Table of Contents

Diagrams

Tables

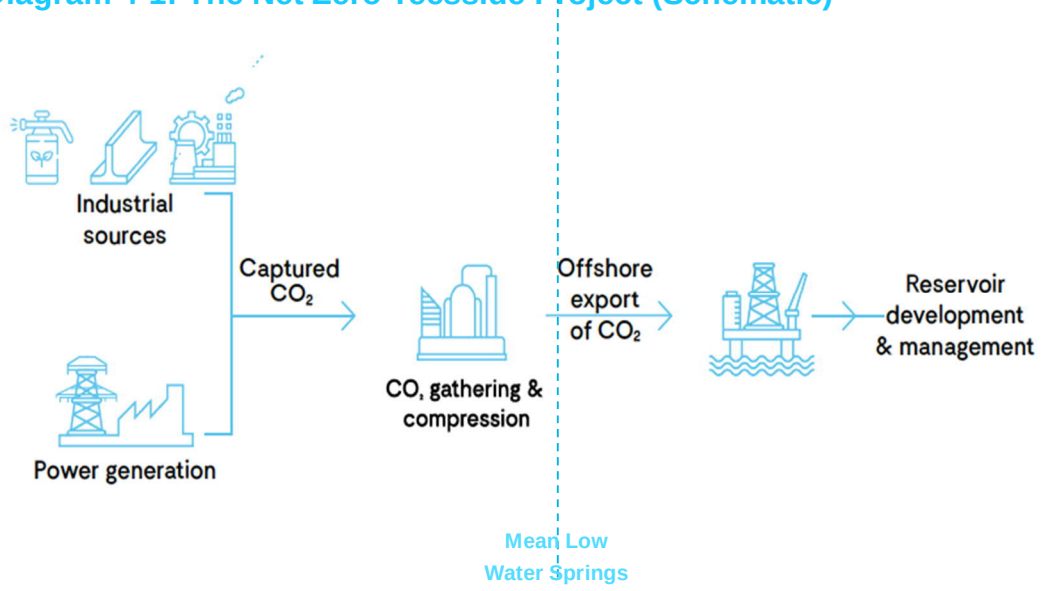
4. Proposed Development

4.1 Introduction and Project Overview

4.1.1 The Proposed Development comprises the construction and operation (including maintenance) and decommissioning of a Carbon Capture Usage and Storage (CCUS) facility comprising a gas-fired generating station with an electrical output of up to 860 MWe, together with equipment required for the capture and compression of carbon dioxide (CO_2) emissions from the power generating station. In addition, there is a need for the provision of supporting infrastructure and connections to support the power generating station and to facilitate the development of a wider industrial carbon capture network on Teesside, the construction of which also forms part of the Proposed Development. The Proposed Development also includes high-pressure compression of CO_2 and the onshore section of a pipeline to export the captured CO_2 for off-shore storage.

4.1.2 The Proposed Development forms the onshore part of the wider Net Zero Teesside (NZT) Project. A schematic of the overall NZT Project including the Proposed Development is shown in Diagram 4-1. Specifically, the Proposed Development to which the Application and supporting Environmental Statement (ES) relates covers all works associated with the Project down to Mean Low Water Springs (MLWS). This includes the initial section of CO_2 export pipeline as well as replacement or maintenance of an effluent outfall into the Tees Bay.

Diagram 4-1: The Net Zero Teesside Project (Schematic)



4.1.3 Whilst the Proposed Development is designed for the future collection and sequestration of CO_2 from third-party industrial emitters, the capture and compression at source of third-party CO_2 emissions from these locations before entering the proposed CO_2 Gathering Network does not form part of

the Application and is not considered in this ES. Development of these third party carbon capture and compression facilities will be the subject of separate consent applications by the operators of these facilities which will, if necessary require separate environmental impact assessments including assessments of cumulative and combined effects.

4.1.4 As discussed in Section 4.8, works below MLWS associated with the construction and operation of the wider Project do not form part of the Application. NZNS Storage will also be responsible for the offshore elements of NZT, comprising the offshore section of the CO_2 export pipeline (below MLWS) to a suitable offshore geological CO_2 storage site under the North Sea, CO_2 injection wells and associated infrastructure.

4.1.5 The consent application for the offshore works is currently being progressed and will be supported by a separate Environmental Impact Assessment (EIA). Nevertheless, it is recognised that the onshore and offshore works together comprise the wider Project. Therefore, the combined effects of the onshore and offshore works in the vicinity of Tees Bay are considered in Chapter 14 Marine Ecology and Chapter 24 (ES Volume I, Document Ref. 6.2). Combined effects with the wider off-shore scheme are considered in Appendix 24C: Statement of Combined Effects (ES Volume III, Document Ref. 6.4). As the offshore EIA is still being developed, there is currently limited information available on the offshore effects, so the Statement of Combined Effects Report that accompanies the Application is relatively high level but provides information to allow consideration of the likely significant effects of the wider off-shore scheme. The offshore EIA will be submitted Q2 2022 for approval Q1 2023, in support of the separate offshore consent application.

4.2 Proposed Development

4.2.1 The Proposed Development includes the following components (references to "Work No." is to the corresponding work number in Schedule 1 to the Draft Development Consent Order (DCO) (Document Ref. 2.1) and as shown on the Work Plans (Document Ref. 4.4):

- A new build low-carbon gas-fired generating station with associated carbon capture plant, low pressure CO_2 compression and associated utilities and buildings (**Low-Carbon Electricity Generating Station, Work No. 1**), comprising:

  Work No. 1A. Combined Cycle Gas Turbine (CCGT) Plant;

  Work No. 1B. Cooling Infrastructure for the CCGT;

  Work No. 1C. Carbon capture and low pressure compression plant for the CCGT;

  Work No. 1D. Administration, control room and stores; and

  Work No. 1E. Ancillary works in connection with Work Nos. 1A, 1B, 1C and 1D.

- Natural gas pipeline to supply the Low-Carbon Electricity Generating Station (**Natural Gas Connection Corridor, Work No. 2A**) and (**Above Ground Installation, Work No. 2B)**;
- Electrical power export lines from the Low-Carbon Electricity Generating Station sub-station on the PCC Site to a new NZT substation to be constructed adjacent to the existing National Grid Electricity Transmission (NGET) substation at Tod Point. The existing Tod Point sub-station will also be extended by the addition of bays to the north and south of it (**Electrical Connection, Work No. 3A and Work No. 3B**);
- A connection corridor to public utility raw water supply infrastructure, for the provision of water for the Proposed Development (**Water Supply Connection Corridor, Work No. 4**);
- Water discharge using an existing or replacement outfall and associated pipework for the discharge of treated effluent and surface water to Tees Bay (including a potential pipeline connection for transportation of process water to Bran Sands Waste Water Treatment Plant and return for discharge) (**Water Discharge Connection Corridor, Work No. 5**);
- Gaseous phase medium pressure CO_2 Gathering Network for the purpose of connecting various industrial installations across the Tees Valley (**CO_2 Gathering Network Corridor, Work No. 6**);
- High Pressure CO_2 Compression facilities (**HP Compressor Station, Work No. 7**);
- High pressure dense-phase CO_2 export pipeline (**CO_2 Export Pipeline Corridor, Work No. 8**);
- Temporary Construction and Laydown Areas (**Laydown Areas, Work No. 9**); and
- Access and Highway Improvements (Access and Highways Improvement Works, Work No. 10).

4.2.2 The Low-Carbon Electricity Generating Station together with the associated Carbon Capture and Compression facilities are referred to as the “PCC Site” in this ES. Further details of the Proposed Development are set out in Section 4.3 and Figures 3-2A to E in ES Volume II, Document Ref. 6.3.

