Determination of an Application for an Environmental Permit under the Environmental Permitting (England & Wales) Regulations 2016

Decision document recording our decision-making process

The Permit Number is: EPR/JP3020LL

The Applicant / Operator is: Cory Environmental Holdings Limited

The Installation is located at: Riverside Decarbonisation Project, Norman Road North, Belvedere, DA17 6JY

What this document is about

This is a decision document, which accompanies a permit.

It explains how we have considered the Applicant's Application, and why we have included the specific conditions in the permit we are issuing to the Applicant. It is our record of our decision-making process, to show how we have taken into account all relevant factors in reaching our position. Unless the document explains otherwise, we have accepted the Applicant's proposals.

We try to explain our decision as accurately, comprehensively and plainly as possible. Achieving all three objectives is not always easy, and we would welcome any feedback as to how we might improve our decision documents in future. A lot of technical terms and acronyms are inevitable in a document of this nature: we provide a glossary of acronyms near the front of the document, for ease of reference.

Preliminary information and use of terms

We gave the application the reference number EPR/JP3020LL/A001. We refer to the application as "the **Application**" in this document in order to be consistent.

The number we have given to the permit is EPR/JP3020LL. We refer to the permit as "the **Permit**" in this document.

The Application was duly made on 31/10/2025.

The applicant is Cory Environmental Holdings Limited. We refer to Cory Environmental Holdings Limited as "the **Applicant**" in this document. Where we are talking about what would happen after the Permit is granted (if that is

our final decision), we call Cory Environmental Holdings Limited "the **Operator**".

Cory Environmental Holdings Limited proposed facility is located at Riverside Decarbonisation Project, Norman Road North, Belvedere, DA17 6JY

The carbon capture facility is part of a multi operator installation.

The carbon capture facility will accept treated flue gases from the two adjacent incineration plants operated by Riverside Resource Recovery Limited and Riverside Energy Park Limited We refer to the multi-operator installation as "the **Installation**". We refer to the carbon capture facility as "the **CC plant**" and the incineration plants "the **incineration plants**" in this document.

The table below shows the permits that form part of the multi operator installation.

Permit number	Operator	Name
EPR/JP3020LL	Cory Environmental Holdings Limited	Riverside Decarbonisation Project
EPR/BK0825IU	Riverside Resource Recovery Limited	Riverside Resource Recovery Facility (Riverside 1)
EPR/EP3245QR	Riverside Energy Park Limited	Riverside Energy Park (Riverside 2)

The proposed application

The Applicant has applied to operate an amine-based (Shell Cansolv) carbon capture activity. The listed activity is section 6.10 Part A(1) (a) of schedule 1 to the Environmental Permitting Regulations (EPR) with associated solvent treatment and carbon dioxide compression and storage (referred to as post combustion carbon capture or PCC).

How this document is structured

Contents:

Glossary of acronyms used in this document

(Please note that this glossary is standard for our decision documents and therefore not all these acronyms are necessarily used in this document.)

APC	Air Pollution Control
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AW	Ancient Woodland
BAT	Best Available Technique(s)
BAT-AEL	BAT Associated Emission Level
BAT AEEL	BAT Associated Energy Efficiency Level
BAT C	BAT conclusions
BREF	Best Available Techniques (BAT) Reference Documents for Waste Incineration
BS	British Standard
CC	Carbon capture
CCS	Carbon capture and storage
CEM	Continuous emissions monitor
CHP	Combined heat and power
CO_2	Carbon dioxide
CROW	Countryside and rights of way Act 2000
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DCC	Direct contact cooler
DD	Decision document
DEA	Diethanolamine
Defra	Department of the Environment, Food and Rural Affairs
DMA	Dimethlyamine
EAL	Environmental assessment level
EfW	Energy from waste
ELV	Emission limit value
EMS	Environmental Management System
EP	Environmental permit
EPR	Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No. 1154) as amended

EQS	Environmental Quality Standard
ES	Environmental standard
EU	European Directive
FEED	Front end engineering design
FSA	Food Standards Agency
GET	Guidance on emerging techniques
HCl	Hydrogen chloride
HSE	Health and Safety Executive
IED	Industrial Emissions Directive (2010/75/EU)
LCP	Large combustion plant
LNR	Local Nature Reserve
LWS	Local Wildlife Site
MCERTS	Monitoring Certification Scheme
MEA	Monoethanolamine
MWe	Mega watts of electrical power
NDELA	n-nitrosodiethanolamine
NDMA	N-nitrosdimethylamine
NH_3	Ammonia
NO	Nitrogen oxide
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
NO_2	Nitrogen dioxide
OTNOC	Other than normal operating conditions
PAH	Poly aromatic hydrocarbon
PC	Process Contribution
PCB	Polychlorobiphenyl
PCC	Post-combustion carbon capture
PEC	Predicted Environmental Concentration
PPS	Public participation statement
RFI	Request for information
RGN	Regulatory Guidance Note
SAC	Special Area of Conservation
SCR	Selective catalytic reduction

SHPI(s)	Site(s) of High Public Interest
SNCR	Selective non-catalytic reduction
SO_3	Sulphur trioxide
SOx	Oxides of sulphur
SPA(s)	Special Protection Area(s)
SSSI(s)	Site(s) of Special Scientific Interest
SWMA	Specified waste management activity
TGN	Technical guidance note
TOC	Total Organic Carbon
UK	United Kingdom
UKAS	UK Accreditation Service
VOC	Volatile organic compound
WFD	Waste Framework Directive (2008/98/EC)

1 Our decision

We have decided to issue the Permit to the Applicant. This will allow it to operate the part of the Installation, subject to the conditions in the Permit.

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

This Application is to operate part of an installation which is subject principally to the Industrial Emissions Directive (IED).

The Permit contains many conditions taken from our standard Environmental Permit template including the relevant Annexes. We developed these conditions in consultation with industry, having regard to the legal requirements of the Environmental Permitting Regulations (EPR) and other relevant legislation. This document does not therefore include an explanation for these standard conditions. Where they are included in the Permit, we have considered the Application and accepted that the details provided are sufficient and satisfactory to make use of the standard condition acceptable and appropriate. This document does, however, provide an explanation of our use of "tailor-made" or installation-specific conditions, or where our Permit template provides two or more options, an explanation of the reason(s) for choosing the option that has been specified.

2 How we reached our decision

2.1 Receipt of Application

The Application was duly made on 31/10/2025. This means we considered it was in the correct form and contained sufficient information for us to begin our determination but not that it necessarily contained all the information we would need to complete that determination: see section 2.3 below.

The Applicant made no claim for commercial confidentiality. We have not received any information in relation to the Application that appears to be confidential in relation to any party.

2.2 Consultation on the Application

We carried out consultation on the Application in accordance with the EPR and our statutory Public Participation Statement (PPS).

We consider that this process satisfies, and frequently goes beyond, the requirements of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental

Matters, which are directly incorporated into the IED, which applies to the Installation and the Application. We have also taken into account our obligations under the Local Democracy, Economic Development and Construction Act 2009 (particularly Section 23). This requires us, where we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of representatives of interested persons in the exercise of our functions, by providing them with information, consulting them or involving them in any other way. In this case, we consider that our consultation already satisfies the requirements of the 2009 Act.

We advertised the Application by a notice placed on our website, which contained all the information required by the IED, including telling people where and when they could see a copy of the Application. We also placed an advertisement in the Bexley Times on 26/11/25 that contained the same information.

We made a copy of the Application and all other documents relevant to our determination available to view on our Public Register. Anyone wishing to see these documents could do so and arrange for copies to be made.

We sent copies of the Application to the following bodies, which includes those with whom we have "Working Together Agreements":

- Local Authorities - Environmental Protection Department
- Fire & Rescue
- UK Health Security Agency and Director of public health
- Health and Safety Executive
- Food Standards Agency
- London City Airport
- National Air traffic Services (NATS)

The CC Plant is located in Bexley London Borough, but is close to several other local authorities that we also consulted with: Barking and Dagenham London Borough, Havering London Borough and Greenwich London Borough. We also consulted with the Greater London Authority.

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly. Note under our Working Together Agreement with Natural England, we only inform Natural England of the results of our assessment of the impact of the installation on designated Habitats sites.

Written comments were accepted beyond the formal consultation period. Further details along with a summary of consultation comments and our response to the representations we received can be found in Annex 4. We have taken all relevant representations into consideration in reaching our determination.

2.3 Requests for Further Information

Although we were able to consider the Application duly made, we did in fact need more information in order to determine it and issued an information notice on 13/05/2026. A copy of the information notice was placed on our public register together with the response on receipt.

3 The legal framework

The Permit will be granted under Regulation 13 of the EPR. The Environmental Permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- part of an installation with Post-combustion Carbon Capture (PCC) for geological storage as described by the IED; and
- subject to aspects of other relevant legislation which also have to be addressed.

We address some of the major legal requirements directly, where relevant, in the body of this document. Other requirements are covered in section 7 towards the end of this document.

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

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

4 The Installation

This Application is for a CC plant, permit EPR/JP3020LL. If forms part of a multi-operator installation that consists of the three permits shown in the table below. The CC plant will capture carbon from the exhaust gases from the two incineration plants, permits EPR/BK0825IU and EPR/EP3245QR.

Permit number	Operator	Name
EPR/JP3020LL	Cory Environmental Holdings Limited	Riverside Decarbonisation Project
EPR/BK0825IU	Riverside Resource Recovery Limited	Riverside Resource Recovery Facility (Riverside 1)
EPR/EP3245QR	Riverside Energy Park Limited	Riverside Energy Park (Riverside 2)

4.1 Description of the CC plant and the proposed activities

4.1.1 The permitted activities

The CC plant is subject to the EPR because it carries out an activity listed in Part 1 of Schedule 1 to the EPR:

- Section 6.10 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.

