estuary and various other brooks and ponds/marshes within 200 metres of the site.
- Land use – Medium-Very High sensitivity – the Site is surrounded by industrial and agricultural land; however residential properties are located within 500m of the site.

Information on relevant hazardous substances stored at the facility, their physical containment, and the management techniques adopted to prevent and control releases are included within the Site Condition Report (Permit Application, Volume III, Appendix A).

The Proposed Installation comprises:

- the demolition of an existing gas treatment plant (GTP) and above-ground installation (AGI), store buildings, and contractors' facilities associated within the existing CQPS;
- the construction, operation (including maintenance) and decommissioning of a proposed low carbon CCGT generating plant fitted with CCP, including supporting infrastructure;
- use of the existing available infrastructure links including electrical grid and gas (specifically the National Grid Electricity Transmission plc (NGET) and National Gas Transmission plc (NGT) networks) and has been sited to facilitate its connection to the HyNet CO₂ Pipeline Project, which was granted development consent in March 2024; and
- repurposing of purging ponds, cooling water abstraction and discharge infrastructure and, where possible, other existing infrastructure from the existing CQPS.

The activities at the Proposed Installation site will be carefully controlled both by local containment and operational techniques. The measures put in place will ensure that operations during the life of the facility are unlikely to lead to pollution of groundwater or the ground and will not lead to deterioration of the state of the land.

3. Management Arrangements

3.1 Introduction

The Proposed Installation will develop a management system prior to commencement of operations in accordance with the EA guidance – 'Develop a management system: Environmental Permits'² as a good practice measure. In this case, EA guidance has been used as there is no specific guidance on management systems provided by NRW.

3.2 Overview

Uniper UK has a long-established EMS which is accredited to ISO 14001:2015³. Uniper's operational sites within the UK have a shared certificate and meet the requirements of the standard by working to central system procedures as well as site specific / local procedures. The central procedures include the core management system requirements to ensure that there is consistency in the implementation of the EMS across all Uniper UK sites. A copy of Uniper's current ISO 14001 certification and the Corporate Health, Safety, Security, Environment (HSSE) and Sustainability Policy are provided with this application in Volume III, Appendix B.

3.3 Organisation – Responsibilities and Structure

The shared system requires individual Uniper Sites to follow the high-level management instructions but also to have in place local management instructions that are specific to their plant and operations. This ensures that the right actions are taken at the right time by the right people.

The Connah's Quay Low Carbon Power Project will follow the normal structure that Uniper employ elsewhere. Staff of various grades will be needed to run and maintain the plant continuously, seven days a week all year. The plant will be managed, operated and maintained by experienced managers and operational teams. The key environmental management responsibilities will be allocated as described below.

- The Plant Manager will have overall responsibility for management of the Connah's Quay Low Carbon Power Project Plant and compliance with the Environmental Permit. The Plant manager will have extensive experience relevant to his responsibilities and will ensure adequate resources are available to manage the environmental requirements.
- The Production Manager will have day-to-day responsibility for the operation of the plant, ensuring operation is compliant with the permit and environmental impact is minimised. In this context, he or she will be responsible for designing and implementing operating procedures which incorporate environmental aspects.
- The Engineering Manager will be responsible for the planning, implementation and general management of maintenance activities, ensuring the plant continues to operate in accordance with its design and environmental requirements.
- The SHE/Environment Team leader will be responsible for producing reports that need to be submitted to Natural Resources Wales, liaising with the Uniper Central environment team and the site management, to ensure the requirements of the Environmental Permit and the EMS are met.

3.4 Management System

The Connah's Quay Low Carbon Power Project will be included within the company's current ISO 14001 EMS. The plant will be designed with an EMS in mind, and a fully integrated EMS will be implemented into all aspects of plant operation. The key aspects of the Connah's Quay Low Carbon Power Project will include:

² Environment Agency (2016) Develop a management system: environmental permits. Last updated: 3 April 2023. Accessed at: <https://www.gov.uk/guidance/develop-a-management-system-environmental-permits>.

³ BS EN ISO 14001: 2015, Environmental Management Systems – Requirements With Guidance for Use

3.4.1 Competence and Training

Using the established competency and training systems, the key competency requirements will be set out for the operation of the installation and the training individuals require. This will be subject to annual review or as operations change. Training will include environmental training in relation to operation of the plant, emissions monitoring and emergency response. The potential environmental risks posed by the work of contractors will be assessed within the work control management systems at the installation, and instructions will be provided to contractors about protecting the environment whilst working on site as part of a specific site induction process which will be compulsory to all on site contractors.

Operational Control is part of the EMS that sets out the key operational controls for day-to-day operation of the installation and will include:

- Site infrastructure plan
- Operational procedures covering start up, shut down and normal and abnormal operations
- Emissions monitoring and associated procedures (e.g. MCERTS, EN14181)
- Site equipment and maintenance plans / systems
- List of wastes produced and waste management procedures on site
- Reporting and recording environmental incidents

3.4.2 Maintenance

The maintenance strategy for the proposed installation shall include a combination of the following approaches to optimise safe and compliant operation.

- Preventive Maintenance (PM): Routine inspections, servicing, and replacement of parts based on the manufacturer's recommendations and operational data to prevent unexpected failures
- Condition-Based Maintenance (CBM): Use of real-time monitoring systems (vibration, temperature, pressure, etc.) to assess the condition of critical assets and trigger maintenance activities based on actual equipment conditions.
- Predictive Maintenance (PdM): Application of advanced analytics and machine learning models to predict potential failures before they occur, allowing for timely intervention.
- Corrective Maintenance (CM): Reactive maintenance in response to equipment failures or performance degradation that cannot be prevented through PM, CBM, or PdM. This will be minimized through the use of the proactive maintenance approaches mentioned above.

Specific maintenance for the CCP will be determined at FEED as recommended by the Licensor.

3.4.3 Monitoring Systems

This will include establishing key performance indicators to measure environmental performance and the effectiveness of the EMS. All actions arising from incidents, accidents and audits will be recorded. The corrective/preventative action that needs to be implemented to stop reoccurrence will also be recorded. Tracking the implementation of these actions will be through Management Review, and monitoring audit actions as part of the key performance indicators for the EMS.

3.4.4 Emergency Management

An Emergency and Business Continuity Plan will be put in place for the Proposed Installation. This will include dealing with environmental incidents and cover site plans and information for emergency services in line with current Uniper operational plant practices.

3.4.5 Climate Change

Climate change adaptation and mitigation will be considered in the proposed plant design. Climate change adaptation risk assessments are carried out at an operational site level. Uniper will consider how a changing climate might affect future operations and ability to comply with permit conditions. The

risk assessment considers climate change projections to support risk identification. Climate related risks and any associated mitigation plans are managed within the Company EMS.

4. Proposed Technical Installation

4.1 Technical Standards

The Proposed Installation will be operated in accordance with a new bespoke EPR Permit issued by NRW. The EPR permit will include the activities and techniques detailed within this application which will be developed in accordance with the standards and guidance which detail 'Best Available Techniques' (BAT). The applicable standards and guidance were reviewed and agreed with NRW during pre-application engagement and include:

- Best Available Techniques (BAT) Conclusions for Large Combustion Plants (LCP BATc)⁴;
- Reference Document on Best Available Techniques for Energy Efficiency⁵;
- Reference Document on the application of Best Available Techniques to Industrial Cooling Systems⁶; and
- EA Guidance on Post-combustion carbon dioxide capture: emerging techniques⁷;

The new CCGT plant for the combustion of fuel to generate power will be covered as a Section 1.1 Part A(1)(a) – Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts. The Proposed Installation will include the installation and operation of a CCP which will be covered as a Section 6.10 Part A(1)(a) - Capture of carbon dioxide streams from an installation for the purposes of geological storage pursuant to Directive 2009/31/EC of the European Parliament and of the Council on the geological storage of carbon dioxide.

The Proposed Installation will be compliant with the above BAT standards and a summary of compliance against the current BATc is provided in Environmental Permit Application, Volume III, Appendix C.

4.2 Operational Modes

Following commissioning the Proposed Installation is designed to operate in dispatchable mode, i.e. being able to export power into the day-ahead market to match the anticipated intermittency of renewable power in a future power market.

The primary operating mode is anticipated to be with CO₂ emissions from the CCGT units abated (i.e. with CCP operational). This is because the Dispatchable Power Agreement (DPA) that the Applicant is seeking, incentivises electricity generation with carbon capture. However, it is anticipated that there would also be a number of limited scenarios in which the CCGT may need to operate without the CCP including:

- Unabated Scenario 1: on commissioning, in the event that the downstream T&S network is unavailable;
- Unabated Scenario 2: during operation, to meet electricity demand when the CCP is offline (e.g. due to outages of the T&S network); and
- Unabated Scenario 3: During a NatTS (electrical) total or partial shutdown event, in which the plant is called upon to support system restoration.

Outside of these circumstances, it is expected that the CCGT would not operate unabated. The CCP would be designed to be capable of capturing a minimum of 95% of the CO₂ emissions (by mass) from the generating station as an annual average of all normal operating conditions (subject to completion of FEED verification studies and commercial agreement).

⁴ European Parliament and Council of European Union, July 2017, Best Available Techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for Large Combustion Plants.

⁵ European Commission, September 2009, Reference Document on Best Available Techniques for Energy Efficiency.

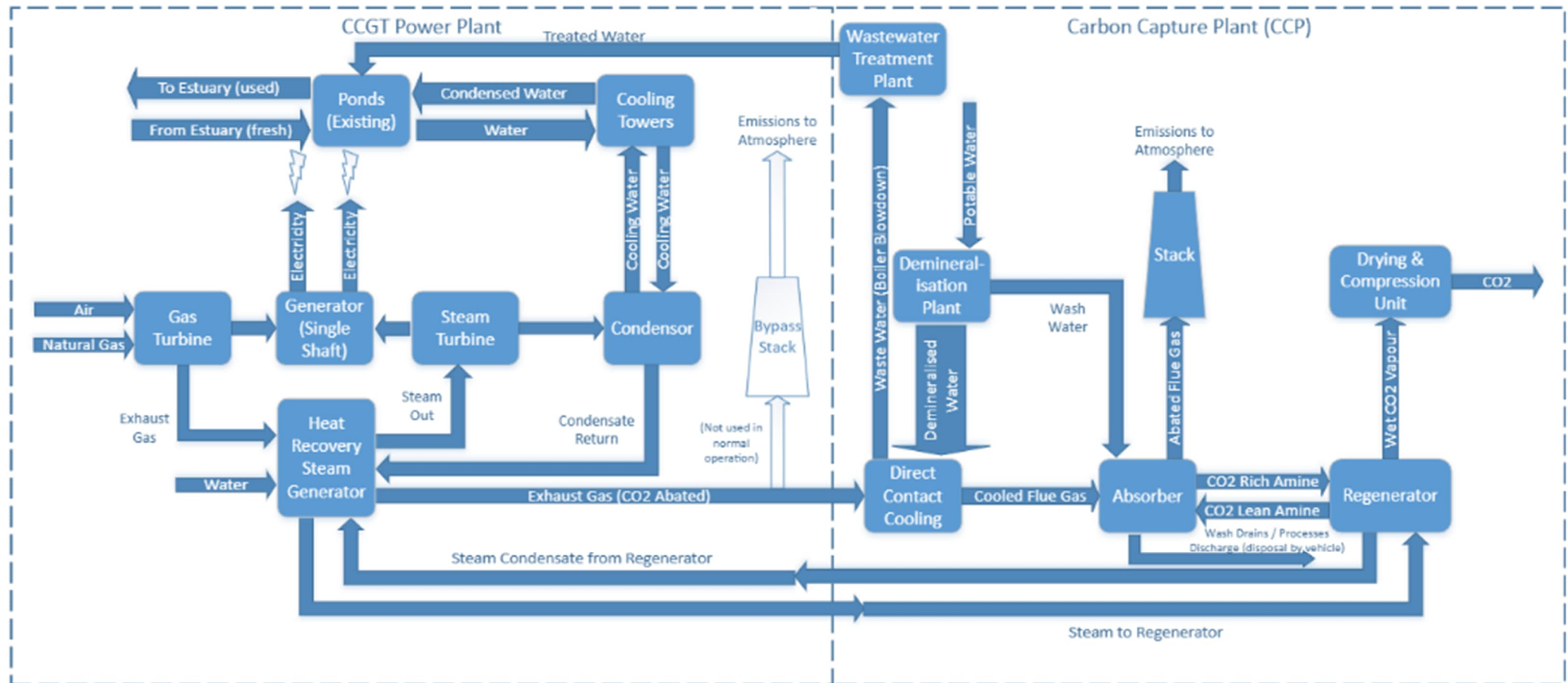
⁶ European Commission, December 2001, Reference Document on the application of Best Available Techniques to Industrial Cooling Systems.

⁷ Environment Agency, (2021) Post-combustion Carbon Capture: Emerging Techniques. Last updated March 2024. Accessed at <https://www.gov.uk/guidance/post-combustion-carbon-dioxide-capture-best-available-techniques-bat>

4.3 Process Description

The development of the Proposed Installation is currently undergoing Front End Engineering and Design (FEED) with two technology providers. This section describes the anticipated process for the Proposed Installation taking a technology neutral approach where design is largely based on pre-FEED information and providing detail of key differences where FEED information is available. An indicative process schematic is provided in Plate 2 on the following the page and process flow block diagrams for each FEED option is provided as Figures 7 and 8 in Permit Application Volume IV.

Plate 2. Indicative Process Schematic of Integrated Power and Carbon Capture Units



4.3.1 CCGT Power Plant Generation

The proposed gas turbine (GT) for each train will be a modern highly efficient gas turbine having a combined nominal output of up to 1380 MWe – abated from up to two trains.

Natural gas from the National Gas National Transmission System (NTS) at Burton Point will supply the Proposed Installation and an Above Ground Installation (AGI) will ensure the gas enters the turbines at the required pressure and temperature. Gas will not be stored on site prior to use as a fuel.

Natural gas is supplied to the existing CQPS from the NTS via the Burton Point AGI and through Uniper's pipeline into the Connah's Quay Gas AGI. The current pipeline and connection is capable of providing 275,000 standard cubic m per hour (Sm³/h) (at standard operating conditions of 15 degrees Celsius (°C) and 1.01325 bar) of natural gas, as per the existing contractual arrangements. The Proposed Installation is designed to operate within the existing capacity limit and existing contractual arrangements. The AGI is existing, with a new tie-in to be provided comprising a 600 mm diameter pipe spur to the decommissioned Gas Treatment Plant (GTP) which currently is in proximity to the proposed site for the Proposed Installation. The GTP is to be demolished. The new tie-in will include new natural gas filters, a pressure reduction station (PRS), metering and conditioning equipment. The existing CQPS will continue receive gas via its existing pipe spur from the existing Connah's Quay Gas AGI. The existing arrangements include separate conditioning, metering and pressure reduction equipment. During the transition period to the full operation of the Proposed Installation, one train of the Proposed installation may operate in parallel with up to two units of the existing CQPS within the constraints of the existing connection agreement,

Within the GT, the gas will then be mixed and combusted with compressed air. The hot combustion gases will expand, rotating the turbine blades at high speed, driving an electrical generator to produce electricity.

The hot exhaust gases from the GT will then be passed through a HRSG to produce high-pressure steam, which is used to drive a Steam Turbine (ST) connected to the same generator; thereby maximising electricity generation from the fuel being combusted.

A portion of steam will be extracted from the ST and used in the CCP for separation of CO₂ from solvent (stripper) and solvent conditioning (reclaimer).

The steam exhausting from the ST and CCP will be cooled and condensed, with the condensate returned to the steam-water cycle of the HRSG for continued reuse. Water used within this steam/ water cycle will need to be treated to be of high purity to regulate the build-up of residual dissolved solids in pipework arising from the continuous evaporation and condensing of water within the cycle. To further manage this, it will be necessary to purge a small amount of the recirculating water ('boiler blowdown') intermittently. Any blowdown removed from the cycle will need to be made up with fresh demineralised water.

The condensation of steam exiting the steam turbine will be achieved using a separate circuit of cooling water that will be recirculated through hybrid cooling towers.