4.2.3 The Proposed Development is a ‘First Of A Kind’ for this type of infrastructure project. Consequently, at this consenting stage of the project, the design of the Proposed Development needs to incorporate a degree of flexibility in the technology used and the dimensions and configurations of buildings and structures to allow for the future selection of the preferred technology and contractor(s).

4.2.4 In order to ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development therefore, the EIA is being undertaken adopting the principles of the ‘Rochdale Envelope’, where appropriate. This involves assessing the maximum (or where relevant,

minimum) parameters for the elements where flexibility needs to be retained (such as the building dimensions or operational modes for example). Where this approach is being applied to the specific aspects of the EIA, this is confirmed within the relevant chapters of this ES.

4.2.5 Justification for the need to retain flexibility in certain parameters is outlined in this chapter and also in Chapter 6: Alternatives and Design Evolution (ES Volume I, Document Ref. 6.2). As such, this ES represents a reasonable worst-case assessment of the potential impacts of the Proposed Development at its current stage of design.

4.2.6 Construction of the Proposed Development is detailed in Chapter 5: Construction Programme and Management (ES Volume I, Document Ref. 6.2). At this stage in the project development a detailed construction programme is not available as this is normally determined by the contractors which have not yet been appointed. However, an indicative construction programme is presented within Chapter 5: Construction Programme and Management (ES Volume I, Document Ref. 6.2) on which the potential environmental effects of the Proposed Development have been assessed.

4.2.7 Should a DCO be granted for the construction, operation and decommissioning of the Proposed Development (which at this stage is anticipated to be late-2022 at the earliest), then, subject to final investment decision, construction is likely to commence 2023 (following the commencement of site preparation and remediation works, expected to be by Teesworks, the landowner). It is anticipated that operation of the Proposed Development would commence in 2026.

4.2.8 It is envisaged that the PCC Site will have an expected design life of around 25 years. At the end of the expected design life, these elements would be assessed for ongoing viability and, only if no longer viable, be decommissioned. It is therefore anticipated that, at the earliest, decommissioning of the PCC Site would be expected to commence at some point after 2051. This ES has assumed that the Proposed Development could operate for longer than a 25 year design life, and in relevant chapters has considered and assessed the potential for operational impacts / effects to continue beyond this timeframe.

4.2.9 The CO_2 Gathering Network and CO_2 Export Pipeline have been designed to operate independently of the PCC Site and will have a design life of around 40 years.

4.2.10 This chapter is supported by Figures 3-2A to E (ES Volume II, Document Ref. 6.3), which show the layout of the Proposed Development. In addition, Figures 4-1 and 4-2 (ES Volume II, Document Ref. 6.3) show an indicative layout of the PCC Site and the location of the proposed landscaping and biodiversity areas.

4.3 Components of the Proposed Development

Low-Carbon Electricity Generating Station

Overview

4.3.1 The proposed Low-Carbon Electricity Generating Station (Work No. 1) will be a gas fired generating station comprising a single high efficiency CCGT unit. The location of the Low-Carbon Electricity Generating Station is shown on Figure 3-2A in ES Volume II (Document Ref. 6.3). An indicative layout for the Low-Carbon Electricity Generating Station within the PCC Site is shown on Figure 4-1 (ES Volume II, Document Ref. 6.3).

4.3.2 Given the 'First-Of- A-Kind' nature of the Proposed Development, the design assessed in this ES is based on a range of the most likely CCGT equipment to be used and most likely licensor designs for the carbon capture plant. This means that the likely range of electrical output of the Low-Carbon Electricity Generating Station for the PCC Site is significant.

4.3.3 In unabated mode (without carbon capture) power output could range from around 650 MWe to over 850 MWe. Since power outputs increase with cooler ambient temperatures, the maximum outputs for any chosen configuration can periodically be higher than this. However, the upper limit on power output is ultimately limited by the grid connection, which is rated at 860 MWe.

4.3.4 In abated mode, when the carbon capture plant is in operation, the auxiliary loads are considerable, and the net output reduces and accordingly the range of carbon-abated export power is likely to be in the range of around 580 MWe to 760 MWe.

4.3.5 In accordance with Rochdale Envelope principles, for the purposes of this Application, the Low-Carbon Electricity Generating Station is therefore described in this document as having a "nominal output of up to 860 MWe unabated (760 MWe abated)".

4.3.6 The integrated power generation and carbon capture facilities within the Low-Carbon Electricity Generating Station (the Site) will comprise:

- a gas turbine;
- a heat recovery steam generator (HRSG);
- a steam turbine (collectively the turbines and HRSG comprise a CCGT);
- gas and steam turbine buildings;
- gas turbine intake filters;
- selective catalytic reduction (SCR) equipment for the removal of nitrogen oxides (NOx) from the flue gas;
- absorber column for carbon capture;
- solvent regenerator / CO_2 stripper enabling re-concentration of the solvent and liberation of atmospheric CO_2;

- CO_2 treatment and low pressure compression;
- mechanical draught cooling towers;
- gas reception facility;
- auxiliary boilers and/or diesel generators;
- a stack for the discharge of treated flue gas from the absorber column plus stacks discharging emissions to air from the HRSG and auxiliary boiler;
- continuous emissions monitoring system;
- onsite substation adjacent to new power generation facility;
- transformers (for the import and export of electricity);
- deaerator and feed water pump buildings;
- chemical sampling/dosing plant;
- demineralised water treatment plant, including storage tanks; and
- ancillary equipment (including compressors, pumps, chemical storage facilities, fan coolers, water treatment plant and pipework etc.).

4.3.7 The electrical, steam, steam condensate and water circuits between the power generation and capture plant will be integrated as far as is technically practicable in order to reduce energy use. For example, steam will be extracted from the HRSG for use in the capture plant and, once used, condensed and returned to the HRSG for re-use. However, consideration has also been given to the potential for export of usable waste heat from the Proposed Development to third party users (known as Combined Heat and Power (CHP)) – see the Combined Heat and Power Assessment (Document Ref. 5.8).

Power Generation

4.3.8 Natural gas supplied by the Natural Gas Connection (Work No. 2) that has been conditioned offsite (by others) to the required temperature and pressure will be combusted in the CCGT. The gas turbine selected will be provided with dry low-nitrogen oxides (NOx) burners to minimise the formation of NOx. Potentially, SCR will be used to reduce this even further before the gas passes into the carbon capture process – see 4.3.14.

4.3.9 Following combustion in the gas turbine, the hot gases that are produced are directed through the turbine section where they will expand across the blades of the turbine causing it to rotate and drive an electrical generator. The gas turbine exhaust gases are passed through the HRSG to recover the useful heat within them in order to produce steam (at various pressures) which is used to generate further power via a separate steam turbine, and for heating of process streams within the carbon capture unit.

4.3.10 The steam exhausting from the steam turbine 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 extremely 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 (known as boiler blowdown) intermittently. Any blowdown removed from the cycle will need to be made up with fresh demineralised water.

4.3.11 The condensation of steam exiting the steam turbine will be achieved using a separate circuit of cooling water that is recirculated through mechanical draught cooling towers which are lower in height than traditional natural draught cooling towers. These can give rise to visible plumes of water vapour dependent on the ambient weather conditions. A short visible plume may be present for the majority of the time once the Proposed Development becomes operational. However, the proportion of time that the visible plume is predicted to extend beyond the boundary of the Low Carbon Electricity Generating Station site (taken as being approximately 100 m from the emission source for the purposes of the assessment) is less than 1% (see Appendix 8B, ES Volume III, Document Ref. 6.4).