An installation may also comprise “directly associated activities”, which at the CC plant includes:

- Raw materials storage for CC plant
- Waste amine solvent storage
- Water treatment plant
- Back pressure turbine
- CO_2 compression
- Emergency power generation

Together, these listed activities and directly associated activities comprise the CC plant. The CC plant and the incineration plant comprise the Installation.

4.1.2 The Site

The CC plant will be located close to the two permitted incineration plants on land within the Belvedere industrial zone.

The Applicant submitted a plan which we consider is satisfactory, showing the site of the Installation and its extent and the part of the Installation to which the Application relates. A plan is included in Schedule 7 to the Permit, and the Operator is required to carry on the permitted activities within the site boundary.

Further information on the site is addressed below at 4.2.

4.1.3 What the CC plant does

The purpose of the Application is to permit the CC plant. The two incineration plant permits are also being varied for associated changes to those sites. The operation of the incineration plant will not be covered further in this section.

The activities taking place at the CC plant comprise:

- Carbon capture plant
- Carbon capture plant flue gas abatement system with water wash
- Back pressure turbine for generating low pressure steam for the CC plant

- CO_2 conditioning before transfer off site which includes, compression, dehydration and liquefaction.
- Water treatment plant consisting of reverse osmosis and bi-sulphite treatment.

4.1.3.1 Operation of the CC plant

(i) Exhaust gas transfer

The treated flue gases will be ducted via pipeline to the CC plant from both incineration plants. Riverside 1 consists of three lines and Riverside 2 of two lines.

The flue gases will be monitored for compliance with the ELVs in the exisiting incineration plant before being passed to the CC plant.

The CC plant is designed so that the flue gases from the incineration plants can either be treated within the CC plant or released to atmosphere through the existing incineration plant stacks without the capture of CO_2.

(ii) Flue gas cooling

Flue gases received from the incineration plants will be cooled in a Direct Contact Cooler (DCC) unit to condense out water. The DCC will include sodium hydroxide dosing to further reduce acid gas levels.

The condensate from the DCC will be routed to the wastewater treatment plant and treated before being used as make-up water for the hybrid cooling system.

(iii) CO_2 absorption

The cooled flue gas (approximately $40^{O}C$) is ducted to an absorber column. Cooled flue gases enter the base of the column and flow counter current to the lean amine solution (amine without CO_2). The CO_2 is absorbed by the amine solvent, which is exothermic. The temperature is maintained using intercoolers.

The flue gas rises through the absorber into a water wash, which is used to capture aerosols and to reduce the levels of amines, and soluble amine degradation products such as nitrosamines and nitramines.

The emission of aerosols, such as Sulphur trioxide (SO_3) droplets and fine particulates, is expected to be minimal due to the low volatility, and the water wash process prior to emission of the treated flue gas, as well as management of incoming impurities to prevent or limit aerosol formation. As the design is developed further during the detailed design process, a detailed assessment of emissions and aerosols will be carried out. As part of the detailed design, where any further measures are required, (such as mist elimination on top of the absorber column or an additional wash stage) these

can then be added to the design if needed. This would prevent or limit any aerosols in the CO_2 depleted flue gas prior to its release via the dedicated stacks. Once operational, regular sampling will be carried out to assess the total vapour and droplet emission levels, ensuring that aerosol emissions are prevented.

(iv) Amine regeneration

The rich amine solution (amine with CO_2) accumulates at the bottom of the absorber column. It is pumped through a rich solvent / lean solvent heat exchanger to the regenerator column.

In the regenerator column, low-pressure steam indirectly heats the rich solvent stripping the CO_2 from the solvent. The Regenerator Column operates at a temperature of approximately 100-120°C to initiate the desorption process. This heat is provided by the steam in the reboiler. Solvent degradation will be minimised through the control of solvent temperature within the absorber column and regenerator column, in line with licensor's guidance and recommendations. At the top of the column, a condenser cools the solvent vapour, returning the condensed solvent stream back to the regenerator column. The remaining CO_2 rich gas stream, at around 40°C is then directed to downstream CO_2 processing. Amine from the regenerator is circulated back to the absorber.

The solvent processing system consists of a filtration and reclamation system, to remove any heat stable salts and amine degradation products. Reclaimer waste (sludge) will be disposed of off-site. Lost solvent will be replaced by fresh solvent from the solvent storage tanks.

(v) CO_2 compression

Compression of low pressure, wet CO_2 is undertaken in stages, with the CO_2 cooled using cooling water or through direct air cooling between compression stages. The compressed CO_2, at approximately 16 bar pressure and a temperature of approximately 40°C, is routed via above ground pipelines for dehydration

(vi) CO_2 conditioning

After compression, the CO_2 stream needs to be dehydrated prior to liquefaction, as it will still be water saturated, to avoid the water freezing in the liquefaction plant. Solid desiccant dehydration is used; this is a process utilising adsorption to retain water on the surface of the desiccant particles (such as molecular sieve or silica gel), typically within adsorber vessels. The dry CO_2 is routed for liquefaction and refrigeration via above ground pipelines.

Liquefaction will be done by cooling either via expansion or through a heat exchange system.

Further conditioning equipment will be required, such as a distillation column, to remove non-condensable components present in the CO_2 stream as a result of co-absorption into the amine solvent from the flue gas, such as oxygen and nitrogen, so that the CO_2 export specification can be met. The non-condensable components are vented to atmosphere via emission points A4 or A5 but will be confirmed after the final design. For this environmental permit application, the non-condensable gases are presented as venting via A4 or A5. The precise location will be determined and confirmed in a later stage of design. The non-condensable gases vent will comprise a small stream constituted almost entirely of nitrogen and oxygen. The CO_2 rich stream will be treated to meet the CO_2 export specification prior to entering the liquefaction stage. Residual amine would be expected to remain in the liquefied CO_2, since it would have a very low vapour pressure at the operating conditions of the CO_2 liquefaction plant. Therefore, no substantive quantities of amines or their breakdown products will be present. We have set pre-operational condition PO11 for the CO_2 conditioning and compression system to be confirmed after detailed design. PO11 also requires confirmation of the emission location, composition, and impacts from venting non-condensable gases.

(vii) CO_2 storage and transport off-site

The Operator will be responsible for temporary CO_2 storage at the buffer storage area prior to transport to the nearby jetty terminal for off-taking and loading onto ship and / vessels for transport of CO_2. The buffer storage area consists of insulated, pressurised, above ground storage tanks made of low-temperature carbon steel.

Due to the liquid CO_2 being stored at saturated conditions, a small amount of boil-off gas (BOG) will be generated due to the ingress of heat into the stage tanks. The CO_2 vapour returned from the vessels during loading operations will be combined with the BOG from the tanks and sent to be re-liquefied in the CC plant. If there is any BOG that is unable to be re-liquefied, it would be vented via a CO_2 Vent (Emission Points A4 or A5).

(viii) CO_2 venting

Venting of CO_2 can occur during certain situations. This will be during start-up and shut-down, maintenance outages or emergency venting. There will be separate vents for small volumes of CO_2. Larger volumes of CO_2 which could occur during start-up and shut-down (in the form of unabated / partially abated flue gas) would be vented via the main CC stack.

(ix) Water treatment plant

The water treatment plant will treat the condensate generated by the DCC and blowdown from the wet/hybrid cooling for re-use within the hybrid cooling system by reverse osmosis, and with bisulphite to remove chlorine. This

means that any effluent potentially contaminated with amines will not be discharged and recycled back into CC process.

(x) Energy use

The CC plant will take steam from the two incineration plants but requires low pressure steam. Steam from the two incineration plants is only available at high pressure. To maximise efficiency, the CC plant will be supported by one back pressure turbine and one pressure reducing de-superheating station. The back pressure turbine will maximise the extraction of energy within the steam during pressure reduction. The pressure reducing de-superheating station will refine the temperature and pressure of the steam exiting the back pressure turbine, to make it suitable for use in the solvent regeneration system. In addition to conditioning the steam required for the carbon capture process, the back pressure turbine will also supply an amount of the electricity required. The thermal energy within the steam entering the back pressure turbine will be used to rotate the turbine shaft and subsequently drive the generator, thus generating electricity. The remaining electrical demand for the CC plant will be supplied from the electricity generated by riverside 1 and riverside 2.

(xi) If the CC plant is not available

Where the CC plant is not available the flue gases will be emitted through the existing incineration stacks as covered by the existing permits for those plants.

4.2 The site and its protection

4.2.1 Site setting, layout and history

The site is situated at Belvedere in south-east London, mainly on strategic industrial land within the Belvedere industrial zone, with a smaller part of the site situated on metropolitan open land. Riverside 1 and 2 are directly to the north. Commercial and residential properties are to the south. The closest residential properties are about 120m away on Clydesdale Way. The Belvedere industrial area is to the east and to the west is Crossness local nature reserve and Crossness sewage treatment works.