4.3.2 Flue Gas Pre-treatment

4.3.2.1 Sulphur Dioxide and Particulates

Combustion of natural gas is highly efficient and due to the nature of the fuel, the combustion gases from a typical CCGT plant contain negligible amounts of sulphur dioxide (SO₂) and particulate matter. Abatement of these species, is therefore not considered to be necessary either for the purpose of solvent efficiency, or for minimisation of emissions to air.

4.3.2.2 Oxides of Nitrogen

The LCP BRef includes a requirement for NO_x emissions from new CCGT plant to be at or below a BAT-AEL annual average of 30mg/Nm³ and a daily average of 40mg/Nm³.

The optimisation of combustion within a GT is well understood, such that the emissions of nitrogen oxides (NO_x) and carbon monoxide (CO) are carefully controlled by design and typically through the implementation of primary control measures such as burner design and staged combustion.

Most (but not all) OEMs of GTs have indicated that the required BAT-AELs can be achieved by means of primary abatement measures such as Dry Low NO_x burners alone, however NO₂ can preferentially react with the amine solvent within the CCP, causing degradation of the solvent, and therefore more solvent is required to replenish.

As such, at this stage of technology design, additional abatement of NO_x is required to minimise potential for oxidative solvent degradation in the CCP. Therefore, SCR based on NH₃, has been included on the CCP for use when the Proposed Installation is operating in CO₂-abated mode. The exhaust gas exiting the HRSG during CO₂-unabated mode will not use SCR, and NO_x will be reduced through primary measures (dry low NO_x burner).

The level of NO_x removal required is therefore the subject of on-going technical studies and will be partially dependent upon the sensitivity of the Technology Licensor's solvent to NO₂. These studies will seek to optimise the operation of the Proposed Installation in order to maximise efficiency and minimise emissions and waste. Information of both Technology Licensor's solvents are provided in Section 4.4.

4.3.2.3 Exhaust Gas Cooling

The exhaust gas (< 100°C) will be cooled in a DCC or exhaust gas quencher to condition the gas to the minimum necessary temperature (circa 32-42°C) for the absorber. The exhaust gas contacts a fine water spray in a packed column to cool it to the required temperature. The conditioned gas then passes to the counter flow absorption column for absorption of CO₂.

4.3.3 Carbon Capture Plant

4.3.3.1 Introduction

Both FEED technologies will use amine-based post-combustion carbon capture (PCC) which will remove CO₂ from the exhaust stream of a conventional combustion process using an amine-based chemical absorption technology. The CO₂ is typically present in the flue gas composition at 3-8% (depending on the process and ratio of fuel to air), with nitrogen as the main constituent of the gas.

Chemical absorption of CO₂ is the most commercially proven method due to considerable experience with the process in the crude oil refining, gas treating and sulphur recovery industries.

The selection of OEM for the CCGT plant and the Technology Licensor for the CCP have not yet been made at this competitive FEED stage. However, data from both FEED contractors and their respective OEMs and Technology Licensors has been used in the preparation of process flow diagrams and outline heat and mass balances, in order to identify maximum operating parameters and emissions.

The CPP design will be provided by the Technology Licensor and therefore the design described below may be subject to minor amendments.

4.3.3.2 Absorber

The gas will be fed to the bottom of the packed section of the absorber. Lean solvent will be fed to the top of the absorption section and contacts the exhaust gas, where CO₂ will be absorbed. The equilibrium limit for this reaction is reached at the absorber top where the leanest lean solvent contacts the exhaust gas with minimum CO₂ concentration. The overall carbon capture efficiency is given by the difference in exhaust gas inlet and outlet CO₂ concentrations.

The treated exhaust gas (CO₂-lean gas) then exits the top of the absorber and passes through solvent retention and air emissions mitigation stages (see Section 5.1) and will be subsequently released to atmosphere via a dedicated stack.

Gas pressure throughout the absorber section will be low, typically below 100 mbar to balance the pressure drop of the absorber equipment before the atmospheric stack.

Typical operating temperatures in the absorber include a range from 30°C to 80°C, depending on the process design parameters such as the compositions of the solvent and exhaust gas, as well as the presence of any intercooling arrangement in the absorber. The final operating temperatures within the absorber will be confirmed by the technology licensor. Note that towards the exit point from the absorber, the exhaust gas will generally approach a temperature within 5-10°C of the lean solvent supply temperature.

4.3.3.3 Desorber

The CO₂-rich solvent exits the bottom of the absorber, via a lean-rich solvent interchanger (heat exchanger) and passes to the top of the stripper column (desorber) which uses hot rising vapour to break the CO₂-amine bond and release the CO₂ from the solvent at a pressure slightly above atmospheric pressure.

The hot CO₂-lean solvent enters the sump at the bottom of the desorber and will be passed to the desorber-reboiler.

The desorber-reboiler boils the lean amine using saturated LP-steam heat-exchanger, and some of this is passed back to the base of the desorber column to strip the residual CO₂ from the falling lean solvent.

Lean amine from the reboiler will also be recirculated back to the absorber via the lean/rich heat exchangers, to cool the lean solvent and heat the rich solvent from absorber. Cooled lean amine solvent may be returned to the Lean Amine Storage Tank.

The CO₂ rich vapour from the top of the desorber passes through a reflux stage to maximise the solvent-CO₂ separation. The CO₂ is saturated with water and is sent to the compression stage.

4.3.3.4 Thermal Reclaimer

The efficient management of the solvent will be fundamental to the performance of the CCP and hence the efficiency of carbon capture, and the Proposed Installation as a whole.

Thermal degradation and oxidative degradation of the solvent will be minimised through application of appropriate process control measures, for temperature and exhaust gas trace species, as required by, and specific to the selected Technology Licensors design.

Selection of appropriate materials of construction will also be necessary to minimise the risk of oxidative degradation, which will be specified at the FEED stage once the specific solvent requirements are known.

Nevertheless, some solvent degradation is expected to occur over time and degradation products and corrosion products must be removed, via thermal reclamation. The use of solvent management techniques specific to the solvent will ensure minimum waste generation and optimum capture performance in accordance with indicative BAT.

Depending on the Technology Licensor's design thermal reclaiming for the solvent may be a continuous or a batch process. In a continuous process a bleed (circa <5%) of the hot lean solvent returning to the solvent storage tank (from the desorber-reboiler) will be passed to the thermal reclaimer where it will be heat treated to break down heat-stable salts formed in the process, to recover solvent and remove degradation products, prior to return to the solvent system.

In a batch process, the thermal reclaiming process may occur for 1 week or so every 2-4 months depending on the degradation profile of the solvent.

The specific design for the thermal reclaimer will be confirmed at FEED stage but it is expected to use low/ medium pressure (LP / MP) steam. The operating regime will also be confirmed in the FEED stage based on the selected Technology Licensor's preference for treating the solvent continuously or in batches.

Impurities removed in the reclaimer, including heat-stable salts, amine by-products and any metals will be sent for processing off-site.

4.3.3.5 Low-Pressure Compression

The CO₂ is compressed in several stages to starting from approximately 8 barg and reaching approximately 43 barg, and then passes through conditioning plant, which will include oxygen removal using a catalyst and dehydration using a desiccant to meet the specification for CO₂ export. Cooling is undertaken in stages during the compression process.

Emergency CO₂ relief vents will be installed within the LP compression plant to be used in the event of a downstream blocked outlet scenario or other emergency situations.

4.3.3.6 Capture Efficiency

The CCP is expected to be designed to be capable of capturing 95% of the CO₂ emissions (by mass) from the generating station as an annual average of all normal operating conditions (subject to completion of FEED) verification studies and commercial agreement). However, for demonstrating compliance with absorber capture rate efficiency, periods of other than normal operating conditions (OTNOC), such as loads below minimum start-up load (MSUL) will not be included in the calculation

The capture rate of the absorber will be optimised by:

- maximising the contact time between solvent and gas through use of a packed column specific to the solvent;
- maintenance of solvent condition through reclaiming, with backup bleed/feed;
- optimised operational parameters (temperature/ solvent concentration/pressure/ solvent flows) to be determined during the commissioning, start-up and early operational phase.

CO₂ emissions during start-ups can have lower than 95% capture rates because the CCP process can take time to reach operational temperatures, pressures, and flows depending on whether the plant was in a hot, warm, or cold state prior to start-up. Additionally, during the initial stages of the CCGT start-up sequence, the flue gas will be diverted to atmosphere via a HRSG stack (damper closed to CCP). This is because of high concentration of contaminants like NO_x present in the flue gas that can potentially accelerate amine solvent degradation.

Upon introducing flue gas to the CCP, CO₂ absorption will begin via the lean solvent stored within the CCP system. As the stored lean solvent continues to absorb CO₂, without the desorber being at operational temperature, the CO₂ absorption capacity will decrease. Once the desorber is at operational conditions, capture rate will return to design performance.

To reduce the duration where capture rate performance isn't at design performance, the CCP will have a Hot Stand-by mode, which is expected to be in use for warm and hot start-ups. These types of start-ups are expected to be the most common, and thereby Hot Stand-by mode will increase the annualised average CO₂ capture rate.

This will help to ensure the plant meets Dispatchable Power Agreement (DPA) requirements.

4.3.3.7 CO₂ Venting

Venting at the facility will be used only for safety reasons, or for non-routine operational conditions (e.g., start-ups, shutdowns), for commissioning activities, and certain DPA tests. No continuous routine venting shall take place, and venting shall be reduced using good engineering design practice and in accordance with BAT. The vent arrangements will be specific to the Technology Licensor selected and the CO₂ capture solvent used, however, detailed design will consider the following:

- use of high integrity relief valves;
- sectioning of vent and isolation pipework;
- steam and inert gas vent streams being discharged to atmosphere in a safe location; and
- vent gases rerouting back through process equipment.

The proposed installation will not be equipped with flaring facilities.

4.3.4 Auxiliary Boiler

An electric auxiliary boiler would provide heat/ steam during commissioning, start-up, shutdown, and maintaining carbon capture equipment in a 'hot' or 'warm' stand-by state when the CCGT is off-line. Steam from the auxiliary boiler can also be used by processes like reclamation when steam is not available from HRSG

During steady operation, steam will be available from the HRSG. Steam supply from the HRSG will stop after shutdown. At start-up, steam supply to the CCP is expected to be available soon after power plant start-up for hot starts and otherwise at a later time, depending on the start-up mode (cold / warm / hot).

4.3.5 Cooling System

A cooling system will be required to condense the steam in the HRSG main condenser, to maximise its working potential through the low-pressure turbine, to cool condensate and to cool auxiliary CCGT functions (oils, bearings), with a total cooling load of circa 175-250 MWth per train. The CCP has a larger cooling requirement (circa 340-390 MWth per train) used in:

- the Direct Contact Cooler (DCC) circulation cooler;
- the overhead condenser to the desorber for condensation of solvent vapour;
- flue gas water-wash stage(s) cooling;
- lean solvent cooling prior to storage;
- steam condensate cooling; and
- low-pressure CO₂ compression prior to the removal of oxygen and water.

The cooling demand for the site will therefore be circa 1,030-1,280 MWth. The cooling method would be recirculating hybrid cooling of both the CCGT and CCP. The assessment of BAT for this method is presented in Permit Application, Volume III, Appendix C4.

4.3.6 Emissions Abatement Measures

SCR will be employed to minimise NO_x from the combustion process entering the CCP. NO_x in the HRSG exhaust gas would otherwise reduce the efficiency of the solvent through preferential reaction with amine and through degradation of the solvent. NH₃ slip from the SCR process is expected to predominantly be stripped from the exhaust gas via dissolution in the DCC water, however a small proportion may be carried through into the CCP (this has no effect on solvent quality).

The DCC water will have a continuous bleed, to also remove accumulated water from the exhaust gas, which will be directed to wastewater treatment.

The CCP design will employ a solvent retention system, to minimise droplet and vapour carryover, that minimises the solvent emissions to atmosphere. The system is expected to include one or two water-wash sections above the absorber to condense amine solvent in the CO₂-lean flue gas, through direct water contact. The wash-water is recycled into the solvent circulation system to minimise solvent and water consumption.

In addition to a small amount of NH₃ slip (described above), and dependent on the proprietary amine used as the carbon capture solvent, NH₃ may also be generated through oxidative degradation of the solvent within the CCP; and oxidative degradation within the CCP may be the dominant NH₃ source within the final flue gas. Any NH₃ dissolved within the water-wash stage(s) would reach equilibrium within the solvent circulation system and would not be abated.

As such, further abatement of the NH₃ emission from the flue gas may be necessary. An acid-wash stage is included in the current design, which would have a continuous recirculation of concentrated sulphuric acid to abate NH₃, and simultaneously act as a final amine removal (polishing) step. Trace nitrosamine and other volatile solvent degradation products entrained in the flue gas are also expected to be soluble within the acid wash and further abated. The acid wash effluent would be disposed of off-site in a hazardous waste treatment facility.

4.3.7 Process Control System

The operation of the Proposed Installation will be highly automated, with a site wide Distributed Control System (DCS) providing monitoring and control.

The design philosophy of the DCS will be to provide the maximum possible level of automation for all systems installed on the Proposed Installation and the plant will generally operate automatically under operator supervision during normal operation.

Semi-automatic sequences and manually requested actions will also be available via the DCS when required, for instance operator intervention may be required to maintain minimum utility flows by the opening of equipment by-passes or shutting down unnecessary equipment (e.g. cooler fans, circulation pumps, amine pumps).

Generally, plant operations will be carried out from the control room. The DCS will allow items, systems and the entire plant to be started, operated and stopped in a safe manner.

The DCS will display and record the plant operating parameters required for best practice process control and minimisation of environmental impacts. For example, the cooling tower purge system will provide information to the operators covering flow, temperature, pH, residual chlorine etc. This information will be available online to the operator via the plant operating screens as instantaneous values, with historical data available via trend screens. The DCS will also include typical Continuous Emissions Monitoring System (CEMS) information. CEMS will comprise monitoring of parameters applicable to the Proposed Installation and include received gas quality, exhaust gas concentrations of oxygen, CO and CO₂ (in the exhaust gas from the HRSG and that being sent to the compression unit), NO_x, NH₃, air flow, moisture content, and plant efficiency. This information will also be available for offline analysis by operators and site engineering. Full details of process and emissions monitoring data and controls will be determined at FEED.

The plant operational data will allow the plant processes and maintenance procedures to be reviewed and optimised. The data available via the DCS will also allow reporting of plant performance and environmental compliance.

Furthermore, the DCS will provide the operators with a series of alarms should an operating parameter approach, or exceed, its control set point value. These alarms will be displayed on the appropriate plant operating screen as well as a dedicated alarm screen for operator review and relevant action. For example, discharge of cooling tower purge would be prevented if any of the monitored parameters exceeded permitted levels

In addition to the DCS, a separate safeguarding system is expected to be employed which will use interlocks and trips to prevent an undesirable situation from occurring or continuing.

4.3.8 Ancillary Equipment and Structures

In addition to the CCGT, CCP and associated stacks described above and the electrical, gas (including CO₂ connection) and cooling process / process water described below, the following infrastructure is likely to be required as part of the proposed installation:

- plant and instrument air utilities;
- Nitrogen utilities;
- Hydrogen utilities for O₂ removal and generator cooling
- administration building(s) – these would contain the main reception, offices, staff welfare facilities;
- electrical control room(s) – these would contain the control room and electrical equipment;
- stores and workshops – these would be required for operation and maintenance activities and storage of materials;
- above-ground chemical storage tanks – these would be required for the storage of chemicals required for operation of the proposed installation;
- fire pumps;
- cooling water pumps;
- above-ground raw and fire water tank;
- above-ground demineralised water tank;
- wastewater treatment plant and building;
- permanent laydown areas;
- internal access roads;
- gatehouse(s); and
- parking areas (including electric vehicle chargers).

It is expected that the above infrastructure would be (at least in part) shared between the two trains.

4.3.8.1 Clean Water Treatment Plant and Demineralised Water Storage

Water will be required for multiple purposes on the CCGT and CCP of differing degrees of water quality. Potable water will be required for multiple purposes including domestic and sanitary uses, firewater uses, and feed for a demineralisation plant.

The plant will need a demineralisation plant to remove dissolved solids and other impurities present. This demineralised water is then of sufficient quality for use in process water systems, boiler feed water, and closed loop cooling systems. An additional demineralisation plant will be required to achieve the make-up water quality for the high pressure (HP) steam/water cycle.