4.3.12 The need for an auxiliary boiler will be considered in further design studies at the front-end engineering design stage. If required, the 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. Exhaust emissions from the auxiliary boiler would be via a dedicated stack. An inline electrical heater would also be used to heat the fuel gas to the gas turbine prior to the availability of steam during start-up.

4.3.13 Emergency diesel generators may need to be installed in order to provide a short-term source of electricity, in the event of a simultaneous loss of power generation and external power supply, to provide power for emergency and safety critical equipment until external power can be re-established.

Selective Catalytic Reduction

4.3.14 Combustion of natural gas is highly efficient, and, due to the composition of the gaseous fuel, the combustion gases from a CCGT contain negligible amounts of sulphur dioxide (SO_2) and particulate matter. In addition, the optimisation of combustion within a gas turbine is well understood, such that the emissions of NOx 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.

4.3.15 In August 2017, revised Best Available Techniques (BAT) Conclusions for Large Combustion Plants were published (European Commission, 2017), which set out the Achievable Emission Levels (AEL) for combustion plant, including new CCGTs. Achievement of these AELs in high efficiency CCGT units may require secondary abatement measures to be used in addition to the primary control measures such as use of dry low-NOx burners. In addition, NOx concentrations in the flue gases entering the carbon capture plant need

to be minimised to prevent the degradation of the solvent within the carbon capture process and in order to optimise CO_2 capture efficiency.

4.3.16 Secondary NOx abatement in the form of SCR will therefore be required to control NOx levels entering the carbon capture system. SCR is a secondary abatement technique involving either the injection of urea or ammonia into the flue gas to react with any NOx present in the presence of a catalyst. The SCR equipment, will be installed within the HRSG, as is common practice within the power industry.

4.3.17 The level of NOx removal required is the subject of on-going technical studies regarding the capture plant and emission limits that will be required to be met from the Generating station and will be partially dependent upon the sensitivity of the carbon capture solvent to NOx. These studies will seek to optimise the operation of a plant in order to maximise carbon capture efficiency and minimise emissions and waste.

4.3.18 The assessment of NOx emissions presented in Chapter 8: Air Quality (ES Volume I, Document Ref. 6.2) has assumed NOx emissions at the BAT-associated emission levels (BAT-AELs), set out in the BAT Reference Document for Large Combustion Plants (European Commission, 2017).

4.3.19 In a conventional CCGT plant, the flue gas from the HRSG is released to atmosphere from an exhaust stack. However, in this plant the flue gas from the HRSG will be ducted directly into the carbon capture plant for the removal of carbon dioxide from the gas stream. However, there will still be a stack located between the HRSG and the capture plant for use at times when the carbon capture plant is not operational, and the plant is operating in unabated mode.

Carbon Capture Plant

4.3.20 The CCGT will be served by a dedicated carbon capture plant. The carbon capture plant will include:

- flue gas pre-treatment, including cooling/scrubbing;
- flue gas blower;
- CO_2 absorption column (absorber);
- CO_2 removal column (stripper/regenerator); and
- ancillary equipment (including heat exchangers, pumps, chemical storage, water treatment plant and associated inter-connecting pipework).

4.3.21 The carbon capture plant will be designed to capture up to approximately 95% by weight (w/w) of the CO_2 emitted from the CCGT. This could equate to a capture of around 1.7 to 2 million tonnes of CO_2 per year, dependent upon the turbine equipment chosen and the dispatch load factor of the power plant. The minimum capture efficiency for the plant will be 90%.

4.3.22 Prior to their introduction into the absorber column, the flue gases from the CCGT will be cooled to the required design temperature (approximately 40°C)

potentially by using a direct contact cooler/flue gas quencher that contacts the hot flue gases with a fine water spray in a packed column.

4.3.23 Once cooled, the flue gases from the CCGT will be introduced to an absorber column. In the column, the flue gases will pass through a solvent that will remove the CO_2 from the gas stream. The solvent to be used is the subject of on-going technical studies but is likely to be an aqueous solution of amines. The alkaline nature of the solvent will mean that it will selectively absorb acidic gases such as CO_2.

4.3.24 Even with the use of SCR technology, it will not be possible to entirely remove NOx or other impurities from the flue gases from the generating station, therefore, some solvent will periodically need to be purged and made-up with fresh solvent.

4.3.25 The CO_2 lean flue gases (treated flue gas) will exit from the top of the absorber column via a dedicated stack for dispersion to the atmosphere. A flue gas washing unit is usually located as a separate stage within the absorber column to remove entrained solvent from the flue gases prior to release. A series of wash stages may be required on the absorber comprising water wash and acid wash steps so as to effectively remove amines and ammonia emissions from the flue gas before it is discharged to atmosphere. The number and nature of the wash steps will be determined based on the solvent selected for the carbon capture plant.

4.3.26 CO_2 rich solvent from the absorber will pass from the bottom of the absorber column to a stripper column for regeneration. The stripper column uses heat to release the CO_2 from the solvent. The hot CO_2 lean solvent then leaves the stripper column and is recirculated, likely via a heat exchanger, back to the top of the absorber column.

4.3.27 The CO_2 gas exiting the top of the stripper column will be passed through a condenser to remove water and solvent vapours. The CO_2 stream will then pass to the CO_2 conditioning/compressor unit.

CO_2 Conditioning and Low Pressure Compressor Unit

4.3.28 The gas CO_2 stream from the capture plant will be saturated with water and will contain traces of oxygen which will need to be reduced in a gas conditioning facility. The conditioning equipment/processes are the subject of on-going technical studies; however, it is envisaged that the captured CO_2 stream will be cooled and partly compressed before the trace oxygen and water are removed.

4.3.29 Once compressed, treated and metered, the CO_2 stream will be at a low pressure between 12 and 20 bar above ambient pressure (barg) and will enter the part of the medium pressure CO_2 Gathering Network within the PCC Site. No on-site storage of compressed CO_2 will be required.

Water Treatment

4.3.30 A water treatment plant will be needed to treat the water feed to the plant to remove dissolved solids present and provide make-up water to the

steam/water cycle, cooling water system, fire water system and for dilution of make-up solvent within the capture plant.

4.3.31 In addition, wastewater treatment will be required for treatment of process effluent from the flue gas quencher and generating station prior to discharge to the environment. Two options are under consideration for the approach to wastewater treatment.

4.3.32 The first option is that the process effluent will be treated on site to an appropriate standard using a wastewater treatment plant (WwTP) and then discharged to Tees Bay via the outfall. The alternative wastewater treatment option under consideration is that the process effluent flow will be directed to Northumbrian Water Ltd (NWL) Bran Sands WwTP via a new dedicated pipeline for treatment there prior to discharge. The treated effluent may be returned by a new return pipeline to the PCC Site for discharge to Tees Bay via the outfall or discharged to the Dabholm Gut from the existing consented outfall for the Bran Sands WwTP.

4.3.33 Wastewater treatment in the Bran Sands facility will be a techno-commercial arrangement and may not be fully agreed until a later stage in the project development.

4.3.34 Other effluent streams, including potentially contaminated surface water, process water from CO_2 compression and blowdown from cooling towers and boilers, will be subject to re-use where practically possible and when not possible, on-site treatment (e.g. by chemical dosing) followed by retention prior to discharge to the outfall. The exact treatment for these streams will be determined during Front-End Engineering Design (FEED).

CO_2 Gathering Network

4.3.35 The UK Government published its Clean Growth Strategy in October 2017 (amended April 2018) (BEIS, 2017) which included CCUS as part of the strategy for decarbonisation. Net Zero Teesside (and prior to that the Teesside Collective) has been actively engaged in the development of industrial CCS solutions for some time in the area identified for the Proposed Development.