4.2.2 Proposed site design: potentially polluting substances and prevention measures

(i) Storage and transfer of chemicals

All liquid chemicals stored onsite will be kept in bunded controlled areas. All materials of construction for primary and secondary containment will be assessed and selected to ensure suitability and compatibility with the stored liquids and substances in each primary containment. Bunds will be designed to ensure that pipework does not penetrate the bund walls or weaken joints,

and storage will be designed to ensure that the facility and measures to detect and catch leaks from tanks and/or fittings is implemented. Bunds will have a minimum capacity of 110% of the largest container or 25% of the total stored volume, whichever is greater. Hardstanding with raised kerbs will provide tertiary containment. All new tanks, bunding and containment will be designed and installed in line with good engineering practice and the requirements of CIRIA 736 and any other relevant guidance or standards, as is required. Chemical handling areas will be paved and equipped with kerbing and/or bunding to contain potential spillages and leaks.

As part of the detailed design, an assessment of the risk for all the tanker/chemical unloading bays will be undertaken. This will determine whether they are designed as fully bunded areas or require suitable protection measures to prevent the entry of any spillages to the onsite surface water drainage systems.

(ii) Drainage

Contained drainage will be in place for the chemical storage and injection areas. Uncontaminated surface water run-off will be collected in dedicated surface water drainage systems. The surface water system will have isolated valves to prevent accidental releases being discharged.

4.2.3 Site condition report

Under Article 22(2) of the IED the Applicant is required to provide a baseline report containing at least the information set out in paragraphs (a) and (b) of the Article before starting operation.

The baseline report is an important reference document in the assessment of contamination that might arise during the operational lifetime of the Installation and at cessation of activities at the Installation.

4.2.4 Closure and decommissioning

Pre-operational condition PO1 requires the Operator to have an Environmental Management System in place before the CC plant is operational, and this will include a site closure plan.

At the definitive cessation of activities, the Operator has to satisfy us that the necessary measures have been taken so that the site ceases to pose a risk to soil or groundwater, taking into accounts both the baseline conditions and the site's current or approved future use. To do this, the Operator will apply to us for surrender of the permit, which we will not grant unless and until we are satisfied that these requirements have been met.

4.3 Operation of the CC plant – general issues

4.3.1 Administrative issues

This is a multi-operator Installation. See preliminary information for details of the operators of this Installation.

We are satisfied that the Applicant is the person who will have control over the operation of the CC plant after the granting of the Permit; and that the Applicant will be able to operate the Installation to comply with the conditions included in the Permit.

4.3.2 Management

The Applicant has stated in the Application that they will implement an Environmental Management System (EMS). A pre-operational condition (PO1) is included in the Permit requiring the Operator to provide a summary of the EMS prior to commissioning of the plant and to make available for inspection all EMS documentation.

We are satisfied that appropriate management systems and management structures will be in place for the CC plant, and that sufficient resources are available to the Operator to ensure compliance with all the Permit conditions.

4.3.3 Site security

Having considered the information submitted in the Application, we are satisfied that appropriate infrastructure and procedures will be in place to ensure that the site remains secure.

4.3.4 Accident management

The Applicant submitted a preliminary accident Management Plan. A full final plan will form part of the Environmental Management System and must be in place prior to commissioning as required by a pre-operational condition (PO1). Having considered the other information submitted in the Application, we are satisfied that appropriate measures will be in place to ensure that accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised.

4.3.5 Off-site conditions

We do not consider that any off-site conditions are necessary.

4.3.6 Operating techniques

We have specified that the Applicant must operate the CC plant in accordance with the following documents contained in the Application:

Table S1.2 Operating techniques		
Description	**Parts**	**Justification**

Table S1.2 Operating techniques		
Description	**Parts**	**Justification**
Application	The following section of the Environmental Permit Application Technical Supporting Document dated September 2025: 3.1, 3.2, 4, 5, 6.1.2, 6.3, 6.4, 6.6, 6.7, 7, 8, 9, 11, 12	These documents contain key operating techniques that will ensure environmental risk is managed on site.
Noise management plan	Measures in noise management plan as approved with the Environment Agency through pre-operational condition PO8	
Schedule 5 notice response	The response to questions 1, 2 and 3	

The details set out above describe the techniques that will be used for the operation of the CC plant that have been assessed by us as being in accordance with our emerging techniques guidance; they form part of the Permit through Permit condition 2.3.1 and Table S1.2 in the Permit Schedules.

We have also specified the following limits and controls on the use of raw materials and fuels:

Raw Material or Fuel	Specifications
Carbon capture solvent used for activity AR1 in table S1.1 of the permit	Shell Cansolv DC-103, formulation consistent with emission profile assessed in application EPR/JP3020LL/A001 (Appendix B speciated emissions from carbon capture)

4.3.7 Energy efficiency

(i) Consideration of energy efficiency

The Application details measures that will be implemented at the CC plant to increase its energy efficiency. We are satisfied that the Applicant has considered the use of energy within the CC process and that they have taken appropriate measures to use energy as efficiently as possible.

(ii) Choice of Cooling System for CC plant

Cooling water will be required to cool the incoming flue gas, the lean amine, absorber, and CO_2 product. Wet / hybrid coolers and dry cooling will be used.

We agree that the Applicant's choice of cooling systems for the CC plant is BAT in accordance with the standards set out in PCC emerging techniques guidance.

(iii) Permit conditions concerning energy efficiency

The Operator is required to report energy usage and energy generated under condition 4.2 and Schedule 4 of the Permit. The following parameters are required to be reported: total energy usage and total (thermal and electrical) energy use per tonne of carbon dioxide captured.

There are no site-specific considerations that require the imposition of standards beyond the emerging techniques guidance, and so we accept that the Applicant's proposals are BAT in accordance with the guidance.

4.3.8 Efficient use of raw materials

Having considered the information submitted in the Application, we are satisfied that the appropriate measures will be in place to ensure that the Operator will make efficient use of raw materials and water.

4.3.9 Avoidance, recovery or disposal with minimal environmental impact of wastes produced by the permitted activities

This requirement addresses wastes produced by the CC plant and does not apply to the waste being treated by the incineration plant. The principal waste streams produced by the CC plant are:

- Reclaimer waste
- Sludge arising from the ETP
- Amine Contaminated Wastewater

Reclaimer waste will be a sludge containing degraded solvent and heat stable salts. It will be disposed off-site, likely in an incinerator. Options to send to a site where amine solvent could be recycled will be investigated once the plant is operating and the exact composition of the waste can be determined.

ETP sludge will be hazardous waste and will be disposed of off-site at a hazardous waste facility.

The volume of amine contaminated wastewater is expected to be small. It will be disposed of off-site. Where possible, amine contaminated wastewater will be reused on site e.g. diluting reclaimer waste.

Having considered the information submitted in the Application, we are satisfied that the waste hierarchy referred to in Article 4 of the Waste Framework Directive (WFD) will be applied to the generation of waste and that any waste generated will be treated in accordance with that Article.

We are satisfied that waste from the CC plant that cannot be recovered will be disposed of using a method that minimises any impact on the environment. Standard condition 1.4.1 will ensure that this position is maintained.

5 The CC plant's environmental impact

Regulated activities can present different types of risk to the environment, these include odour, noise and vibration; accidents, fugitive emissions to air and water; as well as point source releases to air, discharges to ground or groundwater and generation of waste and other environmental impacts. Consideration may also have to be given to the effect of emissions being subsequently deposited onto land (where there are ecological receptors). All these factors are discussed in this and other sections of this document.

For carbon capture using amine solvents, the principal emissions are those:

- to air
- to water
- from noise; and
- from venting from CO_2 compression.

The next sections of this document explain how we have approached the critical issue of assessing the likely impact of the emissions to air from the carbon capture activity on human health and the environment and what measures we are requiring to ensure a high level of protection.

5.1 Assessment Methodology

5.1.1 Application of Environment Agency guidance 'risk assessments for your environmental permit'

A methodology for risk assessment of point source emissions to air, which we use to assess the risk of applications we receive for permits, is set out in our guidance 'Air emissions risk assessment for your environmental permit' and has the following steps:

- Describe emissions and receptors
- Calculate process contributions
- Screen out insignificant emissions that do not warrant further investigation
- Decide if detailed air modelling is needed
- Assess emissions against relevant standards
- Summarise the effects of emissions

The methodology uses a concept of “process contribution (PC)”, which is the estimated concentration of emitted substances after dispersion into the receiving environmental media at the point where the magnitude of the concentration is greatest. The methodology provides a simple method of calculating PC primarily for screening purposes and for estimating process contributions where environmental consequences are relatively low. It is based on using dispersion factors. These factors assume worst case dispersion conditions with no allowance made for thermal or momentum plume rise and so the process contributions calculated are likely to be an overestimate of the actual maximum concentrations. More accurate calculation of process contributions can be achieved by mathematical dispersion models, which take into account relevant parameters of the release and surrounding conditions, including local meteorology – these techniques are expensive but normally lead to a lower prediction of PC.

5.1.2 Use of Air Dispersion Modelling

We required the Applicant to submit a full air dispersion model as part of their Application for the key pollutants from the PCC. Air dispersion modelling enables the process contribution to be predicted at any environmental receptor that might be impacted by the plant.

Once short-term and long-term PCs have been calculated in this way, they are compared with Environmental Standards (ES) for air emissions. ES are described in our web guide ‘Air emissions risk assessment for your environmental permit’.

Our web guide sets out the relevant ES as:

- Air Quality Standards Regulations 2010 Limit Values
- Air Quality Standards Regulations 2010 Target Values
- UK Air Quality Strategy Objectives
- Environmental Assessment Levels

Where a Limit Value exists, the relevant standard is the Limit Value. Where a Limit Value does not exist, target values, UK Air Quality Strategy (AQS) Objectives or Environmental Assessment Levels (EALs) are used. Our web guide sets out EALs which have been derived to provide a similar level of protection to human health and the environment as the limit values, target values and AQS objectives. In a very small number of cases, e.g. for emissions of lead, the AQS objective is more stringent that the Limit Value. In such cases, we use the AQS objective for our assessment.