There would be storage of demineralised water at the Proposed Installation for demineralised water produced in the demineralisation plant.

4.3.8.2 Chemical Storage

A number of chemicals will be transported to, stored and used in the Proposed Installation. These include:

- solvent that would remove the CO₂ from the gas stream in the CCP. The process includes equipment for reclaiming used solvent within the process, but make-up would be required;
- power plant treatment chemicals (including NH₃ for SCR);
- capture plant treatment chemicals (which may include sodium hydroxide, sulphuric acid and hydrogen for (generator cooling and deoxygenation of the product CO₂ stream)); and
- cooling tower chemicals (biocides, anti-scalants, bio-dispersants, corrosion inhibitors, sulphuric acid and sodium hypochlorite as pH controls).

Other chemicals required for routine cleaning, maintenance and emergency firefighting uses would also be required.

The extent of the Proposed Installation would include chemical storage facilities and road tanker unloading area(s). Where any substance could pose a risk to the environment through an uncontrolled release (e.g. surface water drains), the substance would be stored within appropriate containment facilities including impermeable concrete surfaces, isolated drainage areas and appropriately designed and sized bunds.

Further details regarding raw materials intended to be used at the Proposed Installation are provided in Section 4.4.1.

4.3.8.3 Wastewater Treatment

Wastewater treatment will be required for treatment of blowdown from the DCC prior to discharge to the environment if it cannot be re-used. Additionally, wastewater treatment will be needed to treat potentially chemical contaminated surface water drainage (excluding amine), blowdown from the Process Closed Drains systems and boiler blowdown. Discharges from the wastewater treatment to the River Dee via the purge pond would only be permitted if the discharge was compliant with the existing discharge limits.

4.3.8.4 Emergency Diesel Generators

Diesel generators will be used to ensure power is available in the event of a fuel supply interruption and/or a simultaneous loss of power generation and external power failure to the Proposed Installation. This would enable the safe shut-down of the plant in such a scenario until external power can be re-established. Generators may also be used to support maintenance activities.

The final generator design and number will be dependent on the selected Technology Licensor's requirements. At the current stage of design, it is anticipated that the Proposed Installation will need at least five generators and that thermal input capacity will be at least 6.25 MWth each. Diesel for the generators will be stored in bunded tanks in an area of hardstanding. HVO is currently under consideration for use in the generators as an alternative to diesel.

4.3.8.5 Fire Fighting Equipment and Firefighting Water Storage Tanks

The Proposed Installation will be developed in compliance with the statutory fire protection legislation, to provide the necessary fire safety design.

Firefighting equipment will be housed in a dedicated area. In the event of a fire, the connection to the surface water drainage system will be closed via isolation valves, and surface run-off (firewater and rainwater) will be contained within the site to prevent contaminated water being released through the surface water drains.

Firefighting water will be available for fire suppression. The capacity of the storage tank will be determined at FEED.

4.3.8.6 Hydrogen Utilities for Oxygen Removal

Hydrogen (H₂) is needed to facilitate the removal of oxygen and for generator cooling. Technology Licensor No 1 is proposing to generate H₂ via a small electrolysis unit with < 2tpd generation capacity and to import H₂ in bottles for generator cooling. Technology Licensor No 2 is proposing to import the H₂ to site via compressed bottles or tube trailers.

4.3.9 Drainage

4.3.9.1 Surface Water Drainage System

The Proposed Installation is characterised by flat, low-lying coastal topography. A topographical survey indicated that runoff from the undeveloped (field) areas flows towards low points in central and southern areas of the fields, and towards vegetation along field boundaries. Where runoff is directed towards low spots, it is assumed to infiltrate to ground.

There are two ordinary watercourses which are culverted across the Proposed Installation Area:

- Old Rockcliffe Brook is culverted across the existing CQPS, up to the existing headwall structure located at the south-east end of the Proposed Installation Area. From here it returns to an open channel, prior to discharging across the Connah's Quay Nature Reserve and into the Dee Estuary. The pipe size at the culvert outlet (i.e. at the headwall) is nominally 900mm diameter.
- Oakenholt Brook is culverted across the fields on the north-western end of the Proposed Installation Area and underneath the existing access road. It returns to an open channel on the north-east side of the access road (via a headwall beyond the site), prior to discharging across the Connah's Quay Nature Reserve and into the Dee Estuary.

On the existing CQPS site, surface water runoff is captured and conveyed by a gravity surface water system (W2), which discharges unrestricted to Old Rockcliffe Brook. The pipe at the existing outfall headwall is nominally 1200 mm diameter, and an open concrete channel protects the CQPS during tide lock scenarios when the outfall is submerged, creating a backwater effect. W2 will continue to operate for the existing CQPS following the transfer of the gas treatment plant and storage areas, but drainage from these areas will no longer flow to W2. Any drainage that becomes redundant will be made defunct, remediated, or capped, with the approach determined at detailed design stage.

A second gravity surface water system (W3) currently serves the gas treatment plant, storage areas, and other infrastructure at the western end of the site, also discharging unrestricted to Old Rockcliffe Brook. W3 will remain in operation for the CQPS only until these areas are transferred to the Proposed Installation. At that point, W3 will cease to serve the CQPS and all drainage from the transferred areas will be rerouted to a new system (W4) constructed for the Proposed Installation. W4 will replace both W2 and W3 for the Proposed Installation, with the arrangements confirmed in writing to NRW prior to any permit boundary changes. Any drainage infrastructure no longer required will be made defunct, remediated, or capped, with the approach determined at detailed design stage.

An Outline Surface Water Drainage Strategy (EN010166/APP/6.4) has been prepared for the Proposed Installation which incorporates the use of Sustainable Drainage Systems (SuDS) features (e.g. localised filter drains, swales, tree pits and/or pervious pavements) which would provide the initial interception and treatment of runoff.

These SuDS features would provide a degree of water quality treatment. The proposed SuDS include permeable or porous paving within the parking areas, designed to allow for the runoff from the parking and nearby adjacent areas to be intercepted and treated. Proposed filter drains or grassed swales would provide initial treatment of road and/or building drainage. Attenuation tank(s) are also included within the drainage network. Oil interceptors and/or vortex separators would be provided within each drainage catchment to encourage the removal of oils, suspended solids and sediment bound hydrocarbons. The attenuation tank(s) temporarily store Clean surface water discharges, with more

extreme events being permitted to overtop and floodwater routed away from infrastructure. There would be a penstock immediately upstream of the new outfall.

The provisional attenuation strategy is to use grassed swale features and an attenuation tank (or tanks). These would contain the majority of surface water volumes from design storms during tidal lock conditions, with more extreme events being permitted to overtop and floodwater routed away from infrastructure. A new single discharge to Old Rockcliffe Brook is currently planned for the Proposed Installation and this would be situated alongside the existing surface water outfall (referred to as W2) and the Old Rockcliffe Brook culvert outfall. The new outfall will be known as W4.

To assess the performance of the proposed surface water network, provisional hydraulic modelling has been undertaken using FSR rainfall data, including for appropriate climate change allowances and tide lock analysis. A range of climate change allowances have been applied to the hydraulic calculations (20%, 30% and 40%) in accordance with the Welsh climate change allowances guidance "Flood Consequence Assessments", dated September 2011. At detailed design stage hydraulic modelling would be undertaken using the latest Flood Estimation Handbook (FEH) rainfall data, and climate change guidance and project programmes would be reviewed to ensure appropriate climate change allowances are applied and appropriate sensitivity testing is undertaken. Observed tidal data would be reviewed and assessed to understand actual tide levels and durations, and consultations would be undertaken with NRW to confirm which return periods would be subject to the tide lock analysis.

4.3.9.2 Cooling Water and Process Water Discharge

The existing discharge infrastructure consists of two purge ponds (purge pond A and purge pond B), two process water tanks (that are also referred to as SDX tank A and B) as well as two sludge holding tanks (tank 1 and 2). The purge ponds will mainly receive cooling tower blowdown and some process waters. The SDX tanks will receive only process waters. The sludge holding tanks will receive sludge from different areas of the plant, but mainly from the settlement pond. These six tanks are interconnected via the "Common Discharge Chamber". Discharge from those six tanks to the "Common Discharge Chamber" can be controlled via automatic penstock valves.

CQPS is currently permitted to discharge to the Dee estuary during a three-hour period on every tide (a tidal cycle is approximately 12.5 hours), from 1 hour after the predicted time of high water (HW) to 4 hours after the predicted time of HW. The outflow from the "Common Discharge Chamber" to the Dee estuary (River Dee) takes place via the "Controlled Discharge Chamber", is limited to 2.5 m³/s and can be controlled via two flow control valves.

Purge discharge to the River Dee occurs at discharge point W1 and would be regulated under the existing CQPS Environmental Permit (EPR/NP3037AF). No changes are proposed to the existing permit conditions and discharge would be no more than three hours commencing on the ebb tide one hour after high water with temperature and water quality, and would comply with the existing Environmental Permit limits (see Table 3 below).

Table 3 Existing Environmental Permit Limits- Cooling Discharge (EPR/NP3037AF)

Parameter	Limit	Reference Period	Monitoring Frequency
Flow	2.5 m ³ /s	Instantaneous	Continuous
Maximum temperature	25°C		
Maximum temperature difference (April-October)	13°C		
Maximum temperature difference (November-March)	20°C		
Salinity	60 g/l		
pH maximum	9		
pH minimum	6		
Total Residual Oxidant	0.2 mg/l	Instantaneous	
Oil and grease	20 mg/l		

To prevent the discharge of non-compliant water, the water to be discharged is being continuously monitored for temperature, pH, conductivity/salinity, oil and total residual oxidant during the discharge period. In case of exceeding the limits (see Table 1), automatic penstock valves prevent further discharge from the "Common Discharge Chamber" to the estuary (via the "Controlled Discharge Chamber"). Additional analysers are placed upstream of the purge pond and SDX tank and throughout the different process steps. This multi-barrier system reduces the risk of discharge of non-compliant water due to failure of a single sensor to a minimum. Regular maintenance of the online analysers further increases the reliability.

Purge discharge from the Proposed Installation would also be consistent with the existing CQPS operation and the Proposed Installation will be designed to operate so discharge of cooling purge water remains within the conditions and limits of the existing CQPS Environmental Permit.

Purge discharge will be facilitated by the installation of a new purge discharge pipeline and associated pumps (above or below ground) which would pump purge water from the Proposed Installation to the existing purge storage pond A.

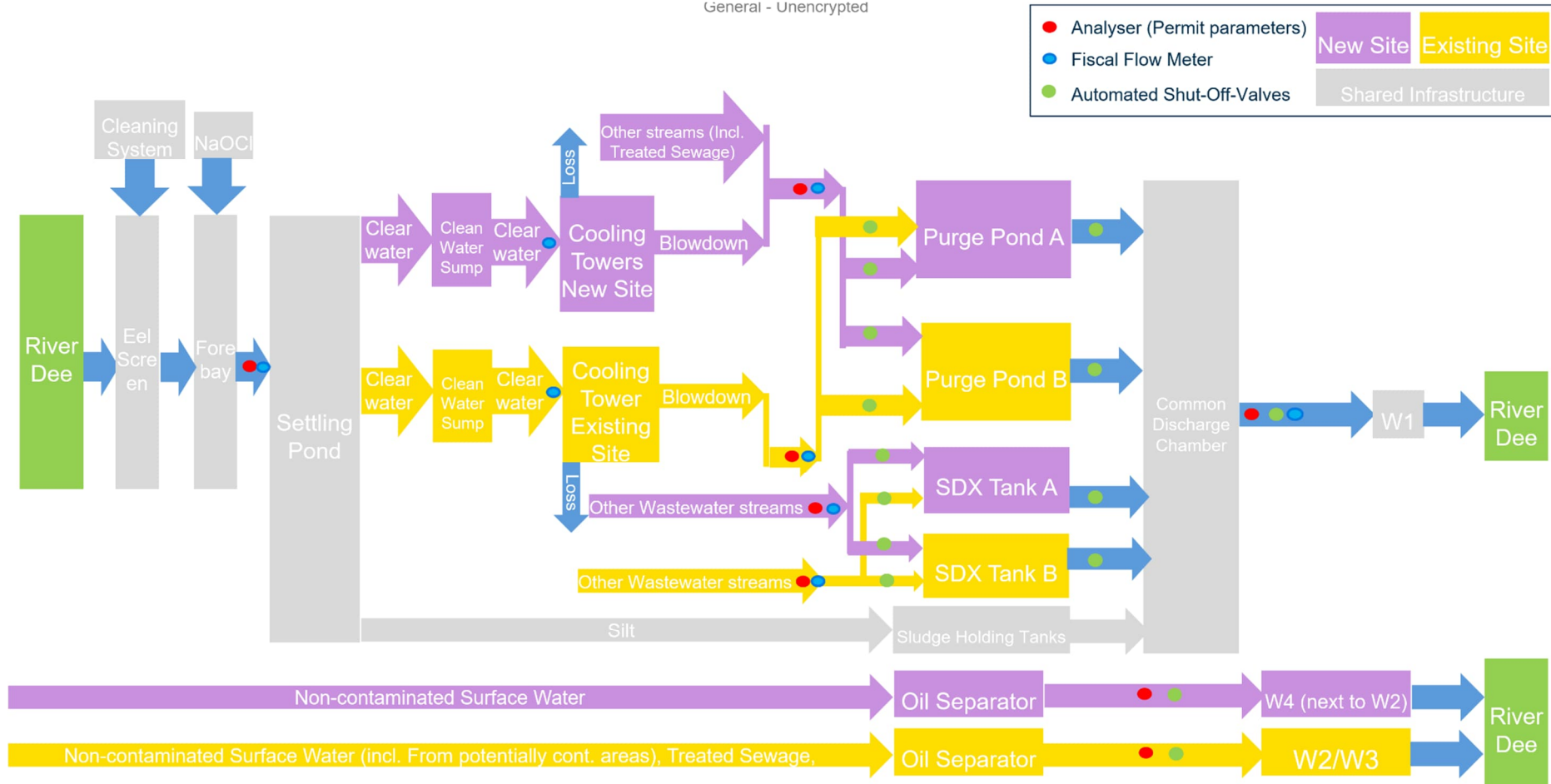
Technically it shall be possible to route either cooling water blowdown and process waters (from CQPS and the Proposed Installation) to either purge pond. Additionally, it shall be possible to route further process water streams to either SDX tank. However, normal operation foresees to assign one purge pond and one SDX tank to one site only. For instance, purge pond A and SDX tank A to be assigned to the Proposed Installation and purge pond B and SDX tank B to the existing CQPS.

During normal operation there will be a transfer from the Proposed Installation to the existing CQPS via the "Common Discharge Chamber". Any discharge from the Proposed Installation to CQPS needs to be permit compliant. Permit compliance can be guaranteed with the help of online analysers in the inlet to the purge pond or SDX tank.

The cooling water from the Proposed Installation will be monitored on the purge pipeline from the new cooling towers to ensure that it meets the following quality parameters before release to the purge storage pond. These points are marked by red dots on Plate 3 on the following page.

Plate 3. Flow of Cooling Water Showing New, Existing and Shared Infrastructure

General - Unencrypted



4.3.9.3 Contaminated Wastewater Drainage System

A number of potential sources of wastewater would arise from the Proposed Installation including (but not limited to):

- neutralised effluent streams from the demineralisation plant;
- blowdown from the CCP and CCGT;
- treated effluent from the CCP; and
- contaminated surface water arising from process areas, that may contain chemicals such as oils or flue gas treatment products.

These would be collected for either off-site treatment and disposal at a suitable licenced waste facility or alternatively treated on site to meet environmental quality standards (EQS) (e.g. for NH₃ and other substances) in an on-site wastewater treatment plant before being discharged to the River Dee via the purge pond.

Amine contaminated water will be contained for possible recycle within the process or taken offsite by a tanker to a specialized treatment plant. Minor leaks and spills, which could be contaminated, would be located within minimised local kerbed areas, and be routed to the amine drain for offsite disposal.

The specific drainage proposals for process related discharges will vary dependant on the selected Technology Licensor, however the current proposed drainage philosophy from each FEED contractor is presented in Figures 9 and 10 in Appendix A.