4.3.36 It is intended that the Proposed Development facilitates future third-party industrial carbon capture connections to the off-shore storage site. This is to be achieved through the installation of the CO_2 Gathering Network (Work No. 6) across the surrounding area, to allow different users to connect CO_2 streams into the Network.

4.3.37 The capture and compression of CO_2 from third-party industrial emitters at source does not form part of the Application and is not considered in this ES but will be the subject of separate consent applications as and when investment decisions are made by third-party operators to connect into the CO_2 Gathering Network infrastructure.

4.3.38 The potential routeing of the initial phase of the CO_2 Gathering Network is shown on Figure 3-2E in ES Volume II (Document Ref. 6.3).

4.3.39 The CO_2 Gathering Network will predominantly use an existing above ground pipe racking network and using existing culverts and overbridges. The CO_2

Gathering Network is proposed to start in Billingham, pass through the Seal Sands industrial area and cross under the River Tees before entering the PCC Site for high pressure (HP) compression.

4.3.40 The routeing of the CO_2 Gathering Network across the River Tees will be either:

- via a micro-bored tunnel from Seal Sands directly to the PCC (and shared with the Natural Gas Connection) and then below ground along the southern side of the Teesworks Spine Road to the PCC Site; or
- installed using a horizontal directional drilled (HDD) bore from Seal Sands to the northern bank of the mouth of Dabholm Gut and then above ground along the northern bank of Dabholm Gut past Bran Sands Wastewater Treatment Plant and then north to the PCC Site (see Figure 5-2, ES Volume II, Document Ref. 6.3).

4.3.41 The selection of the Tees crossing method will be dependent on an assessment of complexity, land availability, constructability, risk assessments, safety and cost-effectiveness.

4.3.42 It will also be necessary to run a fibre-optic control cable for control of the CO_2 Gathering Network from the north bank of the Tees to the PCC Site. This will either cross the Tees via the micro-bored tunnel or, if this option is not used, using an existing services tunnel beneath the Tees.

4.3.43 On a few occasions during the lifetime of the onshore facilities there may be the need to vent some or all of the medium pressure CO_2 in the Gathering Network to atmosphere. Any venting will be a planned activity and will be managed in such a way so as to not exceed acceptable noise limits at residential properties.

CO_2 Export

4.3.44 The export of CO_2 from Teesside to the Endurance store will include an onshore high-pressure (HP) Compressor Station located within the PCC Site adjacent to the Low-Carbon Electricity Generating Station, and the commencement of an export pipeline to the off-shore elements of the Net Zero Teesside (NZT) Project development.

4.3.45 The offshore CO_2 export and storage elements below Mean Low Water Springs (MLWS) will be separately consented and do not form part of the Proposed Development – including the offshore section of the CO_2 Export Pipeline, the CO_2 store itself and CO_2 injection wells into the store and the associated off-shore infrastructure (either platform or subsea or combination thereof) (see Section 4.8).

High Pressure Compressor Station

4.3.46 The HP Compressor Station will be the collection point for CO_2 from the medium pressure CO_2 Gathering Network (including CO_2 from the PCC).

4.3.47 The Compressor Station will consist of inlet metering and compression facilities. CO_2 will be compressed from a pressure of around 12 barg at the

inlet to a pressure between 120 to 190 barg ('dense phase') prior to introduction into the CO_2 Export Pipeline.

4.3.48 The HP Compressor Station will be located on land adjacent to Coatham Dunes to minimise the on-shore length of the high-pressure CO_2 Export Pipeline. The location of the Compressor Station is shown on Figure 3-2A and on Figure 4-1 in ES Volume II (Document Ref. 6.3).

4.3.49 The design life of the HP Compressor Station is longer than the power and capture elements of the Proposed Development. During operation of the Low-Carbon Electricity Generating Station, power for the HP Compressor Station (30 MWe) will be supplied from the generating station with back-up from National Grid's Tod Point substation. After the Low-Carbon Electricity Generating Station has been decommissioned power for the HP Compressor Station will solely come from Tod Point substation.

CO_2 Export Pipeline

4.3.50 The conditioned and compressed CO_2 will be transported off-shore via a new pipeline that will direct the dense phase fluid to the subsurface storage site. The storage site will be located in the Endurance underground storage reservoir beneath the North Sea located approximately 145 km to the east/south-east of the Proposed Development. Endurance is the UK's largest and most well-understood saline aquifer for carbon storage.

4.3.51 The route corridor considered for the onshore and to MLWS section of the CO_2 Export Pipeline to be consented by the DCO is shown in Figure 3-2A in ES Volume II (Document Ref. 6.3).

4.3.52 The section of the CO_2 Export Pipeline included in the DCO application will start within the PCC Site boundary at the HP Compressor Station and pass under the private road to South Gare, under Coatham Dunes and Sands to MLWS. To facilitate this, the pipeline will need to pass under parts of the Teesmouth and Cleveland Coast Special Protection Area (SPA)/Ramsar and the Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI).

4.3.53 The on-shore and near shore section of the CO_2 Export Pipeline will have an indicative diameter of up to 800 millimetres (mm) and will be installed below ground using trenchless techniques, with the depth increasing for areas below key receptors or infrastructure e.g. South Gare Road and Coatham Dunes/Coatham Sands.

4.3.54 Although the current project will allow storage of up to 4 million tonnes per annum (TPA) of CO_2, the export pipeline will be sized to allow up to 10M TPA of CO_2 to be stored. This will provide sufficient capacity for future additional connections from industrial emitters to the CO_2 Gathering Network and for potential future expansion of the Power and Capture plant should this be required.

4.3.55 It will be necessary to run power and fibre-optic control cables from the PCC Site to the off-shore installation and to a remote isolation valve. These will be installed at the same time as the CO_2 Export Pipeline using separate trenchless crossings.

4.3.56 The offshore works associated with construction and operation of the CO_2 pipeline beyond MLWS and operation of the off-shore storage facility will be consented separately supported by a separate EIA (see Section 4.8[1]). Environmental effects from the construction and operation of the off-shore elements of the Project are considered in in Appendix 24C: Statement of Combined Effects (ES Volume III, Document Ref. 6.4) and in the cumulative impact assessment in this ES for the Proposed Development as presented in Chapter 24: Cumulative and Combined Effects (ES Volume I, Document Ref. 6.2).

4.3.57 The Endurance geological storage facility will be operated under a licence from the Oil and Gas Authority (OGA) and regulated by the OGA under a storage permit.

Other Connections

Natural Gas Connection

4.3.58 Natural gas will be used as the fuel for the operation of the Low-Carbon Electricity Generating Station. Subject to agreement with National Gas Grid (NGG), natural gas will be supplied via a tie-in to the gas transmission network in the area (Work No. 2) on the north bank of the Tees at Seal Sands with subsequent transport through a new 24" buried gas line. This option requires a crossing of the Tees direct to the STDC site via a new tunnel shared with the CO_2 Gathering Network. Upon exit from the tunnel the new gas pipeline terminates at the PCC with a new gas receiving facility (Above Ground Installation (AGI)).

4.3.59 The route corridors being considered for connection to the high-pressure transmission system are shown in Figure 3-2B in ES Volume II (Document Ref. 6.3).

4.3.60 The new gas pipeline will be installed below ground using a combination of open-cut and trenchless technologies, depending on the constraints or crossings required.

4.3.61 Two new co-located AGIs will be constructed next to the existing NGG facility at Seal Sands. The first (NGG) AGI will receive the natural gas from the newly created tie-in to the existing NGG pipeline; in turn this will cross feed to the second new (NZT) AGI and then on into the new 24" buried gas line described above. The new NZT AGI will include metering, isolating valves and Pipeline Inspection Gauge ("pig") launcher.