Target values, AQS objectives and EALs do not have the same legal status as Limit Values, and there is no explicit requirement to impose stricter conditions than BAT in order to comply with them. However, they are a standard for harm and any significant contribution to a breach is likely to be unacceptable.

PCs are screened out as **Insignificant** if:

- the **long-term** PC is less than **1%** of the relevant ES; and
- the **short-term** PC is less than **10%** of the relevant ES.

The **long term** 1% PC insignificance threshold is based on the judgements that:

- It is unlikely that an emission at this level will make a significant contribution to air quality;
- The threshold provides a substantial safety margin to protect human health and the environment.

The **short term** 10% PC insignificance threshold is based on the judgements that:

- spatial and temporal conditions mean that short term process contributions are transient and limited in comparison with long term process contributions;
- the threshold provides a substantial safety margin to protect human health and the environment.

Where an emission is screened out in this way, we would normally consider the Applicant's proposals for the prevention and control of the emission to be BAT. That is because if the impact of the emission is already insignificant, it follows that any further reduction in this emission will also be insignificant.

However, where an emission cannot be screened out as insignificant, it does not mean it will necessarily be significant.

For those pollutants which do not screen out as insignificant, we determine whether exceedences of the relevant ES are likely. This is done through detailed audit and review of the Applicant's air dispersion modelling taking background concentrations and modelling uncertainties into account. Where an exceedance of the relevant ES is identified, we may require the applicant to go beyond what would normally be considered BAT for the Installation, where BAT standards are available, or we may refuse the application if the applicant is unable to provide suitable proposals. Whether or not exceedences are considered likely, the application is subject to the requirement to operate in accordance with BAT or other emerging techniques guidance.

This is not the end of the risk assessment, because we also take into account local factors (for example, particularly sensitive receptors nearby such as a SSSIs, SACs or SPAs). These additional factors may also lead us to include more stringent conditions than BAT.

If, as a result of reviewing the risk assessment and taking account of any additional techniques that could be applied to limit emissions, we consider that emissions **would cause significant pollution**, we would refuse the Application.

5.2 Assessment of Impact on Air Quality

The Applicant's assessment of the impact of air quality is set out in Annex D: Dispersion Modelling Assessment of the Application. The assessment comprised.

- Full load, continuous operation of Riverside 1 and Riverside 2 with Carbon Capture
- Full load, continuous operation of Riverside 1 and Riverside without Carbon Capture (Baseline)
- A study of the impact of emissions on nearby protected conservation areas.
- A study of the potential impact at ground level and at elevated working platforms from CO_2 venting.

When the carbon capture plant is not operating, incineration pollutants will be emitted from the current incineration stacks. Impacts from the already permitted incinerator stack have not been re-assessed as part of this Application because they will be unchanged from those already permitted.
When the carbon capture plant is operating the incineration pollutants will be emitted from the carbon capture plant stacks, the following incineration pollutants were included in the dispersion modelling assessment of the impact from the CC plant:

- Oxides of nitrogen
- Sulphur dioxide
- Carbon monoxide
- Particulate matter
- Hydrogen chloride
- Total organic carbon
- Hydrogen fluoride
- Ammonia
- Cadmium and thallium
- Mercury
- Antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel and vanadium
- PAHs
- Dioxins and furans
- PCBs

The mass release rate of emissions of pollutants emitted from the incineration plant is assumed to be unchanged in passing through to the CC plant. The stack parameters and location of the CC stack are different to the existing permitted facility. As this affects dispersion, the impacts of these pollutants were assessed. The Applicant concludes that for these pollutants the PCs are either below 1% and 10% of the ES or the PECs are below the ES. We agree with the Applicant's conclusion.

No further emissions controls are required with the exception of Ammonia which is considered further in sections 5.2.2 and 5.3.2. The pollutants

associated with the carbon capture process are considered further in this section.

To assess the impact from the CC plant's absorber stacks, A1 and A2, the emissions associated with the CC plant were modelled i.e. amine solvent and its degradation products.

This section of the decision document deals primarily with the dispersion modelling of emissions to air from the CC plant absorber stacks and the impact on local air quality. The impact on conservation sites is considered in section 5.3. The impact from CO_2 venting is considered in section 5.4.

The Applicant has assessed the CC plant's potential emissions to air against the relevant air quality standards, and the potential impact upon local conservation and habitat sites and human health. These assessments predict the potential effects on local air quality from the CC plant's stack emissions using the air dispersion model software ADMS 6.0 dispersion model, which is a commonly used computer model for regulatory dispersion modelling. The model used 5 years of meteorological data collected from the weather station at London City Airport between 2018 and 2022. London City Airport is located approximately 6km to the west of the CC plant. We consider this meteorological site reasonably representative. The effect of the terrain surrounding the site upon plume dispersion was considered in the dispersion modelling.

The air impact assessments, and the dispersion modelling upon which they were based, employed the following assumptions:

- All 5 lines of the incineration plant operate continuously at the permitted ELVs with no additional abatement of emissions through the CC plant.
- Direct amine emissions were modelled, these are amine emissions from the solvent and solvent breakdown pollutants, as shown below:

Amine Emission	Concentration (mg/m³)
Amine 1 [1-Piperazineethanol]	0.3
Amine 2 [Piperazine]	0.0012
Nitrosamine 1 [4-Nitroso-1-piperazineethanol]	0.00017
Nitrosamine 2 [1-nitrosopiperazine]	0.0026
Total aldehydes	1
Total amides	0.023
Degradant 100 [Acetone]	0.081
Degradant 101 [Ethanol]	0.032
Degradant 102 [Acetonitrile]	0.29

- Indirect amine impacts, these are the impacts of the degradation of the amines in ambient air, modelled using the ADMS chemistry module
- Amine 3 (1-Piperazineethanol) was not included in the impact assessment. Emissions are unlikely because the amine is a minor, low-volatility solvent component.

We are in agreement with this approach. The assumptions underpinning the model have been checked and are a reasonable worst-case.

The Applicant established background pollutant concentrations from monitoring data from London Marylebone Road and London Westminster, and Defra background maps. We consider the chosen background values to be reasonably representative.

As well as predicting the maximum ground level concentration of the pollutants within the modelling domain, the Applicant has modelled several discrete receptor locations to represent human and ecological exposure.

The Applicant's use of the dispersion models, selection of input data, use of background data and the assumptions made, have been reviewed by our modelling specialists to establish the robustness of the Applicant's air impact assessment. The output from the model has then been used to inform further assessment of human health impacts and impact on protected conservation areas. Our audit takes account of modelling uncertainties. We make reasonable worst-case assumptions and use the uncertainties (minimum 140%) in analysing the likelihood of exceeding any particular standard.

We have audited the air quality and human health impact assessment and, although we do not necessarily agree with the Applicant's exact numerical predictions, we agree with the conclusions, provided that the source terms from the proposed facility are reasonably representative.

The Applicant's modelling predictions are summarised in the following sections.

5.2.1 Assessment of Air Dispersion Modelling Outputs

The Applicant's modelling predicted peak ground level exposure to pollutants in ambient air and at discreet receptors. The table below show their predicted peak ground level concentrations.

As part of our checks, we carry out sensitivity analysis of the data provided and conduct our own check modelling to ensure that the Applicant's modelling predictions are reliable.

Whilst we have used the Applicant's modelling predictions in the table below, we have made our own simple verification calculation of the percentage PC and predicted environmental concentration (PEC). These are the numbers shown in the tables below and so may be very slightly different to those shown in the Application. Any such minor discrepancies do not materially impact on our conclusions.

Incinerator emissions from carbon capture stack

Pollutant	Reference Period	ES ($\mu g/m^3$)	PC ($\mu g/m^3$)	PC as % of ES	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC as % of ES

Pollutant	Reference Period	ES (µg/m^3)	PC (µg/m^3)	PC as % of ES	Background (µg/m^3)	PEC (µg/m^3)	PEC as % of ES
Nitrogen Dioxide	Hourly Mean	200	49.66	24.83	42.2	91.86	45.93
Nitrogen Dioxide	Annual Mean	40	2.13	5.33	21.1	23.23	58.08
Sulphur Dioxide	15min Mean	266	114.43	43.02	8.6	123.03	46.25
Sulphur Dioxide	Hourly Mean	350	68.79	19.65	8.6	77.39	22.11
Sulphur Dioxide	Daily Mean	125	6.35	5.08	8.6	14.95	11.96
PM10	Daily Mean	50	0.4	0.80	31.8	32.2	64.40
PM10	Annual Mean	40	0.13	0.33	15.9	16.03	40.08
PM2.5	Annual Mean	10	0.13	1.30	8.6	8.73	87.30
Hydrogen Chloride	Hourly Mean	750	59.4	7.92	-	-	-
Hydrogen Fluoride	Hourly Mean	160	4.5	2.81	-	-	-
Hydrogen Fluoride	Annual Mean	16	0.1	0.63	-	-	-
TOC (as Benzene)	Annual Mean	5	0.3	6.00	0.51	0.81	16.20
Carbon Monoxide	8 Hour Mean	10000	47.9	0.48	175	222.9	2.23
Ammonia	Hourly Mean	2500	8.25	0.33	2.4	10.65	0.43
Ammonia	Annual Mean	180	0.21	0.12	1.2	1.41	0.78
Mercury	Hourly Mean	0. 6	0.02	3.33	0.02	0.04	6.67
Mercury	24 hour mean (long term)	0.06	0.0041	6.83	0.01	0.0141	23.50
Antimony	Hourly Mean	150	0.0114	0.01		0.0114	0.01
Antimony	Annual Mean	5	0.00029	0.01		0.00029	0.01
Arsenic	Annual Mean	0.006	0.00063	10.50	0.00073	0.00136	22.67
Total Chromium	24 hour mean (long term)	2	0.019	0.95	0.007	0.026	1.30
Copper	24 hour mean (long term)	0.05	0.006	12.00	0.025	0.031	62.00
Lead	Annual Mean	0.25	0.0013	0.52	0.0054	0.0067	2.68