4.3.9.4 Domestic and Sanitary Effluent

Black and grey wastewater (i.e. non-cooling and non-process wastewater) from the existing CQPS is currently directed to an underground septic tank system for storage and settling (as treatment). Current permitted practice is to treat sewage on site and discharge treated sewage waters with main cooling water purge discharge to the River Dee at W1. It is expected that the Proposed Installation will use a new similar system for black and grey wastewater including foul drainage from permanent welfare facilities, with treated black and grey wastewater either to be discharged to the River Dee with main cooling water purge discharge (in accordance with the existing permit) or to be removed by a specialist contractor. Connection to the closest public sewer is not considered feasible due to the presence of the railway line that would need to be crossed.

In the event of a plant malfunction or where a new contaminant stream is generated that is not authorised under the existing CQPS Environmental Permit, the material shall be removed by vacuum tanker and disposed of at an approved off-site facility.

4.3.9.5 Temporary Domestic and Sanitary Wastewater Management During Construction

During the construction phase, a temporary wastewater management arrangement will be required due to increased personnel numbers on site. Black and grey wastewater arisings are currently estimated to be approximately 45,000 litres per day, equivalent to around 300 population equivalent, based on a standard per-capita wastewater generation rate of 150 litres per person per day. At this volume, removal solely by tanker would not be practicable.

A temporary on-site wastewater treatment system, comprising a Moving Bed Biofilm Reactor (MBBR), will therefore be installed to treat black and grey wastewater prior to discharge. This will ensure that untreated sewage is not discharged. Treated effluent will be discharged via the existing permitted outfall with the main cooling water purge to the River Dee, in accordance with permit conditions.

Treated effluent quality will be managed to be comparable to that of nearby municipal wastewater treatment works, specifically the Flint and Queensferry treatment works. Target parameters are: biochemical oxygen demand (BOD₅) of less than 25 mg/L O₂ (or greater than 70% reduction), chemical oxygen demand (COD) of less than 125 mg/L O₂ (or greater than 75% reduction), and total suspended solids (TSS) of less than 60 mg/L.

The discharge volume will vary in line with construction workforce numbers. The temporary treatment and discharge arrangement will be in place from establishment of the temporary site facilities through

to completion of commissioning and performance testing, after which it will be removed and permanent wastewater arrangements reinstated.

4.3.9.6 Management of Firewater

A new fire suppression system would be designed with appropriate firewater tank, firewater pumps, and firewater access points would be provided.

The firewater strategy for the Proposed Installation has not yet been developed and the areas of potential surface water contamination (e.g. impermeable areas surrounding a chemical storage tank) have not been finalised. Some of these areas may not be discharged to the new surface water network, and may instead be directed to a new on-site water treatment facility or the existing purge pond, subject to sampling and analysis to confirm there is no significant pollution present .

If firewater runoff and/or runoff from potentially contaminated areas is to be directed to the new surface water network, isolation techniques (which may include bunding and penstocks) would be required to contain potentially contaminated runoff and prevent it from entering the surface water network prior to testing. Uncontaminated runoff would be released by opening the penstocks (to allow runoff to enter the drainage network), and contaminated runoff would be removed for treatment elsewhere. The surface water drainage strategy for firewater and potential contamination areas would be developed in consultation with NRW and FCC post-DCO consent and would be detailed in the Surface Water Drainage Strategy to be prepared pursuant to a pre-operational condition of the environmental and to requirement 6 of the Draft DCO (EN010166/APP/3.1).

4.4 Resource Management

4.4.1 Potable Water Supply

Welsh Water supplies the existing CQPS with 80-100 m³/h of potable water. A smart meter at the transfer point between Welsh Water and the existing CQPS is monitoring water consumption. The Proposed Installation will tie-in to the supply line of the existing CQPS, downstream of the Welsh Water smart meter, including installation of its own fiscal meter to monitor its potable water consumption.

4.4.2 Cooling Water Supply

The arrangements for cooling water supply for the Proposed Installation will not differ from the arrangements for the existing CQPS plant.

Cooling water is being abstracted from the Dee Estuary. This abstraction is limited to periods around high tides. Abstraction shall only take place during a period between one hour prior to and two hours after each high tide but only when the water level recorder at Victoria Doc, Liverpool is high enough during the specific period (NRW's Summer's Jetty water level recorder, specified as reference point in the permit, no longer exists). The maximum instantaneous abstraction limit is 3,04 m³/s.

Water is abstracted via an eel screen equipped intake structure in the river bed. Eel screens will be replaced from 3 mm to 2 mm screen size (complying with The Eels Regulations 2009 England and Wales). Water flows via gravity through underground pipes to the cooling water forebay located further inland. From the cooling water forebay the water is being pumped to the settlement pond.

At the inlet of the settlement pond the flow, temperature and other potentially required parameters are being measured. Within the settlement pond, silt is retained. A silt removal system cleans the pond from accumulated silt and discharges it through a silt handling system to the sludge holding tanks. The sludge holding tanks retain the silty sludge during periods of no discharge back to the estuary. The clean water from the settlement pond (silt removed) will be diverted to the different cooling towers of CQPS as well as the Proposed Installation . Each off taker will be equipped with flow meters. This allows the Operator to identify the consumption of cooling water from each site.

Current abstraction limits included in the Abstraction License (24/67/10/0124/V004) are shown in Table 4. The general design philosophy equipment would adjust cooling water flow to maintain ~15°C temperature rise across exchangers.

Table 4 Existing Abstraction License (24/67/10/0124/V004) Abstraction Limits

Specified Period	Maximum Quantity of Water to be abstracted during the specified period
Per Hour	11,000 m ³
Per High Tide	33,000 m ³
Per Year	24,090,000 m ³
Instantaneous Rate not to be exceeded	3,040 litres per second

4.4.3 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. The main raw material for the CCGT will be natural gas used as a fuel. The gas handling unit within the gas receiving area will condition the natural gas to ensure that the feed is of suitable quality. Gas will not be stored on site prior to use as a fuel.

The Capture plant will use an amine-based solvent for capture of CO₂, which will be stored, conditioned, regenerated and re-conditioned for subsequent re-use, in accordance with licensor recommendations. The amine-based solvent is likely to be hazardous. Materials of construction will be appropriate to avoid degradation of the solvent during storage and use.

Amine storage and dilution tanks, pipework materials and operating conditions will be confirmed at FEED stage, however it is anticipated that this is likely to include stainless steel tanks, and atmospheric fixed roof with nitrogen blanketing.

It is typical practice to include a breather vent in the storage tank to allow for vapour maintenance/ displacement during tank filling, fire exposure relieving rate from the tank and/ or nitrogen purging when unloading road tankers or cleaning lines. Due to the potential toxicity and odorous nature of emissions associated with the venting of amine, it is considered that abatement may be required on the breather vent for the storage tank. These requirements, with full consideration of BAT, will be considered at FEED stage.

Bulk storage of chemicals in above ground bulk storage tanks will include NH₃ for use in the SCR plant, the amine solvent for the Capture plant, and various cooling water conditioning/ treatment chemicals, chemicals for use in the water treatment plant (sulphuric acid and sodium hydroxide), and other chemicals for use in the CCP and CO₂ compression unit. All bulk storage tanks will be designed to appropriate standards and be provided with containment (at least 110% of tank volume).

Other raw materials will be stored in appropriate containers, within suitable spill protection including; bunds, on banded pallets, on drip trays, in specifically designed cabinets and cupboards or other appropriate storage units and areas. Any hazardous materials will be in supplied, stored and used in containers of 1m³ or less. The full inventory of materials to be stored at the installation will be developed through the design process. All polluting chemicals will have full acceptable, legally compliant environmental storage which are the minimum standards accepted by Uniper.

Emergency generators will be required, that will also require on-site diesel or HVO storage for fuel. Any fuel fire water pump will also need storage facilities.

A list of raw materials is provided in Table 5 below and copies of material safety data sheets (MSDS) are provided in Permit Application, Volume III, Appendix D

Note as amine solvent is dependent on the selected Technology Licensor, details have been provided for both of the proposed solvents, the Operator will confirm the final solvent to be used prior to the plant becoming operational.

Table 5 Raw Materials for the Proposed Installation

Material	Hazardous Materials Classification	Purpose	Estimated Storage Quantity (Tonnes)	Storage Type	Estimated Annual Consumption (Tonnes)
Proprietary Amine Solvent (Cansolv DC103) 99% wt. (as delivered)	Health hazard. Corrosive. Toxic.	CO ₂ capture (lean solvent tank)	1,711 tonnes for Initial Fill. (per train)	Bunded tank	644 tonnes per train
SLB Capturi "S10" Proprietary Solvent	Health hazard. Corrosive. Toxic.	CO ₂ capture (lean solvent tank)	1,920 tonnes for Initial Fill.(per train)	Bunded tank	767 tonnes per train
Caustic soda <ul style="list-style-type: none"> 46% wt for Technology Licensor 1 20% wt for Technology Licensor 2 	Hazardous. Corrosive. Toxic.	pH control (various)	<ul style="list-style-type: none"> 61 tonnes Tank for Technology Licensor 1 (serving both trains) 68T for Technology Licensor 2 serving both trains) 	Bunded tank	<ul style="list-style-type: none"> Technology Licensor 1 364 tonnes per train Technology Licensor 2 2,425 tonnes per train
Hydrogen 99.5% wt.	Hazardous. Highly flammable.	Oxygen removal + Generator cooling	<ul style="list-style-type: none"> Technology Licensor 1 will generate onsite for oxygen removal and use pressurised bottles for generator cooling, the latter equating to 0.1 tonnes per train Technology Licensor 2 will use pressurised bottles for both purposes equating to 0.25 tonnes per train 	Pressurised bottles	<ul style="list-style-type: none"> 3 tonnes for Technology Licensor 1 per train (not counting consumption from generated hydrogen) 12 tonnes For Technology Licensor 2 per train
Aqueous Ammonia <ul style="list-style-type: none"> 19% wt for Technology Licensor 1 24.5% wt for Technology Licensor 2 	Corrosive, Harmful, Environmental Hazard	SCR	<ul style="list-style-type: none"> 98 tonnes tank for Technology Licensor 1 serving both trains 99 tonnes tank for Technology Licensor 2 serving both trains 	Bunded tank	<ul style="list-style-type: none"> 3600 tonnes for Technology Licensor 1 per train 7,184 tonnes for Technology Licensor 2 per train

Material	Hazardous Materials Classification	Purpose	Estimated Storage Quantity (Tonnes)	Storage Type	Estimated Annual Consumption (Tonnes)
Diesel or HVO	Health Hazard, Harmful	Emergency Diesel Generator	205 tonnes serving both trains	Bunded tank	2.85 tonnes/hour based on a 72 hour grid resilience run case
<ul style="list-style-type: none"> Sulphuric acid 96% wt for Technology Licensor 1 98% wt for Technology Licensor 2. 	Corrosive, Irritant, Toxic	pH control (various)	<ul style="list-style-type: none"> 100 tonnes tank for Technology Licensor 1 serving both trains 100 tonnes tank for Technology Licensor serving both trains 2 	Bunded tank	<ul style="list-style-type: none"> 1700 tonnes for Technology Licensor 1 per train 4,000 tonnes for Technology Licensor 2 per train
Sodium Hypochlorite 14.% wt.	Corrosive, Environmental Hazard	Biocide.	116 tonnes serving both trains	Bunded tank	142 tonnes per train
Water Treatment Chemicals	Corrosive, Harmful	Raw water treatment plant dosing; demineralized water plant ion exchange regeneration; cooling water circulation; corrosion and scale inhibitors; and steam system dosing.	TBC		TBC
Antifoam	Irritant		TBC	TBC	TBC
Activated Carbon	-	Emissions control	TBC	TBC	TBC
Sodium Carbonate	Irritant	Water treatment	TBC	TBC	TBC
Argon	Explosive	Generator Purging	TBC	TBC	TBC
Carbon Dioxide	Aspiration Hazard	Generator Purging	TBC	TBC	TBC
Gas Turbine Detergent	Irritant	Gas turbine cleaning	TBC	TBC	TBC
Support Balls for catalyst/dessicant beds	-		TBC	TBC	TBC
Oxygen Removal Catalyst	Corrosive, Harmful, Environmental Hazard		TBC	TBC	TBC

Material	Hazardous Materials Classification	Purpose	Estimated Storage Quantity (Tonnes)	Storage Type	Estimated Annual Consumption (Tonnes)
		Oxygen Removal of CO ₂ product stream			
Dryer Dessicant	-	Dryers	TBC	TBC	TBC
SCR catalyst	-	SCR System	TBC	TBC	TBC
Monoethylene Glycol	Health hazard Harmful	Antifreeze	TBC	TBC	TBC
Filter Media			TBC	TBC	TBC
Hydraulic Oils	Aspiration hazard Harmful Environmental hazard	High pressure applications	TBC	TBC	TBC
Transformer Oils	Aspiration hazard	Transformers	TBC	TBC	TBC
Seal Oils	Aspiration hazard Irritant Toxic Environmental hazard	Equipment seals	TBC	TBC	TBC
Lube Oils	-	Equipment lubrication	TBC	TBC	TBC
Control Oils	Toxic	Equipment lubrication	TBC	TBC	TBC
Antifreeze	Toxic	Equipment Protection	TBC	TBC	TBC

Secondary containment will be provided for all primary storage containers, including bulk tanks and IBCs, in line with the appropriate legislation and regulatory guidance. In general, all bunds and banded pallets shall be sized to accommodate a minimum of 110% of the maximum storage vessel volume located in the bund.

Secondary containment, in the form of kerbed areas connected to the appropriate drainage system, will be provided in areas where there is risk of spills occurring, such as unloading areas for road tankers delivering fuel or chemicals to the plant, so as to contain any spill events.

Furthermore, controls such as emergency isolation valves will be put in place to minimise the risk of discharges off-Site from any spillages entering the Proposed Installation's surface water drainage system.

The Proposed Installation will require a significant quantity of water, primarily as cooling tower make-up, and make-up to the steam-system.

4.4.4 Waste

Small quantities of operational waste will be generated from the operation and maintenance of the Proposed Installation, in addition to minor amounts of general waste from plant staff.

The GT will periodically be taken off-line and washed with a high concentration detergent solution. This activity is expected to be infrequent and will be undertaken as a planned maintenance activity. The effluent from this cleaning activity will be collected in a suitable container, such as an IBC, and disposed of off-site via a licensed waste contractor. Additionally, other wastes may be generated during plant maintenance outages.

Reclaimer waste will be neutralised prior to transport off-site for treatment by licenced contractor at an appropriate hazardous waste management site. The key operating parameters that affect the generation of reclaimer waste are:

- Solvent selection;
- Combustion conditions (higher flame temperatures can lead to increased NO_x formation which can degrade the solvent);
- Temperature control within absorber and desorber (minimises thermal solvent degradation); and
- The efficiency of the reclaiming process.

The maintenance of solvent quality is critical to the performance and efficiency of the CCP operation and therefore is higher in the BAT hierarchy than the minimisation of reclaimer waste generation. The efficiency of the reclaiming process to maximise the quantity of reclaimed solvent will be optimised during the design process, as far as practicable to achieve the primary aim of maintaining solvent quality and the secondary aim of waste minimisation.

Other waste streams generated within the process include but are not limited to:

- Oxygen removal catalyst – CO₂ conditioning;
- Solid desiccant dehydration – CO₂ conditioning;
- Water treatment plant wastewaters or other site wastewaters that can't be discharged to the River Dee;
- Acid wash waste; and
- Amine cartridge filters (technology dependent).

All waste generated on site will be managed in line with the waste hierarchy and disposed of by licensed waste contractors where necessary in accordance with regulatory requirements, Uniper waste management strategies and the governing fleet contracts that Uniper have in place.

Wastes likely to be generated are listed below in Table 6. The final anticipated volumes and compositions of waste will be confirmed during FEED.