4.3.62 The project has identified two alternative routes for the new gas supply which will be further developed during the design phase:

- the outlet from the new NZT AGI gas could be routed into the existing, disused 24" Trafigura pipeline which runs between the Tees Gas Processing Plant (TGPP) on Seal Sands to the Navigator Terminal. At this location a tie-in will be constructed (new AGI with pig receiver)

[1] Note: Land between MHWS and MLWS is covered by both the DCO and Marine Licensing regimes

which then connects (via a new AGI with pig launcher) into the new 24" gas line and into the new tunnel and on to STDC as described above. At present the Trafigura line is under long term preservation and detailed assessment will be undertaken to understand the re-use of this pipeline.

- the outlet from the new NZT AGI could be fed into the existing, disused 24" Sembcorp gas line which runs through North Tees. The existing Sembcorp pipeline crosses the river Tees and lands on the north bank of Dabholm Gut and runs on to Wilton site on the South Tees. At a point near the NWL Bran Sands WwTP, a new tie-in will be constructed which then connects via a new AGI into a new gas pipeline which could run to the STDC site to the new gas receiving station via a wayleave to the South of the NWL Bran Sans WwTP. At present the Sembcorp line is under long term preservation and detailed assessment will be undertaken to understand the re-use of this pipeline. In the event the Sembcorp tie-in is adopted, as this is located on the south bank of the Tees there will be no requirement for a tunnel under the Tees.

4.3.63 The choice of gas connection will be based on techno-commercial considerations and will be made in 2022.

Electrical Connection

4.3.64 The existing electrical infrastructure in the Teesside area comprises 275 kilovolt (kV) and 400 kV overhead lines as well as lower voltage above and below underground cables that serve the existing National Grid Electricity Transmission (NGET) substation at Tod Point.

4.3.65 The proposed Electrical Connection (Work No. 3A) for the import/export of electricity will be between the substation forming part of the Low-Carbon Electricity Generating Station (Work No. 1) and NGET's Tod Point substation 1.3 km to the south (see Figures 3-2C and 5-3 in ES Volume II, Document Ref. 6.3) and the Electrical Connection Plans (Document Ref. 4.8).

4.3.66 The Electrical Connection (Work No. 3A) will comprise a 275 kV single circuit cable route and control system cables connecting the substation on the PCC Site into a new NZT owned Electrical Substation (Work No. 3B) adjacent to the existing NGET 275kV Tod Point substation (also within Work No. 3A). The electrical connection works will also involve NGET extending its Tod Point substation by adding new bays to the existing Tod Point substation compound. This extension to the NGET substation is included in Work No. 3B.

4.3.67 Two possible routeings for the Electrical Connection (1A and 1B) are shown on Figure 5-3 (ES Volume II, Document Ref. 6.3) and the Electrical Connection Plans (Document Ref. 4.8). These two options only relate to the routeing of the cables across part of the Teesworks site and crossing the rail line and are due to uncertainty in the timing and exact location of third party infrastructure being developed in this part of the Site by the site operator and the York Potash project. This infrastructure will be used to facilitate the crossing of the Tees Valley railway line by the Electrical Connection for the Proposed Development.

4.3.68 The remainder of the corridor for the Electrical Connection is broad in parts due to the fact that the site is the subject of development proposals by Teesworks which are still being worked up and designed in detail, and the Electrical Connection routeing needs to be flexible to fit with the development that actually comes forward.

4.3.69 All electrical and control system cables will be installed below ground or at ground level (with a crossing over the railway line) - no new overhead transmission lines are proposed as part of the works. The proposed Electrical Connection corridor and proposed location of the new electrical substation are shown on the Electrical Connection Plans (Document Ref. 4.8). These plans also show the indicative layout and elevation of the new NZT electrical substation and the extension to the existing NGET substation. NGET will be responsible for adding new bays to the existing Tod Point substation; such works would be within the existing Tod Point substation compound. The area required for the new electrical substation and the extension to the adjacent NGET Tod Point substation are both within Work No. 3B and Work No. 3A as illustrated on the Works Plans (Document Ref. 4.4) to facilitate the construction of the connection between them.

4.3.70 The maximum parameters for the new electrical substation are specified in Table 4-1 below. Within Work No. 3B the exact location of the proposed new electrical substation is not currently known as this will be dependent on which of the connection options (1A or 1B) is selected (which is dependent on any development proposals which come forward within Work 3A) and detailed design. Therefore, the area covered by Work No. 3B is larger than required for the new electrical substation but the maximum parameters are as specified in Table 4-1 and the Design Parameters within the draft DCO.

4.3.71 Within the PCC Site a generating station substation will also be constructed. The indicative location in which it will be built within Work No. 1 and its maximum parameters are illustrated on The PCC Facility Plans (Document Ref. 4.6) and in Table 4-1. The area defined for the electrical connection within Work No. 1 is larger than required for the generating station substation to allow a degree of flexibility regarding its exact location but the maximum parameters are as specified in Table 4-1 and the Design Parameters within the draft DCO.

4.3.72 Environmental effects associated with the construction and operation of the Electrical Connection including the Electrical Substation Extension and generating station substation are assessed as part of this Environmental Impact Assessment – see Chapter 5 (Construction Programme and Management), Chapter 11 (Noise and Vibration), Chapter 17 (Landscape and Visual Amenity) and, for Electromagnetic Field (EMF) effects, Chapter 23 (Population and Human Health). No other potentially significant environmental effects have been identified associated with the proposed Electrical Connections and associated infrastructure. The worst case locations within Work Nos. 1 and 3B have been assessed for the effects of the substation infrastructure.

4.3.73 At the time of Application submission, NZT Power Ltd. and NGET have executed the bilateral connection agreement, construction agreement and

related document(s), thus confirming the planned connection date and sufficiency of capacity at the Tod Point substation to accommodate the export of electricity from the Low-Carbon Electricity Generating Station located within the PCC Site.

Water Supply Connection

4.3.74 Water make-up will be required to provide cooling for the Low-Carbon Electricity Generating Station and carbon capture plant. Demineralised water will also be required in order to provide make-up to the steam/water cycle of the Power and Capture plant. There will also be a requirement for water for domestic and sanitary use. The water source will be the existing NWL raw water supply to the Teesworks site.

Water Discharge Connections

4.3.75 The existing on-site outfall to the Tees Bay is proposed for the development. The outfall may require refurbishing or alternatively replacing on a new alignment adjacent to the CO_2 Export Pipeline. As replacement represents the worst-case option, both this and refurbishment are assessed in this ES.

4.3.76 Should the alternative that utilises the Bran Sands WwTP be selected, then a pipeline connection for the return of treated effluent from Bran Sands WwTP to the PCC Site will be included to enable the treated effluent to be discharged to the Tees Bay via the outfall.

4.3.77 Discharge of domestic/sanitary effluent would be to the local sewerage system for treatment with a tie-in on the Teesworks site being proposed. The current system is routed to Marske-by-the-Sea sewage treatment works.

4.3.78 The location of the Water Supply and Discharge Connections is shown on Figure 3-2D in ES Volume II, Document Ref. 6.3.

Chemical Storage

4.3.79 A number of chemicals will be required to be stored and used on the PCC Site. Some of these materials will be classed as hazardous. Where any substance could pose a risk to the environment through its uncontrolled release (e.g. surface water drains), the substance will be stored within appropriate containment facilities including impermeable concrete surfaces and appropriately designed and sized bunds.