Pollutant	Reference Period	ES (µg/m^3)	PC (µg/m^3)	PC as % of ES	Background (µg/m^3)	PEC (µg/m^3)	PEC as % of ES
Manganese	Hourly Mean	1500	0.059	0.00	0.023	0.082	0.01
Manganese	Annual Mean	0.15	0.0015	1.00	0.0117	0.0132	8.80
Nickel	Hourly Mean	0.7	0.218	31.14	0.004	0.222	31.71
Nickel	Annual Mean	0.02	0.0056	28.00	0.0018	0.0074	37.00
Vanadium	Annual Mean	1	0.00015	0.02	0.0011	0.00125	0.13
Chromium VI	Annual Mean	0.00025	0.0000038	1.52		0.0000038	1.52
Cobalt	Annual Mean		0.000139		0.00022	0.000359	
Cadmium	24 hour mean (short term)	0.03	0.0041	13.67	0.0002	0.0043	14.33
Cadmium	Annual Mean	0.005	0.00051	10.20	0.0001	0.00061	12.20
PAH as benzo(a)pyrene	Annual Mean	0.00025	0.00000265	1.06	0.0000603	0.00006295	25.18
PCB	Hourly Mean	6	0.0049	0.08	0.00008	0.00498	0.08
PCB	Annual Mean	0.2	0.00013	0.07	0.00004	0.00017	0.09
Dioxins	Annual Mean		$1.52x10^{-9}$				

Direct emissions from amine solvent

Pollutant	Reference period	ES (µg/m^3)	PC (µg/m^3)	PC as % of ES
Amine 1	Hourly mean	400	0.5	0.13
Amine 1	Daily mean	100	0.052	0.05
Amine 2	Daily mean	15	0.00021	0.001
Amine 1 + Amine 2 (note 1)	Daily mean	15	0.05221	0.35
Nitrosamine 1	Annual mean	0.0002	0.0000043	2.15
Nitrosamine 2	Annual mean	0.0002	0.0000553	27.65
Aldehydes (as formaldehyde)	30 minute mean	100	1.91	1.91
	Annual mean	5	0.02	0.40
Amides	Annual mean	70	0.00048	0.001

Degradant 100	Annual mean	860	0.0017	0.0002
Degradant 101	Annual mean	47	0.00068	0.0014
Degradant 102	Annual mean	50	0.0062	0.01

Amine indirect impacts

Pollutant	Reference period	ES (ng/m^3)	PC Max Study Area (ng/m^3)	PC Max Study Area as % of ES	PC at Residential Receptor (ng/m^3)	PC as % of ES (Residential Receptor)
Nitrosamine 1	Annual mean	0.2	0.0194	9.70	0.0157	7.85
Nitrosamine 2	Annual mean	0.2	0.000086	0.04	0.00007	0.04
Total Indirect Nitrosamines	Annual mean	0.2	0.0195	9.75	0.0158	7.90
Direct Nitrosamines	Annual mean	0.2	0.0589	29.45	0.0257	12.85
Total Nitrosamines	Annual mean	0.2	0.0736	36.80	0.0349	17.45
Nitramine 1	Annual mean	0.2	0.0175	8.75	0.0172	8.60
Nitramine 2	Annual mean	0.2	0.000081	0.04	0.000079	0.04
Total Nitramines	Annual mean	0.2	0.0176	8.80	0.0173	8.65
Total Nitrosamines + Nitramines	Annual mean	0.2	0.0844	42.20	0.0495	24.75

(i) Screening out emissions which are insignificant

From the table above the following emissions can be screened out as insignificant in that the PC is < 1% of the long term ES and <10% of the short term ES. These are:

- PM10, HCl, HF, CO, NH_3, Sb, total Cr, Pb, V and PCBs, amines 1, 2 and 3, amides, degradants 100, 101 and 102.

Therefore, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT in accordance with PCC emerging techniques guidance subject to the detailed audit referred to below.

(ii) Emissions unlikely to give rise to significant pollution

From the table above all other following emissions (which were not screened out as insignificant) have been assessed as being unlikely to give rise to significant pollution in that the PEC is less than 100% (taking expected modelling uncertainties into account) of both the long term and short term ES.

For these emissions, we have carefully scrutinised the Applicant's proposals to ensure that they are applying our emerging techniques guidance to prevent and minimise emissions of these substances. This is reported in section 6 of this document.

5.2.2 Consideration of key pollutants

(i) Ammonia (NH_3)

Ammonia can be screened out as insignificant in that the PC is <1% of the long-term ES and <10% of the short term ES.

(ii) Amines, nitrosamines, nitramines and aldehydes

The above tables shows that for Aldehyde (as formaldehyde) emissions, the maximum long-term PC is less than 1% of the ES and the maximum short-term PC is less than 10% of the ES and so can be screened out as insignificant. Therefore, we consider the Applicant's proposals for preventing and minimising the emissions of these substances to be BAT in accordance with the emerging techniques guidance for the CC plant.

The above tables shows that for amine 1 and amine 2 for the maximum long-term PC is less than 1% of the ES and the maximum short-term PC is less than 10% of the ES and so can be screened out as insignificant. For total nitrosamines and Nitramines the maximum long term PC is greater than 1% of the ES for NDMA and therefore cannot be screened out as insignificant. However, the emission is not expected to result in the ES being exceeded as it is significantly lower than the ES.

For amine 1, the applicant used the available EALs for monoethanolamine (MEA) as a proxy. The UKHSA advised us on a previous application that as there is closer structural similarity of amine 1 to amine 2 (piperazine), the UKHSA considered that piperazine is a more appropriate substance to read across from than MEA. We have therefore added up the total PCs of amines 1 and 2 and compared them against the EAL for piperazine: as these are below 1% of the EAL we have concluded that impacts on human health associated with these emissions are insignificant.

The Environment Agency Risk Assessment Guidance includes Environmental Assessment Levels for MEA (a primary amine) and NDMA (a stable nitrosamine). Amines, nitrosamine and nitramines are not routinely monitored in the UK, therefore in the absence of data the Applicant assumed background concentrations to be zero.

Directly emitted amines have the potential to react in the atmosphere to form amine degradation products – nitramines and nitrosamines. The nitrosamines and nitramines that form in the atmosphere in this way are referred to as indirect emissions.

The Applicant used the ADMS 6 amine chemistry module to calculate concentrations of amines, nitramines and nitrosamines based on the release rate of pollutants and a number of user-defined parameters. The Applicant considered that the main model scenario, in which there are direct emissions of amines, nitrosamines and nitramines, and the amine chemistry is enabled, is the most realistic scenario.

The Applicant concludes that, even under the worst case assumptions, the PEC of total nitrosamines and nitramines would remain well below the ES and no significant effects would occur.

We are satisfied that the Applicant's amine chemistry model incorporates several conservative assumptions based on the proposed emission parameters.

We have included improvement condition IC6 in the Permit for the Operator to review and compare monitoring data from first year of operation of the CC plant to the air emissions risk assessment submitted with the application.

Whilst all emissions cannot be screened out as insignificant, the Applicant's modelling shows that the CC plant is unlikely to result in a breach of the ES. We agree with the Applicant's conclusions.

(iii) Summary

For the above emissions to air, for those emissions that have not screened out as insignificant, we have carefully scrutinised the Applicant's proposals to ensure that they are applying the emerging techniques guidance to prevent and minimise emissions of these substances. This is reported in section 6 of this document. We consider the Applicant's proposals for preventing and minimising emissions to be BAT in accordance with PCC emerging techniques guidance for the CC plant.

5.2.3 Consideration of Local Factors

(i) Impact on Air Quality Management Areas (AQMAs)

The CC plant is located in an AQMA which has been declared for PM_{10} and NO_2.

The maximum modelled PM_{10} PC is <1% of the long-term ES and <10% of the short term ES. The maximum modelled NO_2 PC is slightly over the insignificance criteria but <1% of the long-term ES and <10% at the most impacted residential receptor. Therefore, even though the background is already above the ES, the contribution from the Installation is negligible. This approach is in accordance with Defra's IED EPR Guidance on Part A installations.

5.3 Impact on protected conservation areas (SPAs, SACs, Ramsar sites and SSSIs and local nature sites)

5.3.1 Sites Considered

There are no Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites located within 10 km of the CC plant. However, the Applicant assessed impacts at Epping Forest (SAC) which is outside of the 10 km screening distance.