Table 6 List of Anticipated Waste Streams and Associated Sources

Waste Description	List of Waste (LoW) Code	Source	Quantity	Potential Management
Spent SCR Catalyst	16 08 (Spent Catalyst)	HRSRG	TBC at FEED	Offsite Disposal (expected to be recycled).
Degraded Amine Absorbent	14 06 05* (sludges or solid wastes containing other solvents) MH OR 16 10 01* (aqueous liquid wastes containing hazardous substances) MH (1)	Thermal Reclaimer Unit	TBC at FEED	Offsite Disposal (exact destination TBC)
Heat Stable Salts	19 01 07* (solid wastes from gas treatment) AH (1)	Thermal Reclaimer Unit	TBC at FEED	Offsite Disposal (exact destination TBC)
Degraded Alumina Absorbent (Desiccant)	16 08 (Spent Catalyst)	CO ₂ dryers	TBC at FEED	Offsite Disposal (expected to be recycled).
Spent Catalyst	16 08 (Spent Catalyst)	O ₂ removal reactor	TBC at FEED	Offsite Disposal (expected to be recycled).
Support Balls	16 08 (Spent Catalyst)	O ₂ removal reactor/ CO ₂ dryers	TBC at FEED	Offsite Disposal (expected to be recycled).
Cleaning Balls	20 01 39 (plastics) AN	Power Plant Steam Condenser	TBC at FEED	Offsite Disposal (exact destination TBC)
Spent Activated Carbon	19 01 10* (spent activated carbon from flue-gas treatment) AH	Solvent Carbon Bed Filtration/ Process Effluent Storage Tank/ Ammonia Storage	TBC at FEED	Offsite Disposal (expected to be recycled).
Mechanical Filters and Contaminants	15 02 02* (Filter materials (including oil filters not otherwise specified) contaminated by hazardous substances) MH	CO ₂ dryers/ Regen Gas Discharge / Solvent Handling & Drains/ Power Plant CWS/ Power Plant GT	TBC at FEED	Offsite Disposal (expected to be recycled)
Filter Coalescer elements	15 02 02* (Filter materials (including oil filters not otherwise specified) contaminated by hazardous substances) MH	CO ₂ dryers/ Fuel Gas System	TBC at FEED	Offsite Disposal (expected to be recycled).
Degraded Resin (for ionic exchange)	19 08 06* (saturated or spent ion exchange resins) AH	Mixed Bed Polishing Unit	TBC at FEED	Offsite Disposal (exact destination TBC).

Waste Description	List of Waste (LoW) Code	Source	Quantity	Potential Management
Caustic Sludge	19 08 13* (Sludges containing hazardous substances from other treatment of industrial waste water) MH	Neutralisation Pit	TBC at FEED	Offsite Disposal (exact destination TBC).
Water treatment sludge	19 08 13* (Sludges containing hazardous substances from other treatment of industrial waste water) MH	Water Treatment Package	TBC at FEED	Offsite Disposal (exact destination TBC).
Sanitary Water Treatment inlet screen waste	20 03 06 waste from sewage cleaning AN	Water Treatment Package	TBC at FEED	Offsite Disposal (exact destination TBC).
Used oil (Lube oils)	13 02 08 (other engine, gear & lubricating oils) AH	Lube oil change out during maintenance	TBC at FEED	Offsite Disposal (expected to be recycled).
Oil sludge	13 05 02 (sludges from oil/water separators) AH	Oil-Water Separator Package	TBC at FEED	Offsite Disposal (expected to be recycled).
Oil contaminated cleaning rags	13 08 99 (wastes not otherwise specified) AH	From cleaning of spilled fuel/ during equipment lubrication	TBC at FEED	Offsite Disposal (expected to be Incinerated).
SUNDRY (Domestic/ office/ engineering workshops/ Packaging/ Laboratory)	20 01 01 (paper and cardboard) AN (1); 20 01 02 (glass) AN; 20 01 08 (biodegradable kitchen and canteen waste) AN; 20 01 39 (plastics) AN; 20 01 40 (metals) AN; and accumulators) AN; 20 01 36 (discarded electrical and electronic equipment) AN - WEEE. 20 01 21 (fluorescent tubes and other mercury-containing waste) AH 15 01 Spent Packing material AN 15 01 02 Plastic Drums AN 15 01 04 Metal Drums AN 15 01 10* Packaging containing residues of hazardous substances AH	Admin building/ Canteen/ workshop/ Packaging / Laboratory	TBC at FEED	Disposal in line with waste management regulations and in line with Waste Hierarchy

Waste Description	List of Waste (LoW) Code	Source	Quantity	Potential Management
	16 05 06* Laboratory chemicals MH			
Degraded solvent pump	-	Solvent handling	TBC at FEED	Offsite disposal- licenced waste contractor
Waste water	-	Gas turbine wash water drain pit	Offline water wash volume of 21,015 L is required twice a year. Online water wash volume is 1555 L.	Offsite disposal- licenced waste contractor

- Mirror hazardous; AH- Absolute hazardous; AN- absolute non-hazardous

4.4.5 Energy Use and Efficiency

4.4.5.1 Energy Use

The final plant design will be subject to detailed design by the FEED contractors, who have confirmed that the net output per train will be up to 690 MWe or up to 1,380 MWe for the site.

The total internal electricity auxiliary (parasitic) load of the Proposed Installation is estimated to be around 100-150 MWe per hour for two trains (excluding power loss due to capture plant steam demand). The broad split of power consumption on site is:

- Power Plant is circa 8.94 MWe.
- Capture Plant is circa 38.93 MWe.
- Compression Plant is circa 15-20 MWe.
- Cooling Plant is circa 20.57 MWe.
- Balance of Plant is circa 1.21 MWe.

In addition, to the above the site will utilise back-up generators to provide support to the Proposed Installation during periods of power outage.

4.4.5.2 Energy Efficiency

The anticipated electrical efficiency of the proposed CCGT plant will be >52% Lower Heating Value (LHV) after carbon capture (CO₂-Abated mode) and circa 61-64% for the CCGT operating without carbon capture (CO₂-unabated mode). These will be in line BAT-Associated Energy Efficiency Level (BAT-AEELs) for CCGTs having a thermal input > 600 MW_{th}.

The overall performance of the Proposed Installation for optimised energy efficiency is dependent on the integration, as far as practicable, of electrical, steam, steam condensate and water circuits. The CCP and low-pressure CO₂ compression plant have a parasitic load on the CCGT plant and therefore optimised integration of utilities for energy efficiency is paramount to maximising generational output.

The FEED process will consider the following to help achieve high energy efficiency:

- Optimum location for steam take-off for solvent regeneration;
- Optimised design of the HRSG to provide the steam input for the most efficient operation of the plant;
- Steam supply to CCP from the ST will be optimized during detailed design phase; and
- Optimised recovery or re-use of low-heat streams: the reuse of waste heat from compression is considered to be impractical, however, reuse of the waste heat from the condensate return stream is being integrated in the process.

The CCP will be a proprietary unit, and is therefore expected to be optimised by the Technology Licensor for the specific solvent characteristics.

Detailed thermal modelling, including reheating of the stack gases to include adequate dispersion, and optimisation of the system for energy performance will be refined once the GT technology and Capture plant licensor selection has been made but may include:

- Insulation of capture plant regeneration loop to reduce heat loss during shutdown; and
- Heat recovery from condensate return stream.

The plant will also be subject to regular planned maintenance in order to optimise the efficiency of the equipment on site.

More details are available in the Energy Efficiency BAT in Permit Application, Volume III, Appendix C3.

4.4.5.3 CHP Readiness

A CHP Assessment has been prepared to support the application and is presented in Permit Application, Volume III, Appendix K.

Two technically feasible heat extraction options were identified from the carbon capture process:

- Heat recovery from the carbon dioxide stripper overhead stream; and
- Heat recovery from the low-pressure (LP) condensate return from the carbon dioxide stripper reboiler.

The overall project has been considered as two phases development. Phase 1 corresponds to the initial stage of the project, during which the construction of a single train is anticipated. In Phase-2, the completion of the second train is foreseen.

The assessment considers the feasibility of installing CHP and concludes that based on supply, demand, and practical considerations, there may be potential for a viable district heat network supplying a suitable combination of the following demands:

- The Northern Gateway development
- One or more of the clusters of healthcare buildings (notably Chester and Ellesmere Port)
- One or more of the Paper Mills identified in the vicinity.

The majority of these demands are on the opposite side of the River Dee from the power station. This presents logistical and infrastructure challenges that would need to be carefully considered before progressing with CHP integration.

To move forward, a comprehensive feasibility study to evaluate the technical, economic and environmental implications of CHP integration would be required. For these reasons the Proposed Installation is not considered to be viable for CHP opportunities at the outset of commercial operation. The CHP potential will be periodically reviewed as part of Uniper's ongoing compliance with Environmental Permit conditions. Should future opportunities for viable CHP integration emerge, the CHP Assessment in Permit Application, Volume II Appendix K will be updated accordingly.

4.5 Site Layout

Figures and plans to support the permit application are provided in Volume IV. Figure 2 shows the installation boundary and areas covered by the permit application, Figure 3-1 and 3-2 shows the indicative site layout within the installation boundary for each Technology Provider, with Figure 4 (1 and 2) showing the potential air emissions points within this site layout.

5. Emissions

5.1 Overview

This section sets out a summary of the emissions from the proposed installation.

5.2 Emissions to Air

5.2.1 Emissions During Normal Operations

The point source air emissions during the operational phase are as follows:

- HRSG stack x2 (1x stack per train)
- Two single absorber stacks, one per train, designed in accordance with either the FEED 1 Licensor or FEED 2 Licensor specifications.

Details of the point source emissions to air are shown in Table 7 on the following page.

During normal operation, the CCP absorber stack would be the primary source of emissions from both the combustion and carbon capture processes associated with the Proposed Installation as the exhaust gas from the CCGT plant will pass directly into the CCP for CO₂ removal. This emission during abated mode will therefore comprise the combustion emissions of NO_x and CO from the CCGT plant, additional emissions of NH₃ slip from the SCR and amines and their degradation products from the CCP.

In addition, there would be a HRSG stack associated with Proposed Installations CCGT units (one per train), which would only be operational when the Proposed Installation is operating in an unabated mode (i.e. combustion emissions only, with no carbon capture taking place) These emissions will therefore comprise emissions of NO_x, and CO as no SCR will be used. The use of natural gas as fuel means that emissions of sulphur dioxide (SO₂) and particulates (PM) from the CCGT plant will be negligible. This mode of operation represents an abnormal mode of operation and will only occur for short periods of time, after unplanned shutdown of the carbon capture unit, estimated to be <5% of the year or during periods of CO₂ transport and storage (T&S) outages.

Emissions from each release point for the two Technology Licensor options are provided in Table 8 below and normal operating scenarios for each Licensor have been subject to a detailed dispersion assessment which is presented in Permit Application, Volume III, Appendix G.

Table 7 Stack Emission Parameters

Emission Source	Location (x, y)	Stack Height (m)	Stack Diameter (m)	Release Temp (°C)	Stack Airflow (actual) Am ³ /s	Stack H ₂ O Content (%)	Flue O ₂ content (dry) (%)	Reference O ₂ (%)	Stack flow at reference conditions (STP, dry, Ref O ₂)	Stack gas exit velocity (m/s)
HRSG Train (per stack) – FEED 1	327475, 371420 327439, 371367	120	8.0	87.3	839.4	8.6	13.2	15	755.9	16.7
HRSG Train (per stack) – FEED 2	327487, 371419 327426, 371333	130	8.0	89.0	1,056.7	9.3	12.6	15	1,018.1	21.0
Absorber Train (per stack) – FEED 1	327409, 371426 327372, 371372	145	7.0	60.0	735.0	7.7	13.8	15	669.1	19.1
Absorber Train (per stack) – FEED 2	327444, 371434 327383, 371348	145	7.0	56.7	979.2	9.8	12.8	15	999.3	25.4
Existing CCGT (per stack)	327949, 371137 327932, 371112 327914, 371087 327897, 371063	85	7.4	105.0	676.0	NA	NA	15	547.0	15.8

Table 8 Stack Emission Values

Technology Provider	Emission Point ID	Description	x	y	Pollutant	Annual Average		Short Term Emissions (where applicable)	
						Emission Concentration (mg/Nm ³)	Release Rate (g/s)	Emission Concentration (mg/Nm ³)	Release Rate (g/s)
FEED Technology Licensor 1	A3 Train 1 & A4 Train 2	Single Absorber Stack (per Train)	327409 327372	371426 371372	NOx	11.3	7.6	45.2 (daily) 113.0 (Hourly)	30.2 75.6
					CO	-	-	226 (hourly)	151.2
					NH3	1	0.67	-	-
					Amine 1	0.99	0.662	-	-
					Amine 2	0.01	0.007	-	--
					Nitrosamine 2	0.00495	0.0033	-	-
					Nitramine 1	0.0000495	0.000033	-	-
					Nitramine 2	0.0000005	0.00000034	-	-
					Formaldehyde	4.0	2.0	-	-
					Ketones	8.0	5.35	-	-
					Acetaldehyde	6.0	4.01	-	-
FEED Technology Licensor 2	A3 Train 1 & A4 Train 2	Single Absorber Stack (per Train)	327444 327383	371434 371348	NOx	11.3	11.3	45.2 (daily) 113.0 (hourly)	45.2 112.9
					CO	-	-	226 (hourly)	225.8
					NH3	0.75	0.75	-	-
					Amine 1	0.087	0.087	-	-
					Amine 2	0.019	0.019	-	-
					Nitrosamine 1	0.0028	0.00284	-	-

Technology Provider	Emission Point ID	Description	x	y	Pollutant	Annual Average		Short Term Emissions (where applicable)	
						Emission Concentration (mg/Nm ³)	Release Rate (g/s)	Emission Concentration (mg/Nm ³)	Release Rate (g/s)
					Nitrosamine 2	0.0005	0.00051	-	-
					Formaldehyde	0.13	0.134	-	-
					Acetonitrile	0.18	0.183	-	-
					Acetaldehyde	0.39	0.392	-	-
					Ethanol	0.01	0.010	-	-
					Acetone	0.52	0.517	-	-
					Amide 1	0.032	0.032	-	-
					Formamide 1	0.035	0.035	-	-

5.2.2 Other Than Normal Operating Condition Emissions

5.2.2.1 Unabated Operation

The primary operating mode is anticipated to be with CO₂ emissions from the CCGT units abated i.e. with CCP operational. However, it is anticipated that there will also be a number of scenarios in which the CCGT may need to operate without the CCP including:

- Unabated Scenario 1: on commissioning, in the event that the downstream T&S network is unavailable and/or proving of the CCGT for acceptance testing;
- Unabated Scenario 2: during operation, to meet electricity demand when the CCP is offline (e.g. due to outages of the T&S network or unavailability of the CCP);
- Unabated Scenario 3: During a NatTS (electrical) total or partial shutdown event, in which the plant is called upon to support system restoration.

These scenarios would be classified within the permit as 'other than normal operating conditions' (OTNOC). Unabated operation of the Proposed Installation is not anticipated to be frequent or occur over the long term. Outside of these circumstances, it is expected that the CCGT will not operate unabated.

5.2.2.2 Periodic Capture Efficiency Demonstration During a T&S Network Outage

The plant is required under the Dispatchable Power Agreement to periodically demonstrate capture efficiency by measuring the quantity and quality of CO₂ captured and prepared for geological storage. These tests may coincide with an unplanned or planned outage of the Transport and Storage (T&S) network, during which export of CO₂ is not possible.

In such circumstances, the capture plant will operate under an "Other Than Normal Operating Condition" to complete the efficiency demonstration. During this period:

- The capture process will run at the required load to achieve representative operating conditions.
- CO₂ will be separated and measured for flow rate, purity, and other relevant parameters to confirm compliance with DPA requirements and CCS network code
- As T&S export is unavailable, captured CO₂ will be vented to atmosphere under controlled conditions and limited to the duration of the efficiency test, to minimise environmental impact.

Justification of the event and emissions data will be reported to the Environment Agency. The plant will return to normal operation immediately after completion of the test or restoration of T&S availability.

5.2.2.3 CO₂ Management Plan

The Operator will develop a CO₂ Management Plan which will include how venting emissions will be monitored and managed and how modelling of emissions will be used to develop the detailed design of the facility to ensure these emissions are not significant. The initial CO₂ Management Plan is presented at Appendix I.

5.3 Fugitive Emissions to Air

There is a risk of fugitive emissions from:

- potential leaks and/or accidents. This is predicted to be minimal (intermittent and short in duration) through mitigation and leak detection;
- chemical storage; and
- litter and dust which are also predicted to be low risk through housekeeping on site, including frequent street sweeping plans.