4.3.80 The inventory of materials to be stored on the PCC Site will be finalised through the detailed design. However, where storage of hazardous materials, individually or in-combination exceeds the relevant thresholds, consent separate permissions will need to be sought from the Hazardous Substances Authority, Health and Safety Executive (HSE) and local planning authority for their storage, under the Control of Major Accident Hazards (COMAH) and Hazardous Substance Consent and COMAH regimes respectively. All chemical storage will be regulated by the Environment Agency through an environmental permit that will be required for the operation of the Proposed Development.

Design Parameters

4.3.81 The design of the Proposed Development is not yet finalised and will not be completed until the detailed design stage. However, the final design will be within the parameters assessed within this ES which will be retained in order to allow construction of the Proposed Development to progress from Q3 2022. The evolution of the Proposed Development to date is outlined in Chapter 6: Alternatives and Design Evolution (ES Volume I, Document Ref. 6.2).

4.3.82 Some of the design aspects and features of the Proposed Development cannot be confirmed until the Engineering, Procurement and Construction (EPC) contractor has been appointed. For example, the building sizes may vary depending on the contractor selected and their specific configuration and selection of plant. Focussed use of the Rochdale Envelope approach has therefore been adopted to define appropriate parameters for use in the EIA.

4.3.83 Table 4-1 sets out the maximum dimensions for the principal elements of the Proposed Development which have been used for the basis of the various technical assessments. Maximum and minimum parameters have been devised to enable the EIA to progress in the absence of the final design information and to enable the compilation of a robust assessment based on a reasonable and appropriate worst-case option. The parameters selected have been identified as sufficient to allow a robust worst-case impact assessment to be made in the individual assessments in Chapter 8 – 24 (ES Volume I, Document Ref. 6.2).

4.3.84 Existing ground levels at the proposed location of the PCC Site are approximately 4 to 8 m Above Ordnance Datum (AOD). Ground elevations post- site clearance and remediation are anticipated to be a maximum of 13 m AOD for the development platform. Existing ground levels at the proposed location of the Electrical Substation Extension (Work No. 3B) are assumed to be up to 10 m AOD.

4.3.85 The limits of deviation for the following aspects of the Proposed Development are as shown on Figures 3-2A-E (including optionality for the routeing of the Natural Gas Connection and CO_2 Gathering Network) and the Works Plans (Document Ref. 4.4):

- Low-Carbon Electricity Generating Station (including stack locations) (Work No. 1);
- Natural Gas Connection (Work No. 2A) and Above Ground Installation (Work No. 2B);
- Electrical Connection - including the electrical connection itself (Work No. 3A) and substation works at Tod Point (Work No. 3B);
- Water Supply Connection (Work No. 4);
- Water Discharge Connection (Work No. 5);
- CO_2 Gathering Network (Work No. 6);
- HP Compressor Station (Work No. 7);

- CO_2 Export Pipeline (Work No. 8);
- Construction Laydown (Work No. 9); and
- Highway Improvements and Access (Work No. 10).

4.3.86 The detailed design of the development will be secured by a Requirement in the DCO.

Table 4-1. Maximum Design Parameters

Component		Dimensions (m)		
		Length	Width	Maximum Height in Metres (mAOD)*
Gas Turbine Hall		76	76	30 (<43 mAOD)
HRSG Building		63	28	50 (<63 mAOD)
HRSG Stack		-	6.5 m inner diameter	85 m (<98 mAOD)
Steam Turbine Hall		64	54	30 (<43 mAOD)
Absorber Tower		35	25	80 (<93 mAOD)
Absorber Stack		-	6.5 m inner diameter	115 m (<128 mAOD)
Generating station substation (PCC Site)		130	120	29 m (<42 mAOD)
New NZT Electrical Substation (Tod Point)		80	60	12 m (<22 m AOD)
Extension to NGET Electrical Substation (Tod Point)	Northern Bay Extension	70	50	12 m (<22 m AOD)
	Southern Bay Extension	60	30	

* Heights above ordnance datum for the PCC Site assume a maximum development platform level of 13 m AOD following site clearance and associated earthworks. The minimum height of the absorber stack will be controlled by a Requirement.

4.4 Proposed Development Operation

Operational Modes

4.4.1 The Low-Carbon Electricity Generating Station is designed to be able to operate in either baseload or in a flexible (dispatchable) mode in the future.

4.4.2 Baseload mode power refers to power generation that generally runs continuously at high levels of power output throughout the year and whereby the CCGT plant is operated at stable power output levels. Dispatchable mode generation refers to highly flexible operation when the Low-Carbon Electricity

Generating Station will be on demand and dispatched according to market conditions and requirements needs.

4.4.3 A CCGT plant generating station capable of running in both baseload and dispatchable modes is:

- able to provide robust utility scale power throughout the year;
- responsive to seasonal demand fluctuation;
- responsive to daily demand fluctuation (flexible power);
- able to address renewables intermittency (in particular wind and solar) by replacing the electricity supplied by renewables at time of low renewable generation capacity; and
- able to adapt to a changing market in the future (i.e. an increase in renewables capacity).

4.4.4 It is anticipated that on commissioning, the Low-Carbon Electricity Generating Station will operate in baseload mode with continuous operation with carbon capture for several years. Continuous and stable CO_2 production and export is preferable during this period to minimise changes to injection rates to the offshore underground storage reservoir.

4.4.5 After a period of base-load operation, and after CO_2 within the wider gathering network has grown and stabilised, there is the opportunity for the Low-Carbon Electricity Generating Station plant to be able 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 the future power market. Operating in dispatchable mode could involve multiple start-up/shutdown cycles per year. Operations in baseload mode are considered the worst-case in terms of environmental impacts and have therefore been assessed in the ES.

Hours of Operation

4.4.6 The Low-Carbon Electricity Generating Station will be designed to operate 24 hours per day, 7 days per week with programmed offline periods for maintenance (see below for information on these).

Staff

4.4.7 It is anticipated that during the operational phase, the Proposed Development will generate approximately 60 - 100 full-time permanent jobs. Operations staffing will be on a shift basis to be spread over a 24-hour period.

4.4.8 Temporary and contractor employees associated with maintenance activities will also be employed at the PCC Site as required.

Process Inputs

4.4.9 The Proposed Development will use various raw materials during operation. Except for natural gas and water, it is anticipated these will be delivered to the facility in bulk transportation vehicles. Storage capacity on Site will be set to reflect the process requirements and delivery capability.

4.4.10 The Proposed Development will also use a number of chemicals during operation. These are anticipated to include:

- amine based solvent;
- urea or ammonia solution;
- water treatment chemicals (including sodium hypochlorite, hydrochloric/sulphuric acid, sodium hydroxide, sodium hypochlorite, carbohydrazide (or alternative oxygen scavenger), urea and trisodium phosphate);
- distillate fuel;
- nitrogen (for purging of the natural gas system and other equipment);
- cleaning chemicals;
- acetylene (metal cutting);
- inert fire-fighting gases;
- lubricating oils;
- hydrogen for generator cooling and deoxygenation of product CO_2 stream; and
- carbon dioxide for purging of electrical generators for maintenance purposes.

4.4.11 In order to reduce the risks of contamination to processes and surface water, all liquid chemicals stored on site will be kept in bunded controlled areas with a volume of 110% of storage capacity and be appropriately segregated.

Maintenance

4.4.12 Inspection and Maintenance activities will be one of the key factors for consideration in the design and layout of the PCC Site. The objective of plant maintenance is to ensure the PCC elements of the Site and the Connections operate safely and reliably.

4.4.13 Routine maintenance will be planned and scheduled via the maintenance management system with on-going regular maintenance and major overhauls occurring approximately once every five years. These maintenance activities will require additional contractors to work on-site.