The following Sites of Special Scientific Interest (SSSI) are located within 2 km of the CC plant:

- Inner Thames Marshes
- Abbey Wood

The following local nature sites (ancient woodlands (AW), local wildlife sites (LWS) and national and local nature reserves (LNR)) are located within 2 km of the Installation:

- Crossness
- Lesnes Abbey Woods
- Rainham Marshes
- Belvedere Dykes
- Erith Marshes
- River Thames and tidal tributaries
- Southmere Park & Yarnton Way/Viridion Way
- Crossness Sewage Treatment Works Pond
- Lower River Beam and Ford Works Ditches
- Thamesview Golf Course
- Dagenham Breach and the lower Beam River in Dagenham
- Franks Park, Belvedere
- The Ridgeway
- Crossway Park and Tump 52
- Lesnes Abbey Woods and Bostall Woods
- St John the Baptist Churchyard, Erith
- Crossways Lake Nature Reserve and Thameside Walk Scrub
- Wennington, Aveley and Rainham Marshes
- Hollyhill Open Space

- Erith Quarry and Fraser Road
- Riverside Sewage Treatment Works
- Streamway, Chapman's Land and Erith Cemetery
- Ridgeway in Greenwich
- Mudlands
- Goresbrook and the Ship & Shovel Sewer
- Lesnes Abbey Woods

5.3.2 Habitats assessment

5.3.2.1 Epping Forest SAC

Epping Forest SAC is about 12 kilometres from the site. The Applicant looked at possible effects on the SAC even though it is more than 10 kilometres away, which is the screening distance, as agreed with Natural England.

The Applicant's assessment shows negligible change in impacts from the currently permitted incineration plants.

5.3.3 SSSI Assessment

The results of the Applicant's assessment of the impacts of emissions at the SSSIs are shown in the tables below.

5.3.3.1 Inner Thames Marshes

Pollutant	ES	Background	Process contribution		Predicted environmental contribution		Change in impact from permitted incineration plants	
	µg/m³	µg/m³	µg/m³	% of ES	µg/m³	% of ES	µg/m³	% of ES
NO_x Annual	30	31.6	1.73	5.77	33.33	111.10	0.18	0.60
NO_x Daily Mean	200		11.106	5.55				
Ammonia annual	3	1.1	0.111	3.70	1.21	40.37	-0.046	-1.53
SO_2 annual	10	4.4	0.47	4.70	4.87	48.70	0.055	0.55
	kgN/ha/yr	kgN/ha/yr	kgN/ha/yr	% of ES	kgN/ha/yr	% of ES	kgN/ha/yr	% of ES
N deposition	10	12.2	0.752	7.52	12.95	129.52	-0.236	-2.36

(1) For detailed assessments where the ozone is below the AOT40 critical level and sulphur dioxide is below the lower critical level of 10 micrograms per cubic metre

NOx daily mean impacts are insignificant because the PC is <10% of the critical level. Ammonia and SO_2 are not likely to damage because the PEC is less than the ES. The PCs for NOx annual mean and N deposition are above 1% of the critical level or critical load and the background is already exceeded. Ammonia and N deposition impacts are being reduced from those that are already permitted. For NOx annual mean the table above shows a

small increase in impacts, however the modelling also shows that NOx annual mean will reduce over some areas of the SSSI. The range of change in impacts is from a reduction of 0.3% to an increase of 0.6% of the critical load

5.3.3.2 Abbey Wood

This site is designated as a SSSI for geological features. There are no emissions from the Installation that could damage the geological features.

See section 7.3.1 for consultation with Natural England.

5.3.4 Assessment of local nature sites

Conservation sites are protected in law by legislation which provides the highest level of protection for SACs and SPAs, and also protection for SSSIs. The Environment Act 1995 provides more generalised protection for flora and fauna rather than for specifically named conservation designations. It is under the Environment Act 1995 that we assess other sites (such as ancient woodlands, local wildlife sites and national and local nature reserves) which prevents us from permitting something that will result in significant pollution; and which offers levels of protection proportionate with other European and national legislation. However, it should not be assumed that because levels of protection are less stringent for these other sites, that they are not of considerable importance. Local sites link and support EU and national nature conservation sites together and hence help to maintain the UK's biodiversity resilience.

For SACs, SPAs, Ramsars and SSSIs we consider the PC and the background levels in making an assessment of impact. In assessing the local nature sites under the Environment Act 1995 we look at the impact from the Installation alone to determine whether it would cause significant pollution. This is a proportionate approach, in line with the levels of protection offered by the conservation legislation to protect these other sites (which are generally more numerous than Natura 2000 or SSSIs) whilst ensuring that we do not restrict development.

Critical levels and loads are set to protect the most vulnerable habitat types. Thresholds change in accordance with the levels of protection afforded by the legislation. Therefore, the thresholds for SAC, SPA and SSSI features are more stringent than those for local nature sites.

We would generally conclude that the Installation is not causing significant pollution at these other sites if the PC is less than the relevant critical level or critical load, provided that the Applicant is using BAT or operating in accordance with the guidance on emerging techniques to control emissions.

The Applicant concluded that the PC does not exceed the critical level or critical load at any of the local nature sites. We are satisfied that the CC plant will not cause significant pollution at any of the other conservation sites. The

Applicant is required to prevent, minimise and control emissions in accordance with the emerging techniques guidance.

5.4 Other Emissions

5.4.1 Impact of abnormal venting of carbon dioxide (CO_2)

The release of the captured highly concentrated CO_2 under pressure from the CC plant has the potential to cause harm to human health. It is recognised that venting to atmosphere of concentrated CO_2 may be required during operation of the CC plant. For this reason, the Applicant provided an assessment of the impact of the vented concentrated CO_2 on harm to health at nearby sensitive receptors.

The applicant provided an assessment which presented a number of venting scenarios. They used DNV PHAST to predict impacts on nearby receptors and compared these to HSE Workplace Exposure Limit guidance (EH40).

The applicant concluded that there are no modelled ground level concentrations greater than 5,000 ppm. Based on the Applicant's assessment we are satisfied that there won't be a significant impact on the health.

A pre-operational measure PO6 has been included in the Permit requiring the Operator to provide an updated assessment for approval to confirm the conditions when venting will occur before commissioning of the CC plant. Also included in this condition is a requirement for the Operator to submit to the Environment Agency for approval a management plan detailing operating techniques to minimise potential CO_2 phase changes, solid effects and dense gas behaviour when venting CO_2 atmosphere. This is included because the Operator's assessment assumes that CO_2 releases are (fully expanded) gas with no phase change and we, therefore, require the Operator to have plans in place to minimise the CO_2 phase changes, dense gas behaviour or incidents that could occur during the proposed venting operation. The approved vent management plan submitted under PO6 will be an operating technique under the permit.

5.4.2 Noise and vibration

The Application contained a noise impact assessment which identified local noise-sensitive receptors, potential sources of noise at the proposed plant and noise mitigation measures.

The Applicant's assessment identified a rating level 7 dB above the nighttime background level at the most affected receptor when no additional mitigation is applied. The dominant noise source is the back-up air source heat pump (ASHP) fans. According to BS4142, an exceedance of +7 dB may indicate an adverse impact, depending on the context. We have reviewed the Applicant's assessment and agree with their conclusions.

The Applicant explained that the plant has not yet reached final design and that further mitigation is planned. Their aim is to ensure that nighttime rating levels do not exceed the background level of 49 dB, which is also a requirement of their planning permission. The Applicant identified the following mitigation options, each of which could reduce impacts to meet the planning requirements:

- relocating the ASHP fans further away and behind the water heating facility so the building provides noise shielding
- selecting quieter ASHP fan models
- installing an acoustic barrier around the ASHP fans

Our view is that an adverse impact would only be acceptable if Best Available Techniques (BAT) were applied to minimise noise. On this basis, we agree with the Applicant that further mitigation is necessary. We have therefore set a pre-operational condition (PO8) to ensure these measures are implemented, incorporated into the noise management plan, and followed by a revised noise impact assessment once the final design is complete. A pre-operational condition is appropriate given that detailed plant design is outstanding.

Based upon the information in the application, we are satisfied that the appropriate measures will be in place to prevent or, where that is not practicable, to minimise noise and vibration and to prevent pollution from noise and vibration outside the site.

5.4.3 Emissions to water

There will be no process emissions to water. Uncontaminated surface water run-off will be emitted via a series of 12 outfalls into a network of ditches to the west of the carbon capture plant. The outfalls are shown as N1 to N12 on the drainage plan provided in the Application.

5.4.4 Emissions to sewer

There will be no discharges to sewer, other than from welfare facilities that are not regulated under this Permit.

5.4.5 Fugitive emissions

The IED specifies that plants must be able to demonstrate that the plant is designed in such a way as to prevent the unauthorised and accidental release of polluting substances into soil, surface water and groundwater. In addition, storage requirements for waste and for contaminated water under Article 46(5) of the IED must be arranged.

The Applicant has provided information regarding the storage and bunding of the raw materials that will be required for the operation of the CC plant. This is described in detail in section 4.2.2 of this document.

Based upon the information in the Application we are satisfied that appropriate measures will be in place to prevent and /or minimise fugitive emissions.

5.4.6 Summary of our conclusions of the CC plant's environmental impacts

As described in section 5, we are satisfied with the information provided in the application and that there will be no risk of significant impact. As this is emerging technology, we have included improvement and pre-operational conditions asking the Applicant to verify the assessments provided with the application based on operational experience. In the unlikely event these assessments do not confirm that there is no risk of significant impact further action will be taken to address this. We are satisfied the CC plant will operated in accordance with the emerging techniques guidance which is considered to be BAT.

6 Application of Emerging Techniques Guidance

6.1 Scope of Consideration

In this section, we explain how we have determined whether the Applicant's proposals are in accordance with the emerging techniques, or equivalent, for the carbon capture sector. We currently consider that meeting this guidance or proposing alternative measures that deliver an equivalent level of environmental protection demonstrates the use of BAT.