5.4 Emissions to Water

The types of effluent anticipated to be generated during the operation of the Proposed Installation have been classified as below:

- Clean surface water which is not classed as effluent and that can be discharged with minimal treatment;
- Potentially contaminated surface water (no amine contamination), process water (except from the CCP) and blowdown waste water, which can be discharged following onsite treatment (e.g. chemical dosing);
- Process water from the CCP direct contact cooler or NH₃ which can be discharged following treatment on-site;
- Blowdown from the hybrid cooling system.

5.4.1.1 Process Wastewater

The potential sources of process wastewater are outlined in section 4.3.9.2 above and this water will be managed via purge discharge consistent with the existing site operation, with no more than three hours commencing on the ebb tide one hour after high water.

This periodic abstraction and discharge requires storage capacity for make-up and purge water via holding ponds within the existing wider site.

Subject to ongoing feasibility work, the existing CQPS cooling water make-up and purge tanks will be utilised with upgrades to existing pumps and pipework, as required. New cooling water supply and purge pipelines (either above or below ground) would then be constructed to link into the proposed cooling towers and CCP. These pipelines would be short in length and within the existing site boundary only. The capacity of the outfall and intake structures, and the rate of cooling water discharge into the estuary, would be the same as for the existing CQPS. As such, there would be no change associated with scour and erosion at the point of discharge into the River Dee.

Disposal of degraded amine and other process wastewaters that can't meet existing permit discharge limits will be removed via tanker for off-site disposal at a suitably permitted waste facility.

5.4.1.2 Cooling Water

Cooling water will be discharged back to the River Dee as described in section 4.3.9.2 above. The cooling water discharge would be consistent with the operation of the existing CQPS in terms of temperature and water quality, and would comply with the existing CQPS Environmental Permit limits. No changes are proposed to the existing CQPS permit limits, which are summarised in Table 9.

Table 9 Existing Permit (EPR/NP3037AF/V005) Discharge Limits

Parameter	Limit	Unit	Reference Period
Flow	2.5	m ³ /s	Instantaneous
Maximum Temperature	25	° C	Instantaneous
Maximum Temperature Difference (April – October)	13	° C	Instantaneous
Maximum Temperature Difference (November – March)	13	° C	Instantaneous
Salinity	60	g/l	Instantaneous
pH maximum	9	-	Instantaneous
pH minimum	6	-	Instantaneous
Total residual oxidant	0.2	mg/l	Instantaneous
Oils and Grease	20	mg/l	Instantaneous

5.4.1.3 Drainage and Surface Water Attenuation

The Proposed Installation has been designed to provide a drainage system that protects the environment from accidental discharges including segregation of clean water / rainwater and firewater from potentially contaminated water and / or firefighting chemicals. Details are provided in sections 4.3.9.1 and 4.3.9.5 above.

Surface water would be appropriately segregated and contaminated surface water will be treated prior to discharge via the same system as the process wastewater stream. Following attenuation, surface water site drainage would be discharge to the River Dee via a new surface water outfall (W4) adjacent to the existing outfall. The final design of the proposed outfall will be subject to various technical assessments to identify the most appropriate solution.

The discharges from W4 will be monitored and limits proposed are in line with the CQPS discharge limits for W2 and W3. These are set out in

Table 10. Proposed Discharge Limits for W4

Parameter	Limit	Unit	Reference Period
Oil and Grease	20	mg/l	Instantaneous
pH Maximum	9	-	Instantaneous
pH Minimum	6	-	Instantaneous

5.4.2 Point Source Emissions to Sewer

There will be no releases to sewer from the Proposed Installation.

5.4.3 Emissions to Groundwater

There are no emissions to groundwater proposed.

5.4.4 Fugitive Emissions to Water

Potential impacts on the surrounding surface watercourses includes potential operational accidental spillages, leaks and potential runoff of hazardous fire-fighting chemicals.

5.5 Emissions to Land

All areas at the Proposed Installation, with the exception of any landscaped areas (which will be located away from process areas), will be covered in hardstanding. Based on the current drainage design there will be no soakaways on the site. Consequently, no direct emissions to land will occur as a result of the operation of the Proposed Installation. Regular inspections of the hardstanding areas and drainage systems will be carried out to identify and repair possible damage and prevent any potential releases to land.

5.6 Noise

The potential noise sources on site include:

- Motors, pumps and drives;
- Fans from the cooling system; and
- Vent stacks.

An assessment of the potential noise impacts has been completed as part of the application and is presented at Permit Application, Volume III Appendix I.

5.7 Odour

The Proposed Installation is not expected to be a significant source of odour emissions, due to the contained nature of the process system. However, with all such systems, there is the risk of fugitive emissions from potential leaks and/or accidents. There is a risk of odour from the storage of NH_3 for the SCR plant, and storage and use of amines with CCP may have the potential to generate odour.

6. Monitoring

6.1 Process Monitoring

The DCS system and CEMS monitoring is described in more detail in Section 4.3.7 Process Control System.

6.2 Infrastructure

An infrastructure monitoring plan will be implemented at the Proposed Installation, so as to protect the soil and groundwater beneath the site.

Regular inspection of all site infrastructure will be undertaken in accordance with Uniper engineering management plans and containment associated with bulk storage of oils, chemicals and fuels will be undertaken will be inspected in accordance with a defined schedule. The routine infrastructure audits are likely to comprise identification of issues relating principally to:

- Minor leaks;
- Standing water in bunded areas; and
- Bulk storage tank bunds.

6.3 Emissions to Air

6.3.1 Point Source Emissions

There are potentially 5 new release points to air including:

- A1 and A2 – HRSG emission stack for each train;
- A3 and A4 – Absorber emission stack for each train;
- A5 – emergency diesel generator stack(s);

The list of the main CCGT emission points at the Proposed Installation and the proposed monitoring to be carried out is shown below in Table 11 below. This includes a combination of continuous and periodic monitoring. The emission points A1 – A4 inclusive will be equipped with CEMS which will meet the relevant MCERTs standards and will be subject to calibration and maintenance in accordance with manufacturers recommendations. CEMs will be linked to the DCS to allow the monitoring of emissions in real time from the control system and the information also be available for offline analysis by operators and site engineering personnel.

Periodic monitoring will be undertaken to the defined British or International standards at the frequencies proposed by an appropriately certified laboratory.

Table 11 Proposed Emission Limits and Monitoring

Emission Point ID	Description	Parameter	Limit ⁽¹⁾	Reference Period	Monitoring Frequency	Monitoring Standard or Method	Comment		
A1 and A2	Single HRSG Stack	NO _x	30 mg/m ³ Effective DLN to base load	Annual mean of validated hourly averages	Continuous	BS EN 14181	Only operational when the Proposed Installation is operating in CO ₂ -unabated mode.		
			100 mg/m ³ Effective -DLN to base load	95% of validated Hourly Average in a calendar year					
			50 mg/m ³ Effective DLN to base load	Monthly mean of validated hourly averages					
			40 mg/m ³ Effective DLN to base load	Daily mean of validated hourly averages					
			To be confirmed for MSUL/MSDL to base load						
		CO	100 mg/m ³ Effective DLN to base load	Monthly mean of validated hourly average				Continuous	BS EN 14181
			200 mg/m ³ Effective DLN to baseload	95% of validated hourly averages within a calendar year					
			110 mg/m ³ Effective DLN to baseload	Daily mean of validated hourly averages					
				To be confirmed following confirmation					

Emission Point ID	Description	Parameter	Limit ⁽¹⁾	Reference Period	Monitoring Frequency	Monitoring Standard or Method	Comment
			of MSUL/MSDL to base load				
			200 mg/m ³ Effective DLN to baseload	95% of validated hourly averages within a calendar year			
A3 and A4	Single Absorber Stack	NO _x	45 mg/m ³ Effective DLN to baseload To be confirmed following confirmation of MSUL/MSDL to base load	Daily mean of validated hourly averages	Continuous	BS EN 14181	
			34 mg/m ³ Effective DLN to baseload	Yearly Average			
			51.7 mg/m ³ Effective DLN to baseload	Monthly mean of validated hourly averages			
			100 mg/m ³ Effective DLN to base load	95% of validated hourly averages within a calendar year			
		CO	113 mg/m ³ Effective DLN to base load	Monthly mean of validated hourly average	Continuous	BS EN 14181	
			113.7 mg/m ³ Effective DLN to baseload To be confirmed	Daily mean of validated hourly averages			

Emission Point ID	Description	Parameter	Limit ⁽¹⁾	Reference Period	Monitoring Frequency	Monitoring Standard or Method	Comment
			following confirmation of MSUL/MSDL to base load				
			206.7 mg/m ³ Effective DLN to baseload	95% of validated hourly averages within a calendar year			
			34.4 mg/m ³ Effective DLN to baseload	Yearly average			
		NH ₃	1 mg/m ³ Effective DLN to base load	Annual Average	Continuous	BS EN 14181	
		Total Amine	1 mg/m ³ Effective DLN to base load	Average over the sampling period	Bi-annual	Isokinetic impinger method based on EN 14791 to be agreed with the EA in writing	
		Total Nitrosamine expressed as N-nitrosodimethylamine (NDMA)	0.002 mg/m ³ Effective DLN to base load	Average over the sampling period	Bi-annual		
		Formaldehyde	4 mg/m ³ Effective DLN to base load	Average over the sampling period	Bi-annual	Isokinetic CEN TS 17638	
A5	Emergency Diesel generators	NO _x	No Limit		Periodic	BS EN 14792	
		CO	No Limit		Periodic	BS EN 15058	

6.4 Fugitive Emissions To Air

To control fugitive emissions to air or water from the GGCT and CCP, a leak detection management plan will be in place prior to commissioning, ensuring that leaks can be identified, recorded and repaired quickly.

6.5 Odour

As discussed in Section 5.7 above, the risk of odour from the Proposed Installation is minimal. Potential odour will be managed in line with the management system on site including planned preventative maintenance and regular site inspections, along with other fugitive emissions. Any reports of odour will be logged and complaints to the site investigated.

6.6 Emissions to Water

6.6.1 Point Source Emissions

The Proposed Installation will discharge process waters, cooling waters, wastewater by sending waters to Purge Pond A and SDX A in normal operations and then transferring the water to be discharged to CQ-B via the common discharge chamber for discharge to the River Dee in accordance with the CQ-B Environmental Permit (EPR/NP3037AF). The control of the discharge arrangements are described in section 4.3.9.2 above and the limits to be met are present in Table 8.

Only permit compliant waters may be discharged from the Proposed Installation to the common discharge chamber for release to the River Dee. Permit compliance will be guaranteed with the help of online analysers in the inlet to the purge pond or SDX tank. When inlet analysers of discharges to the purge pond or SDX tank detect concentrations above selected threshold values, the automatic discharge to the "Common Discharge Chamber" will be stopped.

6.6.2 Fugitive Emissions To Water

Potential impacts associated with the accidental spillage of polluting materials during the operational phase will be mitigated by way planned preventative maintenance, provision of containment around storage tanks and kerbed hardstanding throughout the site.

The Operator will maintain a high standard of housekeeping across the site including regular road sweeping and plant inspections of drainage and containment related checks. In the event that contamination reaches the drainage system, the SuDS features proposed are designed to allow runoff to be intercepted and directed through oil interceptors and/or vortex separators within each drainage catchment to encourage the removal of oils, suspended solids and sediment bound hydrocarbons. Discharges of surface water at the new W4 outfall will be monitored for the presence of visual oils/grease or high levels of turbidity and if these are identified, the discharge can be isolated in the drainage system by activating penstock valves. Contaminated surface would then either be sent through the site wastewater treatment for discharge via the purge ponds or would be removed from site by third party contractor for offsite treatment and disposal.

7. Impact Assessment

7.1 Introduction

This section discusses the potential impact on sensitive receptors and the surrounding area and shows how the emissions from the Proposed Installation have been assessed and minimised.

Guidance contained in the EA guidance – ‘Risk assessments for your environmental permit’, has been used to scope and assess the emissions from the Proposed Installation.

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

7.2 Site Location and Sensitive Receptors

Potential receptors which could be impacted by the operations of the Proposed Installation include:

- Residential, commercial and industrial human receptors;
- Habitat receptors associated with designated and other sensitive sites; and
- Location related receptors associated with site geology, hydrogeology and hydrology.

7.2.1 Human Receptors

The receptors are selected to be representative of residential dwellings, recreational areas and schools in the area around the Proposed Installation. A list of the human receptors within 2km of the Proposed Installation are shown below and are shown on Figure 5 in Environmental Permit Application, Volume IV.

Table 12 Human Receptor Locations (from ES Air Quality Chapter)

Receptor ID	X (m)	Y (m)	Description	Minimum Distance from the Proposed Installation's Stacks (m)
R1	327170	371241	Kelsterton Road, Rockcliffe, Flint, Connah's Quay, Flintshire, Wales, CH6 5SJ	220
R2	327152	371210	Chester Road, Oakenholt, Flint, Connah's Quay, Flintshire, Wales, CH6 5SJ	260
R3	326749	371070	Chester Road, Oakenholt, Flint, Connah's Quay, CH6 5SF	660
R4	327557	370826	Kelsterton Road, Rockcliffe, Connah's Quay, Flintshire, Wales, CH6 5TH	490
R5	327880	370743	Kelsterton Road, Rockcliffe, Connah's Quay, Flintshire, Wales, CH5 4BJ	700
R6	327972	370700	Connah's Quay, CH5 4BL	790
R7	328024	370545	Deeside College, York Road, Golftyn, Connah's Quay, CH5 4YE	950
R8	326371	371298	Papermill Lane, Oakenholt, Flint, CH6 5TD	950
R9	326452	370953	Oakenholt Lane, Oakenholt, Flint, CH6 5SX	970
R10	326048	371070	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST	1,310
R11	325943	371334	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST	1,370
R12	325928	371585	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST	1,390
R13	325967	371792	Leaderbrook Drive, Oakenholt, Flint, CH6 5ST,	1,390
R14	325966	371823	Chester Road, Oakenholt, Flint, Flintshire, Wales, CH6 5WF	1,400
R15	328454	370344	Church Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4AS	1,380

Receptor ID	X (m)	Y (m)	Description	Minimum Distance from the Proposed Installation's Stacks (m)
R16	328381	370167	College View, Connah's Quay, CH5 4BY	1,460
R17	328213	370061	Golftyn Lane, Connah's Quay, Flintshire, Wales, CH5 4DT,	1,450
R18	328026	370163	Connah's Quay High School, Golftyn Lane, Connah's Quay, CH5 4BH	1,270
R19	327314	369848	Top-y-fron Hall, Kelsterton Lane, Connah's Quay, Northop Hall, Flintshire, Wales, CH6 5TF	1,460
R20	326567	369690	Oakenholt Lane, Rockcliffe, Connah's Quay, Northop Hall, CH6 5SU	1,840
R21	328609	369883	Golftyn Primary School, York Rd, Connah's Quay, Deeside CH5 4XA	1,830
R22	328824	370107	Church Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4AQ	1,820
R23	328830	370114	Church Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4AQ	1,820
R24	329067	369895	St Mark's Parish Church, Church Hill, Golftyn, Connah's Quay, CH5 4AD	2,140
R25	328941	369539	Bryn Deva C.P. School, Linden Avenue, Golftyn, Connah's Quay, CH5 4SN	2,300
R26	328634	369331	Lon Dderwen, Connah's Quay, Deeside CH5 4WG	2,300
R27	325516	372175	St David's, Croes Atilla, Flint, CH6 5SP	1,950
R28	324919	372091	St Richard Gwyn Roman Catholic High School, Albert Avenue, Flint, CH6 5JZ	2,480
R29	324990	372645	Ysgol Gymraeg Croes Atti, Chester Road, Flint, CH6 5DU	2,620
R30	324385	371941	Ysgol Maes Hyfryd, Maes Hyfryd, Flint, CH6 5LN	2,970
R31	324516	372532	Gwynedd County Primary School, Ysgol Pen Coch, Maes-y-Dre Avenue, Flint, CH6 5JT	3,010
R32	324546	373323	Lloyd Street, Flint, CH6 5PD	3,350
R33	324186	370145	St Thomas's Church, St Thomas's Court, Flint, Flint Mountain, CH6 5SL	3,370
R34	329678	369534	High Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4DJ	2,840
R35	329955	369652	Dock Road, Connah's Quay, CH5 4EF	2,990
R36	329953	369351	High Street, Golftyn, Connah's Quay, Flintshire, Wales, CH5 4DJ	3,170
R37	329600	369081	Mold Road, Connah's Quay, Flintshire, Wales, CH5 4QN	3,090
R38	329128	368936	Cranbrook Close, Connah's Quay, CH5 4JY	2,900
R39	328165	368716	Mold Road, Connah's Quay, CH5 4QN	2,680
R40	330375	368913	Christ Church Deeside, Victoria Road, Shotton, CH5 1ES	3,770
R41	330528	367801	Deeside Community Hospital, Plough Lane, Aston, Deeside CH5 1XS	4,660
R42	332295	369161	Farm Road, Garden City, CH5 2HJ	5,270
R43	331087	366723	Overlea Drive, Deeside CH5 3HS	5,840
R44	331149	373884	Greenwood Farm, Unnamed Road, Neston CH64 5SH	4,410

7.2.2 Sensitive Environmental Habitats

NRW 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 10km for European designated sites and up to 2km for nationally designated sites.