4.4.14 The maintenance strategy to be adopted will use established methods such as Risk Based Inspection and Reliability Centred Maintenance to support the required facility availability. Therefore, to support the maintenance strategy for the PCC facilities each major equipment item will have appropriate access and laydown areas and the road scheme for the PCC Site will enable free movement for cranes and heavy lifting equipment.

4.4.15 Pipeline inspection plans will be prepared and if required, pig launching and receiving facilities for intelligent “pigging” operations will be considered.

4.4.16 It is anticipated that an integrated Operations and Maintenance team will have responsibility for daily operations, including troubleshooting and effecting minor repairs on the PCC. Major and specialist Operations and Maintenance interventions (turn-arounds, CCGT scheduled maintenance and overhauls, etc) are likely to be outsourced and major equipment items serviced by original equipment manufacturers.

4.4.17 It is intended that major maintenance activities be harmonised around the longest or most constrained outages. For example, it is likely that maintenance of the CO_2 compressors will be aligned with shutdowns of the CO_2 emitter facilities or the Low-Carbon Electricity Generating Station.

Hazard Prevention and Emergency Planning

4.4.18 The Applicants aims to protect human health by safely and responsibly managing activities on site. A Health and Safety Plan covering the works, commissioning and operation of the Proposed Development will be prepared by the Operator. For design and construction, a competent and adequately resourced Construction (Design and Management) (CDM) Coordinator and Principal Contractor will be appointed. The Applicants will ensure that their own staff, designers and contractors follow the Approved Code of Practice laid down by the CDM Regulations 2015.

4.4.19 Written procedures clearly describing responsibilities, actions and communication channels will be available for operational personnel dealing with emergencies. Procedures will be externally audited, and contingency plans written in preparation for any unexpected complications.

4.4.20 The inventory of materials to be stored on the PCC Site will be finalised through the detailed design. However, where storage of hazardous materials, individually or in-combination exceeds the relevant thresholds, consent separate permissions will need to be sought from the HSE and local planning authority for their storage, under the COMAH and Hazardous Substance Consent regimes respectively. All chemical storage will be regulated by the Environment Agency through an environmental permit that will be required for the operation of the Proposed Development.

4.4.21 As set out in Chapter 22: Major Accidents and Natural Disasters (ES Volume I, Document Ref. 6.2), CO_2 is not harmful to human health at low concentrations, it is not flammable and will not support combustion. However, as the concentration of CO_2 in air rises, the hazardous effects on people and the environment increase. The key risk relates to its toxicity at elevated concentrations and potential to act as an asphyxiant gas in low lying locations or confined spaces should it displace air from these locations due to its density being higher than that of air.

4.4.22 Guidance and best practice information for carbon capture technology and transport via pipeline is available from the HSE. The Proposed Development is anticipated to be subject to the Hazardous Substance Consent and potentially COMAH Regulations due to storage of hazardous materials (see Chapter 22: Major Accidents and Disasters in ES Volume I (Document Ref. 6.2). The Applicants are currently working on the basis that the Proposed

Development will come under lower tier COMAH as a minimum, this will be confirmed during detailed design once all chemicals required have been identified along with the quantities which will be stored on the PCC Site.

4.4.23 CO_2 is not currently defined as a dangerous substance under The COMAH Regulations 2015. The HP Compressor Station and the CO_2 Export Pipeline have been located to maximise the distance to residential properties, to minimise the length of the on-shore part of the CO_2 Export Pipeline and taking into consideration the prevailing wind strength and direction for the Site. A Major Accident Prevention Document will be produced during the design process and the HSE will be consulted.

External Lighting

4.4.24 An Indicative Lighting Strategy is included in the Application (Document Ref. 5.11). Before any lighting is installed at the Proposed Development a detailed lighting scheme will be submitted to Redcar and Cleveland Borough Council (RCBC) for approval. The external lighting scheme will be designed in accordance with relevant standards, such as the Guidance Notes for the Reduction of Obtrusive Light (2020) published by the Institute of Lighting Engineers and/or Chartered Institution of Building Services Engineers requirements, as appropriate.

4.4.25 The external lighting scheme will be designed to provide safe working conditions in all areas of the Site whilst reducing light pollution and the visual impact on the local environment. This is likely to be achieved using luminaires that eliminate the upward escape of light. This will be secured by a Requirement in the draft DCO.

Environmental Management

4.4.26 The Proposed Development will comply with the Environmental Permitting (England and Wales) Regulations 2016 under its Environmental Permit so that any impacts of emissions to air, soil, surface and groundwater, to the environment and human health will be minimised and avoided where possible.

4.4.27 The Site will be operated in line with appropriate standards and the operator will implement and maintain an Environment Management System (EMS) which will be certified to International Standards Organisation (ISO) 14001. The EMS will outline requirements and procedures required to ensure that the Site is operating to the appropriate standard.

4.4.28 Sampling and analysis of pollutants will be undertaken where required including monitoring of exhaust emissions levels using a Continuous Emissions Monitoring System prior to discharge from the stacks, in accordance with the Environmental Permit.

Heavy Good Vehicle Movements

4.4.29 The PCC Site will be accessed from the A1085 via the former Redcar Steelworks entrance. Operational and Construction traffic movements are detailed within the Transport Assessment (Appendix 16A, ES Volume III, Document Ref. 6.4). In summary it is anticipated that during the operational

phase of the Proposed Development, total Heavy Goods Vehicle (HGV) movements at the PCC Site will be less than 5 to 10 in and out movements per day. These figures include movements associated with delivery of consumables and removal of waste products.

4.4.30 The air quality, noise and transportation assessments (Chapters 8, 11 and 16 respectively in ES Volume I, Document Ref. 6.2) consider the worst-case traffic profile relevant to that topic which are associated with construction. Construction traffic movements are described in Chapter 5: Construction Programme and Management (ES Volume I, Document Ref. 6.2).

4.5 Landscaping and Biodiversity

4.5.1 Construction of the PCC will involve the removal of existing habitats within the PCC Site. The proposed landscaping and biodiversity enhancement measures will be provided within the PCC Site on land within the long-term management control of the Applicants. It will therefore be provided at the location affected by substantive permanent land take for the Proposed Development. The locations of the landscaping and biodiversity enhancement measures are shown on Figure 4-2 (ES Volume II, Document Ref. 6.3)

4.5.2 The frame of reference for the proposed approach is defined by the existing baseline of post-industrial land and extensive relatively species-poor unmanaged secondary grassland, and proximity to high quality habitats and open landscape of the Teesmouth and Cleveland Coast SSSI. The proposed approach therefore allows for compensation of some of the original losses of sub-optimal grassland, and to 'put back better' by making use of the existing favourable ground conditions (nutrient-poor, free-draining and summer drought-stressed) to create semi-improved grassland and favourably manage it thereafter. Tree planting is not proposed given the unfavourable coastal location, but scattered scrub will be provided within grassland areas to add structural diversity and enhance the biodiversity value of the grassland. The surface water drainage arrangement will also be used to secure additional complementary habitat for biodiversity.

4.6 Decommissioning

4.6.1 The power generation and carbon capture elements of the Proposed Development are expected to have a design life of approximately 25 years. At the end of its design life it is expected that these elements of the Proposed Development may have some residual life remaining and the operational life may be extended. The design life of the CO_2 Gathering Network, the HP Compressor Station and the CO_2 Export Pipeline is anticipated to be around 40 years and they could operate independently of the power generation elements of the Proposed Development.

4.6.2 Consequently, decommissioning of the following elements are likely to occur separately, at different times:

- the Low-Carbon Electricity Generating Station and associated connections; and

- the CO_2 Gathering Network, HP Compressor Station, Electrical Connection and CO_2 Export.