6.2 Post- combustion Carbon Dioxide Capture Emerging Techniques

We have reviewed the Application against the emerging techniques guidance for capture of CO_2: Post-combustion carbon dioxide capture: emerging techniques - GOV.UK (www.gov.uk).

The Applicant's response to each technique is set out in Annex 1 of this decision document together with our assessment of whether the Operator will be compliant with the relevant emerging techniques.

6.3 Monitoring

6.3.1 Monitoring during normal operations

We have decided that monitoring should be carried out for the parameters listed in Schedule 3 using the methods and to the frequencies specified in those tables. These monitoring requirements have been imposed in order to demonstrate compliance with ELVs, to enable correction of measured concentration of substances to the appropriate reference conditions and

provide data regarding the quantity of CO_2 captured in order for the Operator to determine the capture rate of the CC plant.

For emissions to air, the methods for continuous and periodic monitoring are in accordance with our guidance for monitoring of stack emissions to air where methods are available.

Based on the information in the Application and the requirements set in the conditions of the Permit we are satisfied that the Operator's techniques, personnel and equipment will have either MCERTS certification or MCERTS accreditation as appropriate.

6.4 Reporting

We have specified the reporting requirements in Schedule 4 of the Permit either to meet the reporting requirements set out in the IED or in the emerging techniques guidance, or to ensure data is reported to enable timely review by us to ensure compliance with the Permit conditions and to monitor the efficiency of material use and the efficiency of the CC plant in capturing CO_2.

7 Other legal requirements

In this section we explain how we have addressed other relevant legal requirements, to the extent that we have not addressed them elsewhere in this document.

7.1 The EPR 2016 and related Directives

The EPR delivers the requirements of a number of European and national laws.

7.1.1 Schedules 1 and 7 to the EPR 2016 – **IED Directive**

We address the requirements of the IED in the body of this document above and the specific requirements of the emerging techniques guidance in Annex 1 of this document.

There is one requirement not addressed above, which is that contained in Article 5(3) IED. Article 5(3) requires that "In the case of a new installation or a substantial change where Article 4 of Directive 85/337/EC (now Directive 2011/92/EU) (the EIA Directive) applies, any relevant information obtained or conclusion arrived at pursuant to articles 5, 6 and 7 of that Directive shall be examined and used for the purposes of granting the permit."

- Article 5 of EIA Directive relates to the obligation on developers to supply the information set out in Annex IV of the Directive when making an application for development consent.

- Article 6(1) requires Member States to ensure that the authorities likely to be concerned by a development by reason of their specific environmental responsibilities are consulted on the Environmental Statement and the request for development consent.
- Article 6(2)-6(6) makes provision for public consultation on applications for development consent.
- Article 7 relates to projects with transboundary effects and consequential obligations to consult with affected Member States.

The grant or refusal of development consent is a matter for the relevant planning authority. The Environment Agency's obligation is therefore to examine and use any relevant information obtained or conclusion arrived at by the local planning authorities pursuant to those EIA Directive articles.

In determining the Application we have considered the following documents: -

- The Environmental Statement submitted with the planning application (which also formed part of the Environmental Permit Application).
- The decision of the Planning Inspectorate (through national infrastructure planning) to grant planning permission on 05/11/2025.
- The report and decision notice of the planning authority accompanying the grant of planning permission.

From consideration of all the documents above, the Environment Agency considers that no additional or different conditions are necessary.

The Environment Agency has also carried out its own consultation on the Environmental Permitting Application which included the Environmental Statement submitted to the local planning authority. The results of our consultation are described elsewhere in this decision document.

7.1.2 Schedule 9 to the EPR 2016 – **Waste Framework Directive**

We must exercise our relevant functions for the purposes of ensuring that the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste and that any waste generated is treated in accordance with Article 4 of the Waste Framework Directive. (See also section 4.3.9)

The conditions of the Permit ensure that waste generation from the facility is minimised. Where the production of waste cannot be prevented it will be recovered wherever possible or otherwise disposed of in a manner that minimises its impact on the environment. This is in accordance with Article 4.

We must also exercise our relevant functions for the purposes of implementing Article 13 of the Waste Framework Directive; ensuring that the requirements in the second paragraph of Article 23(1) of the Waste Framework Directive are met; and ensuring compliance with Articles 18(2)(b), 18(2)(c), 23(3), 23(4) and 35(1) of the Waste Framework Directive.

Article 13 relates to the protection of human health and the environment. These objectives are addressed elsewhere in this document.

Article 35(1) relates to record keeping and its requirements are delivered through permit conditions.

7.1.3 Schedule 22 to the EPR 2016 – **Water Framework and Groundwater Directives**

To the extent that it might lead to a discharge of pollutants to groundwater (a "groundwater activity" under the EPR 2016), the Permit is subject to the requirements of Schedule 22, which delivers the requirements of EU Directives relating to pollution of groundwater. The Permit will require the taking of all necessary measures to prevent the input of any hazardous substances to groundwater, and to limit the input of non-hazardous pollutants into groundwater so as to ensure such pollutants do not cause pollution, and satisfies the requirements of Schedule 22.

No releases to groundwater from the Installation are permitted. The Permit also requires material storage areas to be designed and maintained to a high standard to prevent accidental releases.

7.1.4 Directive 2003/35/EC – **The Public Participation Directive**

Regulation 60 of the EPR 2016 requires the Environment Agency to prepare and publish a statement of its policies for complying with its public participation duties. We have published our public participation statement.

This Application has been consulted upon in line with this statement. This satisfies the requirements of the Public Participation Directive.

Our decision in this case has been reached following a programme of public consultation on the original Application. The way in which this has been done is set out in Section 2. A summary of the responses received to our consultations and our consideration of them is set out in Annex 2.

7.2 National primary legislation

7.2.1 Environment Act 1995

(i) Section 4 (Pursuit of Sustainable Development)

We are required to contribute towards achieving sustainable development, as considered appropriate by Ministers and set out in guidance issued to us. The Secretary of State for Environment, Food and Rural Affairs has issued *The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance (December 2002)*. This document:

"*provides guidance to the Agency on such matters as the formulation of approaches that the Agency should take to its work, decisions about priorities for the Agency and*

the allocation of resources. It is not directly applicable to individual regulatory decisions of the Agency".

In respect of regulation of industrial pollution through the EPR, the Guidance refers in particular to the objective of setting permit conditions "*in a consistent and proportionate fashion based on Best Available Techniques and taking into account all relevant matters…*". The Environment Agency considers that it has pursued the objectives set out in the Government's guidance, where relevant, and that there are no additional conditions that should be included in this Permit to take account of the Section 4 duty.

(ii) Section 5 (Preventing or Minimising Effects of Pollution of the Environment)

We are satisfied that our pollution control powers have been exercised for the purpose of preventing or minimising, remedying or mitigating the effects of pollution.

(iii) Section 6(1) (Conservation Duties with Regard to Water)

We have a duty to the extent we consider it desirable generally to promote the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and the land associated with such waters, and the conservation of flora and fauna which are dependent on an aquatic environment.

We consider that no additional or different conditions are appropriate for this Permit.

(iv) Section 6(6) (Fisheries)

We have a duty to maintain, improve and develop fisheries of salmon, trout, eels, lampreys, smelt and freshwater fish.

We consider that no additional or different conditions are appropriate for this Permit.

(v) Section 7 (General Environmental Duties)

This places a duty on us, when considering any proposal relating to our functions, to have regard amongst other things to any effect which the proposals would have on sites of archaeological, architectural, or historic interest; the economic and social well-being of local communities in rural areas; and to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna, features, buildings, sites or objects.

We considered whether we should impose any additional or different requirements in terms of our duty to have regard to the various conservation objectives set out in Section 7, but concluded that we should not.

(vi) Section 39 (Costs and Benefits)

We have a duty to take into account the likely costs and benefits of our decisions on the applications ('costs' being defined as including costs to the environment as well as any person). This duty, however, does not affect our obligation to discharge any duties imposed upon us in other legislative provisions.

In so far as relevant we consider that the costs that the permit may impose on the applicant are reasonable and proportionate in terms of the benefits it provides.

(vii) Section 81 (National Air Quality Strategy)

We have had regard to the National Air Quality Strategy and consider that our decision complies with the Strategy, and that no additional or different conditions are appropriate for this Permit.

We have also had regard to the clean air strategy 2019 and consider that our decision complies with the Strategy, and that no additional or different conditions are appropriate for this Permit.

We have had regard to the National Air Pollution Control Programme (set under the National Emissions Ceiling Regulations 2018) and consider that our decision complies with the Strategy, and that no additional or different conditions are appropriate for this Permit.

7.2.2 Section 108 Deregulation Act 2015 – Growth duty

We considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit.

Paragraph 1.3 of the statutory guidance issued by the Department of Business, Energy and Industrial Strategy in March 2017 says:

"The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation."

We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise

non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections.

We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards. It also ensures that any pollution that may arise from the regulated facility does not adversely affect local businesses.

7.2.3 Legislative and Regulatory Reform Act 2006

In accordance with section 21 of this Act, when making this decision we have had regard to the need to be transparent, accountable, proportionate and consistent, and the need to target action where it is needed.

In accordance with section 22 of the Act we have had regard to the Regulators' Code; in particular the need to base our decision on environmental risk, and to support the applicant to comply and grow, so that burdens have only been imposed where they are necessary and proportionate.