Statutory designated sites have been identified through a desk study of the Defra Magic mapping website, which identifies SSSIs, Ramsar sites, SPAs and SACs.

Sensitive nature conservation receptors within 10km of the installation boundary used in the ES Air Quality assessment are listed within Table 13 and shown in and are shown on Figure 6 in Environmental Permit Application, Volume IV

Table 13 Sensitive Operational Ecological Receptors

Receptor ID	Ecological Site	Designation	OS Grid Coordinate*		Distance from the Proposed Installations Stacks (m)
			X	Y	
OE01	Heswall Dales	SSSI	326127	381815	10,400
OE02	Dee Estuary	Ramsar, SAC, SPA and SSSI	330798	372117	Varied
OE03	The Dungeon	SSSI	325074	383034	11,770
OE04	Thurstaston Common	SSSI	324893	384379	13,130
OE05	Dibbinsdale	SSSI	332304	380953	10,690
OE06	Mersey Estuary	Ramsar, SPA, SSSI	337932	379707	13,340
OE07	New Ferry	SSSI	335477	384176	15,070
OE08	Hallwood Farm Marl Pit	SSSI	334355	375893	8,190
OE09	Inner Marsh Farm	SSSI	330718	372980	3,580
OE10	River Dee and Bala Lake	SAC, SSSI	328755	371000	1,300
OE11	Connah's Quay Ponds and Woodland	SSSI	328955	368680	3,020
OE12	Maes y Grug	SSSI	326031	366762	4,760
OE13	Deeside and Buckley Newt sites	SAC, SSSI	329081	365705	5,830
OE14	Coed Talon Marsh	SSSI	327012	358683	12,630
OE15	Bryn Alyn	SSSI	320410	359418	13,820
OE16	Cambrian Quarry	SSSI	321432	362367	10,780
OE17	Alyn Valley Woods and Alyn Gorge Caves	SAC, SSSI	319797	366391	9,040
OE18	Halkyn Mountain	SAC, SSSI	318259	376351	10,310
OE19	Pen-y-Cefn Pasture	SSSI	318909	366514	9,730
OE20	Cefn Meadow	SSSI	318929	366042	9,950
OE21	Coed Trefraith	SSSI	313639	372797	13,740

Receptor ID	Ecological Site	Designation	OS Grid Coordinate*		Distance from the Proposed Installations Stacks (m)
			X	Y	
OE22	Ddol Uchaf	SSSI	314317	371354	12,990
OE23	Caerwys Tufa	SSSI	313035	371844	14,280
OE24	Tyddyn-y-barcut	SSSI	319073	367525	9,110
OE25	Parc Bodlondeb and Gwenallt-parc	SSSI	317876	370857	9,450
OE26	Parc Linden, Lixwm	SSSI	318383	371925	8,940
OE27	Flint Mountain	SSSI	324875	371560	2,440
OE28	Herward Smithy	SSSI	319855	373980	7,880
OE29	Shotton Lagoons and Reedbeds	SSSI	329515	371040	2,030
OE30	Local Ancient Woodlands	Ancient Woodlands	329795	368480	3,670

*Point of maximum long-term impact within each site

7.2.3 Hydrology

There are numerous surface water features located within the study area. These are presented in Table 14 below.

Table 14 Surface Water Features

Surface Water Feature	Closest Distance to the Area and Direction
River Dee / Dee Estuary	120 m northeast at closest point.
Kelsterton Brook	Parallel to the northern and southern boundaries, crossing the Main Site (culverted beneath cooling towers); discharging into River Dee.
Lead Brook (and associated drains further to the west, and Oakenholt reservoir to the south)	200 m to the north-west.
Old Rockcliffe Brook	200 m to the south
Oakenholt Brook	125 m south
Unnamed brooks/drains	30 – 200 m to the south.
Network of ponds/marshes	Adjacent to the northern boundary of the Site.
Three ponds	Within 50 – 150 m to the west.

The Groundsure Report provided in the Site Condition Report (Document Reference: CQ-WPCC15718-APP-SCR in Application Volume III) confirms the River Dee is listed as having the following River Quality classification:

- Moderate – overall;
- Fail – chemical; and
- Moderate – biological.

The Groundsure GIS dataset does not report any surface water abstractions within 250 m of the Proposed Installation.

According to the NRW online map viewer, there is one surface water abstraction permit, located within the footprint of the Water Connection Corridor, on the River Dee. The permit is effective from 2017 for abstraction from the River Dee Estuary associated with CQPS, operated by Uniper UK Limited for energy production.

According to the Groundsure dataset, there are no nitrate vulnerability zones (NVZ) within 250 m of the Proposed Installation.

The Groundsure GIS dataset does not report any Drinking Water Protected Area (surface water) for the Proposed Installation and the study area.

The Proposed Installation is situated on the south bank of the River Dee. The Proposed Installation is potentially at risk from fluvial, tidal and, to a lesser extent, surface water flooding.

7.2.4 Geology

The BGS Geoindex website and published 1:50,000 scale geological map of the area (Sheet 108, Flint) and associated memoir have been reviewed, alongside the historical borehole records available from the Proposed Installation. An overview of the geological succession across the Proposed Installation is reported in Table 15.

Table 15 Summary of Anticipated Geology

Geology	Lithological Description	Expected Location
Made Ground	Made Ground is an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the Made Ground is unspecified.	All of the area except the Access to Proposed Installation and a small area north of it.
Superficial Deposits		
Till	Unsorted and unstratified drift, generally overconsolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier. It consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape (diamicton).	Present at the Access to the Proposed Installation and a small area north of it.
Tidal Flat Deposits	Tidal flat deposits, including mud flat and sand flat deposits, form extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit.	All of the area.
Bedrock		
Gwespyr Sandstone - sandstone and argillaceous rocks, interbedded	Fine-grained, feldspathic and micaceous sandstones, cross-stratified on a variety of scales, with conglomerate-lined scours and intercalated siltstone and mudstone beds. Intertongues with Craven Group mudstones in its lower part and Pennine Lower Coal Measures Formation in its upper part. The Gwespyr Sandstone records the entry, and southwards advance of a northerly derived "Millstone Grit" deltaic facies into the North Wales area.	Western portion of the area.

7.2.5 Hydrogeology

NRW aligns with the Environment Agency's Groundwater Protection Policy which adopts aquifer designations that are consistent with the Water Framework Directive.

According to this system the Tidal Flat Deposits present on site are classified as Secondary (Undifferentiated) Aquifers. The Tidal Flat Deposits are classified as an Unproductive Aquifer. Pennine Lower Coal Measures Formation and Gwespyr Sandstone are classed as Secondary A Aquifer: these are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Mapping provided by the BGS included within the Groundsure GIS dataset outlines the combined vulnerability of groundwater to pollution and has been classified as medium and high. Medium groundwater vulnerability is described as areas that offer some groundwater protection. Intermediate between high and low vulnerability. High groundwater vulnerability is described as areas able to easily transmit pollution to groundwater. They are characterized by high leaching soils and the absence of low permeability superficial deposits.

According to NRW, the Site does not lie within a Source Protection Zone (SPZ) and there are no SPZ within 1 km of the Site.

According to the Groundsure GIS dataset, the Site and study area overlie the Dee Carboniferous Coal Measures WFD groundwater body, which was classified as being of 'poor' overall quality in 2017.

Groundsure GIS dataset does not report any licensed groundwater abstraction recorded within the Site and none within the extended 1km study area for groundwater abstractions. According to the NRW online map viewer there are no groundwater abstractions within 1 km of the Site.

There is insufficient information to conclude at this stage whether groundwater levels in the limited public records are representative of true groundwater levels across the wider area. Given the proximity to the River Dee estuary, tidal influence on groundwater levels is possible. NRW does not hold any groundwater level monitoring data within a 1 km radius from the Site Boundary.

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:

- Chemicals required for the operation of the Proposed Installation might leach into the ground and be washed into surface water or groundwater through the underlying soils.
- Chemicals required for the operation of the Proposed Installation could be accidentally released and discharged into surface water.
- Emissions to air from the Proposed Installation will be dispersed in the air to sensitive receptors.

In order to prevent and minimise the risk of pollution, the Proposed Installation will have dedicated chemical storage areas within appropriate containment to prevent loss of materials to soil as well as controlled waters.

7.4 Point Source Emissions to Air

7.4.1 H1 Screening

A H1 screening assessment of point source emissions to air was conducted using the Environment Agency's H1 tool (Permit Application, Volume III, Appendix F). An assessment was completed for the current operation of CQPS as a baseline, and for each Technology Licensor's proposed emissions for normal abated operation and unabated operation. To establish the worst case impact, 100% run time was assumed for all assessments.

The assessment of the CQPS confirmed that short term impacts of nitrogen dioxide could not be screened as insignificant.

The assessment for both technology providers showed that:

- Short term impacts of nitrogen dioxide could not be screened as insignificant for both abated and unabated operations;
- Short term impact of CO could not be screened as insignificant for both abated and unabated operations;
- Short term impact of formaldehyde could not be screened as insignificant for abated operations of Technology Licensor No1; and
- Long term impacts of ammonia and NDMA as a representative species for nitrosamines could not be screened as insignificant during abated operations.

Therefore, detailed modelling has been conducted. This detailed modelling is presented in Permit Application, Volume III, Appendix G, and the summary results are discussed below.

7.4.2 Air Quality Dispersion Assessment

Detailed dispersion modelling has been used to calculate the concentration of pollutants at identified sensitive receptors and these have been compared with National Air Quality Strategy objectives, and Critical Levels and Critical Loads for ecosystems, with consideration for the baseline air quality and ecological deposition rates, in accordance with the Risk Assessment methodology adopted by NRW.

The assessment has considered the following future scenarios:

- Operation of two CCGT Trains in unabated mode with the Front End Engineering Design (FEED) 1 Design, referred to as the "Unabated FEED 1 scenario". In this mode emissions would occur via the Heat Recovery Steam Generator (HRSG) stacks (abnormal temporary operating scenario e.g. periods when the CO₂ transport and storage system is not available);
- Operation of two CCGT Trains in unabated mode with the Front End Engineering Design (FEED) 2 Design, referred to as the "Unabated FEED 2 scenario". In this mode emissions would occur via the Heat Recovery Steam Generator (HRSG) stacks (abnormal temporary operating scenario e.g. periods when the CO₂ transport and storage system is not available);
- Operation of two CCGT Trains with Absorber trains for Carbon Capture with the FEED 1 Design, referred to as the "Abated FEED 1 scenario". In this mode emissions would occur via the Absorber stacks; and
- Operation of two CCGT Trains with Absorber trains for Carbon Capture with the FEED 2 Design, referred to as the "Abated FEED 2 scenario". In this mode emissions would occur via the Absorber stacks.

It has been assumed that the Proposed Installation operates continuously (24 hours a day for 365 days a year) as this is considered to represent the reasonable worst-case scenario in terms of the annual average operational emissions.

The impact of emissions on human health receptors has been considered in the context of the relevant Air Quality Standards and Environmental Assessment Levels. The magnitude of air quality impacts at sensitive ecological receptors has been considered in the context of relevant critical levels and critical loads for designated and non-designated ecological sites.

An assessment of stack height has demonstrated that a release height of 145 m for the absorber stacks and 120m to 130m above ground level for the HRSG stacks is predicted to provide a sufficient degree of dispersion such that ground level PCs are below the Environment Agency's 1% and 10% screening criteria for long term and short-term impacts respectively.

For the Abated FEED 1 and Abated FEED 2 scenarios, the predicted annual average and short-term impacts at all human health receptors can be screened out from the need for further assessment. In the case of N-Amine, impacts of greater than 1% of the NDMA EAL are predicted at discrete receptors, however the PECs are below 70% of the EAL and can therefore be screened out from the need for further assessment.

For the unabated scenario, the predicted annual average and short-term impacts at all human health receptors can be screened out from the need for further assessment.

Overall, the impacts of the Proposed Installation on local ecological sites are very limited and below screening thresholds at the majority of these sites. Where long-term impacts are above the threshold, they comprise a low proportion of the Environmental Standard (less than 2%) and any exceedances of the Environmental Standard are dominated by background sources. Where short-term impacts exceed the screening threshold they remain below the Environmental Standard by a significant margin. Taking into account the numerous robust assumptions used in the assessment, it is reasonable to conclude that the air quality impacts will not have significant effects on the local ecological sites.

The results of the assessment can be found in the Air Quality Assessment in Permit Application, Volume III, Appendix G.

7.5 Point Source Emissions to Land

There will be no soakaways at the Proposed Installation. Consequently, no direct emissions to land will occur as a result of the operation of the proposed installation. Regular inspections of the hardstanding areas and drainage systems will be carried out to identify and repair possible damage and prevent any potential releases to land. Given the absence of soakaways at the Proposed Installation, the risk of impact to land from the proposed operations will be low due to the following controls that will be in place:

- all areas of the Proposed Installation will be covered in hardstanding, with the exception of any landscaped areas (which will be located away from process areas) and the parking areas which will be covered in permeable or porous paving,
- filter drains or swales would provide initial treatment of road and/or building drainage. The drainage network could include oil interceptors and/or downstream defenders within each catchment to remove oils, suspended solids and sediment bound hydrocarbons, as necessary based on the development layout.
- Oil interceptors and/or vortex separators would be provided within each drainage catchment to encourage the removal of oils, suspended solids and sediment bound hydrocarbons. Attenuation tank(s) are also included within the drainage network and would contain the majority of design storm water during tidal lock conditions.

7.6 Point Source Emissions to Water

There will not be any direct discharges to the ground/ groundwater from the activities proposed by this application.

As stated in Section 5.4.1.1 above, the main sources of water being discharged from the site is cooling water and wastewater arising from the Proposed Installation comprising effluent from the demineralisation plant, blowdown from the CCP and CCGT, effluent from the CCP, and contaminated surface water from the process areas. As these will be discharged via the same discharge location and in compliance with the existing CQPS permit limits, no further assessment has been completed as these have been previously agreed by NRW as being acceptable. There are no proposals to discharge any contaminated wastewater from the Proposed Installation into the foul sewer.

On this basis it is considered that the risk of impact to controlled water from treated and uncontaminated wastewaters from the Proposed Installation will be low.

7.7 Other Operational Impacts

Other potential impacts from the operation of the Proposed Installation were considered primarily through a Qualitative Environmental Risk Assessment (Document Reference CQ-WPCC15718-ERA, in Permit Application, Volume III Appendix E) and, in relation to noise, through a detailed Noise Impact Assessment (Document Reference CQ-WPCC15718-NIA, in Permit Application, Volume III Appendix I)

The following sections summarise the findings of these assessments in relation to releases from the Proposed Installation, 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.

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

- fugitive releases to air, land and water;
- nuisance impacts associated with litter, mud and debris, odour and noise;
- visibility of plumes;
- abnormal operations and accidents;
- fire risk; and
- climate risk.

7.7.1 Fugitive Emissions to Air, Land and Water

A qualitative risk assessment has been undertaken for the Proposed Installation and is included in Permit Application, Volume III, Appendix E of this document.

Based on the various controls placed on the site plant and equipment, it is expected that fugitive emissions from the site, particularly process emissions to air and water will be negligible. The sources reviewed were:

- Windblown dust and particulates from external roads and surfaces;
- Leaks from valves and flanges;
- Venting from storage tanks;
- Spillage of fuels or chemicals on site surfaces with run-off from pavements, roads and hardstanding; and
- Liquid leaks from storage tanks, containers, valves and pipework flanges.