4.6.3 At the end of its operating life, it is anticipated that all above-ground equipment associated with the parts of the Proposed Development to be decommissioned will be decommissioned and removed from the Site. Prior to removing the relevant plant and equipment, all residues and operating chemicals will be cleaned out from the plant and disposed of in an appropriate manner.

4.6.4 The bulk of the relevant plant and equipment will have some limited residual value as scrap or recyclable materials, and the construction contractor will be encouraged to use materials that could be recycled.

4.6.5 Prohibited materials such as asbestos, polychlorinated biphenyls, ozone depleting substances and carcinogenic materials will not be allowed within the design of the Proposed Development. Other materials recognised to pose a risk to health, but which are not prohibited, will be subject to a detailed risk assessment.

4.6.6 Prevention of contamination is a specific requirement of the Environmental Permit for the operation of the Proposed Development and therefore it is being designed such that it will not create any new areas of ground contamination or pathways to receptors as a result of construction or operation. Once the relevant plant and equipment have been removed to ground level, it is expected that the hardstanding and sealed concrete areas will be left in place. Any areas of the PCC Site which are to be decommissioned and that are below ground level will be backfilled to ground level to leave a levelled area.

4.6.7 The decommissioning of the Proposed Development will be considered during design with the objective that that no additional significant hazards would exist during the decommissioning phase. A Decommissioning Plan (including Decommissioning Environmental Management Plan (DEMP)) will be produced within the period specified in the relevant legislation in force at the time of cessation of operations of either the power generation or off-site CO_2 Gathering Network, compression and export facilities and agreed with the Environment Agency as part of the Environmental Permitting and site surrender process. The DEMP will consider in detail all potential environmental risks and contain guidance on how risks can be removed, mitigated or managed. This will include details of how surface water drainage should be managed during decommissioning and demolition. The DEMP will be secured by a Requirement.

4.6.8 The Decommissioning Plan will include an outline programme of works. For the Low-Carbon Electricity Generating Station, it is anticipated that it would take up to a year to decommission, with demolition following thereafter, taking approximately two years to complete.

4.6.9 During decommissioning and demolition there will be a requirement for the provision of office accommodation and welfare facilities.

4.6.10 Any demolition contractor would have a legal obligation to consider decommissioning and demolition under the CDM Regulations 2015, or the equivalent prevailing legislation at that time.

4.6.11 Decommissioning activities will be conducted in accordance with the appropriate guidance and legislation at the time of the Proposed Development's closure. All decommissioning activities will be undertaken in accordance with the waste hierarchy. Materials and waste produced during decommissioning and demolition will be stored in segregated areas to maximise reuse and recycling. All materials that cannot be reused or recycled will be removed from the Site and transferred to suitably permitted waste recovery/disposal facilities. It is anticipated that a large proportion of the materials resulting from demolition will be recycled and a record will be kept in order to demonstrate that the maximum level of recycling and reuse has been achieved.

4.6.12 Upon completion of the decommissioning programme, including any remediation works that might be required, the Environment Agency will be invited to witness a post-decommissioning inspection by site staff. All records from the decommissioning process will be made available for inspection by the Environment Agency and other relevant statutory bodies, in accordance with the Environmental Permit requirements.

4.6.13 In the light of the control measures set out above that would form part of the DEMP, decommissioning is not anticipated to present any significant environmental impacts beyond those assessed for the construction phase of the Proposed Development.

4.7 Elements of the Proposed Development Consented under a Deemed Marine Licence

Marine Licensing

4.7.1 In England, the Marine and Coastal Access Act (2009) (MCAA) provides that a ML is required for certain ‘licensable activities’ within the UK Marine Area (Section 42, MCAA). These activities include deposits, removals and construction/’alteration’ works (Section 66, MCAA) which are below Mean High Water Springs (MHWS).

4.7.2 A ML can be issued via a ‘standalone’ Marine Licence Application (MLA) or a licence ‘deemed’ within the body of the DCO i.e. a Deemed Marine Licence (DML). The MMO is the body responsible for issuing, revoking and enforcing a Marine Licence, other than where a licence is in the form of a DML, in which case the Secretary of State has the power to grant it.

4.7.3 Several aspects of the Proposed Development are considered to require MLs from the MMO. The Application includes a request to grant MLs for NZT Power and NZNS Storage via DMLs for the following.

CO_2 Export Pipeline – Near-shore Section

4.7.4 The near-shore section of the CO_2 Export Pipeline includes a portion of the corridor which is below MHWS and above Mean Low Water Springs (MLWS).

Outfall Refurbishment and/or Replacement

4.7.5 Pending the condition of the existing outfall infrastructure, works may be required below MHWS at Coatham Sands within the wider Tees Bay to either refurbish or replace the existing discharge. Replacement will involve use of Trenchless Technologies to reach a suitable discharge point within the Tees Bay whilst minimising impact to the surrounding environment. At the outfall, the emplacement of a suitable discharge head would also be required to be placed via a jack-up barge or similar.

Tees Crossings

4.7.6 The CO_2 Gathering Network and the Natural Gas Connection both require crossings underneath the tidal River Tees using either a micro-bored tunnel (Natural Gas Connection and CO_2 Gathering Network) or a pipeline installed using HDD techniques (CO_2 Gathering Network only) which are below MWHS.

4.8 Off-shore Elements Separately Consented

4.8.1 The following parts of the Proposed Development (as shown in Diagram 4-2) will be located off-shore below MLWS:

- installation of the continuation of the CO_2 Export Pipeline from below MLWS to the Endurance geological storage facility, located beneath the North Sea approximately 145 km to the east south-east of Teesside; and
- the construction of either a sub-sea injection system or an un-manned platform for the injection of exported CO_2 using a well or wells drilled into the underground storage reservoir over 1,000 m below sea level. The injection wells will be drilled and completed using an appropriate mobile offshore drilling unit.

4.8.2 The Endurance geological storage will require an Oil and Gas Authority (OGA) Carbon Dioxide Appraisal and Storage Licence and Permit). The offshore CO_2 Export pipeline will also require consent under the Petroleum Act 1998. A Marine Licence may also be required. These elements do not form part of this Application.

4.8.3 Potential combined effects of the on-shore and off-shore elements of the project are considered in Chapter 14: Marine Ecology and Chapter 24: Cumulative and Combined Effects (ES Volume I, Document Ref. 6.2) and Appendix 24C Statement of Combined Effects (ES Volume III, Document Ref. 6.4).

Diagram 4-2: Off-Shore Elements

4.9 References

BEIS (2017). *The Clean Growth Strategy.* London: The Stationery Office.

European Commission (2017). *Commission Implementing Decision (EU) 2017/1442 of 31st July 2017, establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants'* (2017). *Official Journal* L212 p. 1.

'Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)' (2010). *Official Journal* L334 p. 17.

HM Treasury (2014). *National Infrastructure Plan 2014*. London: The Stationery Office.

Institute of Lighting Professionals (2020). *Guidance Notes for the Reduction of Obtrusive Light.* Rugby: Institute of Lighting Professionals.

National Infrastructure Commission (2020). *Opportunities for the Power Sector*. London: NIC.

The Construction (Design and Management) Regulations 2015 (SI 2015/51). London: The Stationery Office

The Control of Major Accident Hazards Regulations 2015 (SI 2015/483). London: The Stationery Office.

The Marine and Coastal Access Act 2009 (c. 23). London: The Stationery Office

The Marine Licensing (Exempted Activities) Order 2011 (SI 2011/409). London: The Stationery Office.

The Pipeline Safety Regulations 1996 (SI 1996/825). London: The Stationery Office.