Ensuring that storage, containment and wider infrastructure are designed and built in accordance with appropriate standards minimises the potential for fugitive releases. In addition planned preventative maintenance and inspections are an additional primary control for fugitive releases. All maintenance activities will be controlled under a permit to work system and will follow a Risk Assessment and Method Statement (RAMS). The RAMS will define the necessary mitigating measures to minimise fugitive emissions from maintenance work.

7.7.2 Litter

The Proposed Installation presents a low potential for litter to be generated and the only source would be windblown material from externally stored bins that are not secured properly. All waste will be dealt with in accordance with the Proposed Installation's waste management procedures, with appropriately designated storage areas that will be subject inspection.

7.7.3 Mud and Debris

The potential for mud and debris at the Proposed Installation have been evaluated and as external surfaces, pathways and roads are hard surfaced there is minimal risk of this occurring. Impact is therefore considered to be very low.

7.7.4 Odour

Natural gas supplied to the site should contain an odouring agent in accordance with Gas Regulation requirements which could contribute to odour potential. Maintenance of the gas infrastructure including pipelines, flanges and pumps will minimise the risk of leaks.

There is a risk of odour from the storage of diesel, NH₃ for the SCR plant, and storage and use of amines within the CCP which may have the potential to generate odour. The design of tank and pipeline systems for these materials will be undertaken in accordance with the appropriate industry codes and standards. In order to minimise the potential for odour to occur, fixed roof storage tanks will be used.

The Proposed Installation will implement a Leak Detection and Repair (LDAR) plan to assist with the detection and management of fugitive releases of the substances with odour potential.

7.7.5 Noise

A detailed noise assessment has been completed for the Proposed Installation and is presented in Permit Application, Volume III, Appendix I.

The Proposed Installation has been designed, as far as possible, to avoid or minimise impacts and effects of noise and vibration through the process of design development, and by embedding measures into the design of the Proposed Installation.

The BS 4142 assessment has considered the sound during the common overnight operational mode of the existing CQPS, the Proposed Installation and the combined existing CQPS and Proposed Installation.

The initial BS 4142 assessment suggests a significant adverse impact for the Proposed Installation, when the local context is considered, it suggests the Proposed Installation would have an impact broadly comparable to that which has arisen from operation of the existing CQPS.

In the context of an ambient sound climate influenced by road traffic, sound from various operational states of the existing CQPS has not given rise to public complaint recently and a broadly similar outcome could be expected for the Proposed Installation.

Overall, as proposed in the DCO ES, it is considered that the site context means that sound from the Proposed Installation, could potentially result in an adverse, but not significant impact on nearby noise sensitive receptors.

During the detailed design stage, mitigation measures and general principles to minimise noise operational sound will be considered. These measures may include, but not limited to the following depending on the potential benefits achievable:

- enclosure of key noise sound sources;
- use of quieter plant (including limits on sound noise emissions from plant and equipment at source);
- orientation of plant within the site to provide screening of low-levels sound noise sources by other buildings, structures and dedicated barriers, or orientating fans and the air inlets away from sensitive receptors; and
- use of additional acoustic barriers/screens or earth bunds to reduce transmission of sound noise from the Proposed Installation to noise sensitive receptors.

An initial Noise Management Plan (Document Reference: CQ-WPCC15718-APP-NMP) has been included in Appendix J of Environmental Permit Application, Volume III. Furthermore, during detailed design, an operational noise control scheme (including noise limits where agreed with the local authority) will be prepared and secured by a Requirement of the draft DCO.

The noise control scheme will set out the noise reduction measures to be incorporated into the Proposed Installation, and will demonstrate the use of Best Available Techniques (BAT) for the control of noise.

7.7.6 Visible Plumes

The proposed CCGT units will burn natural gas fuel, and water vapour would form part of the composition of the combustion gases released from the stacks. Under certain conditions this water vapour can cool and condense in close enough proximity to the stack exit to form a visible plume. The Atmospheric Dispersion Modelling System (ADMS) dispersion model which was used to evaluate the impact on local air quality contains a plume visibility module and this has been used to evaluate the number of hours per year where a visible plume could form, using information on the emissions from the stacks and representative meteorological data from Hawarden Airport.

For the purposes of this assessment a stack plume is described as being 'visible' when condensed water is present in the plume. This definition does not take account of whether or not the plume can actually be seen (for example at night), and for this reason can be considered to be a precautionary

approach likely to over-estimate the frequency of visible emissions. The procedure used in this assessment is based on that outlined in the 2003 version of the NRW's H1 horizontal guidance.

The assessment looked at both abated and unabated operations based on:

- For the FEED Licensor 1 option (abated) the initial water vapour mixing ratio of the plume was 0.05 kg/kg (mass of water vapour per unit mass of dry release at the stacks)
- For the FEED Licensor 2 option (abated) the initial water vapour mixing ratio of the plume was 0.06 kg/kg (mass of water vapour per unit mass of dry release at the stacks):.
- For the Unabated scenario, the initial water vapour mixing ratio of the plume was 0.05 kg/kg (mass of water vapour per unit mass of dry release at the stacks) for FEED Licensor 1 and 0.06 kg/kg (mass of water vapour per unit mass of dry release at the stacks) for FEED2 Licensor 2.

The detailed results can be seen in the Air Dispersion Assessment report in Permit Application, Volume II, Appendix G, with the assessment concluding that the Unabated scenario for each Licensor produced an overall less visible plume, due to its higher temperature, followed by the Abated FEED Licensor 1 option, which has a lower water content than the abated FEED Licensor 2 option, and the FEED Licensor 2 option having the highest "percentage time plume is visible", due to the combined low temperature and higher water content, as well as a higher mass flow rate.

Using the H1 methodology, the percentage time the plume is visible and extends beyond the installation boundary can be rated as insignificant, moderate or significant impact. For the purposes of the assessment, the time the plume was visible over 100m was used and this showed that:

- the unabated scenarios for both FEED Licensors were $\leq 5\%$ thus categorising these as insignificant; and
- the abated options were $>5\%$ but $<25\%$ which is categorised as moderate significance.

It should however be noted that:

- the reported longest 'visible' plume lengths are based on the physical properties of water at the plume centre line, i.e., if the water is present at conditions that would result in droplet formation. At distances beyond a few hundred metres the water droplets would be too dispersed for the plume to be visible to the eye; and
- the assessment is conservative because it includes night time, and hours when ambient conditions are below the dew point (fog). The average visible plume length is within the site boundary which is located approximately 100 m from the point of release, at its closest.

7.7.7 Accidents and Abnormal Operations

An assessment of major accidents and disasters was carried out for the Proposed Installation and wider development and is presented in the Major Accidents and Disasters chapter of the ES (see Appendix M, DCO, Chapter 22). It details the main hazards within the Proposed Installation and identifies appropriate precautionary actions, to prevent or mitigate potentially significant risks.

For the management of accidents with lower environmental risk, an Accident Management Plan (AMP) will be developed to include the Proposed Installation and all associated equipment.

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

- Plans to deal with accidental pollution and any necessary equipment (e.g. spill kits) will be held on site and site personnel will be trained in their use. The EMS will incorporate details on how to appropriately deal with accidental spillages to ensure they are not released into any surface water system.
- Implementation of containment measures, including bunding or double-skinned tanks for oils. All chemicals will be stored in accordance with their COSHH assessments.
- Incorporation of interceptors into the drainage system to prevent spilled fuel entering the surface water drainage system or local water bodies.

In line with BAT, a management plan will be developed as part of the EMS in order to reduce emissions to air and/ or to water during other than normal operating conditions (OTNOC) that includes the following elements:

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

7.7.8 Fire Risk Assessment

In addition to the above abnormal operations and emergency situations, specific consideration has been given to fire risk at the Proposed Installation. Key controls to minimise and mitigate the likelihood and impact from fire include:

- A new fire detection and suppression system would be designed with appropriate firewater tank, firewater pumps, and firewater access points would be provided.
- A firewater strategy for the Proposed Installation will be developed to ensure the impact of firewater is managed and controlled.
- Condition based and preventative maintenance strategies will minimise the risk due to plant defects.
- The current Emergency Plan for CQPS which is developed as part of the EMS, will be reviewed and updated to include appropriate consideration and controls for the Proposed Installation.

7.7.9 Climate Risk Assessment

In line with the "Adapting to Climate Change: Risk Assessment for Your Environmental Permit" guidance on the www.gov.uk website, as the site has operations beyond 2050 and abstracts water from the River Dee, consideration has been given to risk associated with the impacts that need to be considered from a changing climate including managing changes associated with flood risk.

The NRW Flood Map for Planning⁸ identifies that the Proposed Location is located within a Flood Zone 3, with part of the Proposed Installation classified as a Flood Zone 2. Flood Zone 3 is an area with a combined 1% risk of flooding from rivers and the sea including climate change.

A Flood Zone 2 is an area with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers in a given year, including the effects of climate change.

The area does not have any recorded flood events according to the map. In terms of managing any potential future flood risk, the Proposed Installation drainage arrangements have been designed taking into consideration appropriate rainfall events and climate risk. Other mitigation measures proposed are:

- a) Raising the development platform to 7.4 m AOD to mitigate against tidal water flood;
- b) Raising vulnerable equipment 300mm above proposed ground levels to mitigate against groundwater and surface water flood;
- c) Site wide rainwater run-off will be collected through a series of SuDs features;
- d) Implement an attenuation strategy incorporating a grassed swale and attenuation tank(s); and
- e) Install a new surface water outfall into Old Rockcliffe Brook alongside the existing outfall on the north-eastern boundary.

The management of climate risk will be part of the EMS and the minimisation and mitigation measures for other future risks include:

⁸ NRW Flood Map for Planning. Accessed at: <https://naturalresources.wales/flooding/flood-map-for-planning/?lang=en>
(Accessed on 28/05/2025)

- Ensuring installed plant and equipment is operated in line with any critical operating temperatures defined by manufacturers;
- Ensure preventive maintenance strategies are defined and implemented;
- Providing insulation on the plant and equipment as appropriate and implement winterisation procedures; and
- Implementing engineering management plans and bund inspections to ensure that infrastructure and containment are not compromised.

7.8 Installation Waste

Details of the waste generated on site are discussed in Section 4.4.4 of this document.

Operational waste is likely to comprise minor quantities of waste generated by maintenance activities, periodic waste from the detergent clean of the GT and reclaimers waste which will be neutralised prior to transport for offsite treatment.

All waste will be dealt with in accordance with the waste hierarchy and the Proposed Installations waste management procedures, with appropriately designated storage areas for hazardous and non-hazardous wastes, and consigned via a registered waste carrier for treatment or disposal at a suitably licenced waste facility.

It is therefore considered that further assessment of the waste from the proposed site operations is not required.

7.9 Global Warming Potential

In line with current guidance for bespoke permits, the impact of the operations of the Proposed Installation on global warming should be completed.

To understand the global warming potential of the Proposed Installation, the H1 methodology has been utilised. The current Excel version of the tool is not fully operational at the time of writing and version 2.78 of the previous MS Access version was used and is provided in Permit Application, Volume III, Appendix F.

This section is based on conversion factors presented in the UK Government guidance – “Government conversion factors for company reporting of greenhouse gas emissions” published in June 2025.

The GWP emissions are based on emissions produced or associated with energy and fuel use which include:

- emissions from natural gas combustion in the CCGT have been calculated using Design Performance Summary developed by the AECOM design team;
- in the absence of an Energy System Restoration event diesel consumption is associated with maintenance testing of the generators, and is assumed to be 50 tonnes/year, in line with requirements from a similar CCGT CCP project. Diesel is assumed to be used in the emergency generators and fire suppression system (including testing). The net calorific value for diesel is taken from Digest of UK Energy Statistics (Dukes) produce by DESNZ.
- Auxiliary electrical load is based on the Power Consumption Summary developed by the AECOM design team. It is assumed this load is provided from power generated at the Proposed Installation rather than being imported from the national grid.

The assessment was based on a worst case 100% runtime and is presented in table 16 below and represents the total for two trains running without carbon capture.

Table 16. Estimated Global Warming Potential (Unabated)

Energy Source	Energy at Primary Source (MWh)	CO ₂ Factor (kg CO ₂ e / kWh)	Emissions (tCO ₂ e/yr)
Natural Gas	19,009,200	0.20489	3,894,795
Diesel/HVO	813	0.25953	211
Parasitic Load	3,153,600	0.1770	558,187
TOTAL			4,453,193

As the Proposed Installation will be operated in abated mode during normal operations and achieve a 95% capture rate (during normal operation), the annual GWP for abated operations (100% run time) would be reduced to 222, 660 tCO₂e/yr.

8. Commissioning, Decommissioning and Closure

8.1 Commissioning

Prior to the commencement of plant commissioning the Operator will ensure that any pre-operational conditions are discharged including:

- Provision of the final design layout and arrangements of the plant which is being constructed. This will ensure that NRW has the final 'as built' arrangements for site layout and drainage.
- Provision of a written commissioning plan including the timescales for completion. The plan will include the stages of commissioning, the durations of expected commissioning activities, the expected emissions to the environment, the actions that will be taken to protect the environment and the arrangements to report to NRW in the event that expected emissions are exceeded or permit conditions cannot be met.

8.2 Decommissioning and Closure

A plan for appropriate decommissioning and closure of the Proposed Installation at the end of its operating life will be developed by the Operator. The plan will ensure that the site is returned to the baseline condition.

Decommissioning would be undertaken safely, in line with specific procedures and subject to risk assessment and permit to work schemes, and with regard to the environmental legislation at the time of decommissioning. The required licences and permits would also be acquired.

Decommissioning of the power plants would likely involve leaving underground infrastructure such as pipelines, piles, foundations, culverts and drainage in situ and making them safe. All above ground infrastructure associated with the Project would likely be dismantled and all materials removed would be reused or recycled where possible or disposed of in accordance with relevant waste disposal regulations at the time of decommissioning. Land would be restored to a satisfactory state.

When the Proposed Installation is decommissioned and taken permanently out of service, the following steps will be taken:

1. Reduce waste inventory to zero by treating or shipment off site.
2. Shut and cool down the process equipment and make safe.
3. Purge all plant piping and equipment with nitrogen to assure that the atmosphere in the vessels is below the lower explosive limits (LEL).
4. Close battery limit valves for all connecting services, including natural gas, cooling water supply, cooling water return, nitrogen, wastewater and demineralised water.
5. Drain all water streams (cooling water) to the sump.
6. Remove a spool section or install blind flanges on all connecting services, including natural gas, cooling water supply, cooling water return, nitrogen, wastewater, and demineralised water.
7. Drain all chemicals and lubricants for all machinery items (compressor) and reclaim for re-use or dispose of in a legal manner.
8. Remove all process catalysts and absorbents and ensure they are appropriately packaged and labelled for transport, with materials sent for reclamation and re-use where practicable, or otherwise disposed of in a legally compliant manner.
9. Remove all remaining wastes, by-products and raw materials from site to either reuse or dispose of in legal manner according to the site waste management plan.
10. Lock out, tag out and disconnect all electrical sources.
11. Dismantle all interconnecting process piping.
12. Remove process modules and enclosures and transport for re-use at another site, or for dismantling and reclaim in a legal manner. In some cases, for example tanks for reuse, may constitute large loads

13. At end of life the plant may be dismantled in-situ and transported for disposal from the facility. Plant may also remain at site for a period of time until a new location has been determined.
14. Document the presence of underground piping and cut and cap at ground level.
15. Take samples of soil and groundwater as necessary to show site is in a 'satisfactory state'.
16. Perform any additional close out requirement documentation as may be outlined in the final EPR permit.
17. Document in site condition report.

Appendix A Site Condition and Baseline Report

Appendix B ISO 14001 Certificate & HSSE Policy

Appendix C BAT Assessments

- C1 Large Combustion Plant BAT Assessment
- C2 Carbon Capture BAT Assessment
- C3 Energy Efficiency BAT Assessment
- C4 Cooling BAT Assessment

Appendix D Material Safety Data Sheets

Appendix E Qualitative Environmental Risk Assessment

Appendix F H1 Assessment

Appendix G Air Quality Assessment

Appendix H CO₂ Management Plan

Appendix I Noise Assessment

Appendix J Noise Management Plan

Appendix K CHP Readiness Assessment