7.2.4 Human Rights Act 1998

We have considered potential interference with rights addressed by the European Convention on Human Rights in reaching our decision and consider that our decision is compatible with our duties under the Human Rights Act 1998. In particular, we have considered the right to life (Article 2), the right to a fair trial (Article 6), the right to respect for private and family life (Article 8) and the right to protection of property (Article 1, First Protocol). We do not believe that Convention rights are engaged in relation to this determination.

7.2.5 Countryside and Rights of Way Act 2000 (CROW 2000)

Section 85 of this Act imposes a duty on Environment Agency to have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty (AONB). There is no AONB which could be affected by the CC plant.

7.2.6 Wildlife and Countryside Act 1981

Under section 28G of the Wildlife and Countryside Act 1981 the Environment Agency has a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest. Under section 28I the Environment Agency has a duty to consult Natural England in relation to any permit that is likely to damage SSSIs.

We assessed the Application and concluded that the CC plant will not damage the special features of any SSSI. This was recorded on a CROW Appendix 4 form.

The Wildlife and Countryside Act (CRoW) assessment is summarised in greater detail in section 5.3.3 of this document. A copy of the full Appendix 4 Assessment can be found on the public register.

7.2.7 Natural Environment and Rural Communities Act 2006

Section 40 of the Natural Environment and Rural Communities Act 2006 has been amended with effect from 1 January 2023 to require consideration of the general biodiversity objective, which is to further the conservation and enhancement of biodiversity through the exercise of our functions.

We have considered the general biodiversity objective when carrying out our permit application determination and, consider that no different or additional conditions are required in the permit.

7.2.8 Countryside Act 1968

Section 11 imposes a duty on the Environment Agency to exercise its functions relating to any land, having regard to the desirability of conserving the natural beauty and amenity of the countryside including wildlife. We have done so and consider that no different or additional conditions in the Permit are required.

7.2.9 National Parks and Access to the Countryside Act 1949

Section 11A and section 5(1) imposes a duty on the Environment Agency when exercising its functions in relation to land in a National Park, to have regard to the purposes of conserving and enhancing the natural beauty, wildlife and cultural heritage of the areas, and of promoting opportunities for the understanding and enjoyment of National Parks by the public.

We have done so and consider that no different or additional conditions in the Permit are required. There is no National Park which could be affected by the CC plant.

7.3 National secondary legislation

7.3.1 Conservation of Habitats and Species Regulations 2017

We assessed the Application in accordance with our guidance and concluded that for the purposes of the Habitats Regulations there will be likely significant effects on any European site and undertook an Appropriate Assessment (Habitats Regulations Assessment Stage 2) of those effects.

The Habitats Regulations Assessment is summarised in greater detail in section 5.3.2 of this document. A copy of the Habitats Regulations Assessment can be found on the public register.

We have also considered our general duties under Regulation 9(3) to have regard to the requirements of the Habitats Directive in the exercise of our powers and under Regulation 10 in relation to wild bird habitat to take such steps in the exercise of their functions as we consider appropriate so far as lies within our powers to secure preservation, maintenance and re-establishment of a sufficient diversity and area of habitat for wild birds.

We considered whether we should impose any additional or different requirements in the permit in terms of these duties but concluded that we should not.

7.3.2 **Water Environment (Water Framework Directive) Regulations 2017**

Consideration has been given to whether any additional requirements should be imposed in terms of the Environment Agency's duty under regulation 3 to secure compliance with the requirements of the Water Framework Directive, Groundwater Directive and the EQS Directive through, amongst other things, environmental permits, and its obligation in regulation 33 to have regard to the river basin management plan (RBMP) approved under regulation 31 and any supplementary plans prepared under regulation 32. However, it is felt that existing conditions are sufficient in this regard and no other appropriate requirements have been identified.

We are satisfied that granting this application with the conditions proposed would not cause the current status of the water body to deteriorate.

7.4 Other relevant legal requirements

7.4.1 Duty to Involve

Section 23 of the Local Democracy, Economic Development and Construction Act 2009 require us where we consider it appropriate to take such steps as we consider appropriate to secure the involvement of interested persons in the exercise of our functions by providing them with information, consulting them or involving them in any other way. Section 24 requires us to have regard to any Secretary of State guidance as to how we should do that.

The way in which the Environment Agency has consulted with the public and other interested parties is set out in section 2.2 of this document. The way in which we have taken account of the representations we have received is set out in Annex 4. Our public consultation duties are also set out in the EP Regulations, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive. In addition to meeting our consultation responsibilities, we have also taken account of our guidance in Environment Agency internal Guidance Note RGN6.

Annexes

Annex 1: Compliance with guidance: Post-combustion carbon dioxide capture (PCC) emerging techniques

We have considered the Applicant's proposals in accordance with the emerging techniques guidance and assessed whether the proposals are compliant with the guidance.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
2. Power Plant selection and integration with the PCC plant				
2.1 Energy efficiency in plants with PCC	You must maximise the thermal energy efficiency of the plant and of the supply of heat for the associated PCC plant.	General energy efficiency measures are implemented across the CC. The effect of the carbon capture plant on energy efficiency of the two incineration plants is covered in the decision documents for variations: EPR/BK0825IU/V013 EPR/EP3245QR/V004	Y	Condition 1.2.1
2.2 Dispatchable Operation	In line with the needs of a UK electricity system with a large amount of intermittent renewable generation, all thermal power plants, including those with CO_2 capture, are likely to be dispatchable. This means that the power plant operator can, within technical limits on rates of change in output and on minimum stable generation levels, operate the plant at any required output, up to its full load, at any time, and sustain this output indefinitely. CHP plants and EfW plant are not expected to be dispatchable, but some variation in output is likely. However, they may not be able to meet the requirements	The CC plant has been designed so that the incineration plants can operate independently.	Y	Condition 2.3.1 with table S1.2 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	for good quality CHP over periods when electrical output is constrained. The design of the plant may be changed to help variable operation, possibly with a slight impact on full load thermal efficiency. Where you plan to install CO_2 capture onto a CHP plant, you must design the plant so that it can operate efficiently during periods of power only mode. The primary purpose of an EfW plant is to treat waste. Therefore, they need to operate continuously. The PCC plant design and operation must be compatible with this.			
2.3 Supplying heat and power for PCC operation	You will need to use low grade (for example 130°C) heat and electrical power to operate the PCC plant. You should work out the amounts needed based on factors that include the: • selected solvent • PCC plant configuration • CO_2 capture level • CO_2 delivery pressure You should supply this heat and electricity from the main power plant. Where not possible, this will need to be by fuel combustion in ancillary plants (with CO_2 capture) that are then also treated as a power plant system for performance calculations. The ratio between heat supplied as steam (or otherwise) and electricity output lost will depend on the: • temperature at which you need to supply heat • steam condenser cooling water temperature You should consider using a back-pressure turbine if it is not possible to supply enough steam to the PCC plant by	The heat and electricity for the CC plant will be supplied by the incineration plants. High pressure steam will be drawn from the incineration plant and expanded through a back pressure turbine. District heating is not currently supplied by the incineration plants Riverside 1 and Riverside.	Y	Condition 2.3.1 with table S1.2 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	extracting steam from a condensing turbine. If the plant needs to supply heat for district heating, and extracting steam to supply the PCC plant will mean there is insufficient steam to do this, you should consider using heat pumps or other plant to reduce the amount of steam required to meet that heat demand.			
3. PCC plant design and operation				
3.1 Purpose	The purpose of the PCC plant is to maximise the capture of CO_2 emissions for either use or secure geological storage. You should aim to design your plant to achieve a CO_2 capture rate of at least 95% during normal operating conditions, although operationally this can vary, up or down. You will need to justify proposing a design CO_2 capture rate of less than 95% as an annual average of all normal operating conditions. You can submit a cost benefit analysis as part of your application.	The Applicant has stated that the CC plant has been designed for a CO_2 capture rate of 95% under normal operation.	Y	Condition 3.5.1 with table S3.3 of the permit and improvement condition IC4.
	You will need to deliver CO_2: • at local transport system pressures (gas phase such as 35 bar or dense phase such as 100 bar) • with levels of water, oxygen and other impurities as required for transport and storage such as that for the system operator National Grid (NGC/SP/PIP/25 Dec.2019)	CO_2 will be shipped offsite, having had water, oxygen and other impurities reduced to the limits required, and been liquefied. It is anticipated that custody transfer will occur as part of the ship loading process where the CO_2 becomes the responsibility of the network operator for transport and storage.	Y	Condition 2.3.1 with table S1.2 of the permit.
	The PCC plant must also have acceptable environmental risks through preventing or minimising emissions or render them harmless.	The Applicant has provided an air impact assessment and an environmental risk assessment. We have reviewed these	Y	Condition 3.1.1 with table S3.1 of the permit and

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	You must achieve environmental quality standards for air emissions from the PCC plant and their subsequent atmospheric degradation products (including, for example, nitrosamines and nitramines). You should confirm this using: • atmospheric dispersion and reaction modelling tools • specific site parameters which will define plant-specific ELVs	and we are satisfied that no environmental standards will be exceeded. Relevant ELVs are set in the permit.		improvement condition IC6.
3.2 Solvent selection	While the process design for the PCC plant is likely to be generally similar for all solvents, the amine solvent you select will determine details of the design and performance. Solvent types and published performance figures are described in the PCC evidence review. There is particular concern about impacts on the environment from nitrosamines and other potentially harmful compounds formed by reaction of the amines and their degradation products with nitrogen oxides (NOx) in the flue gases. Check the environmental standards for air emissions for the protective environmental assessment levels. You have a choice between: • solvents using primary amines that may require more heat for regeneration but will not readily form stable nitrosamines in the PCC plant, especially if a high level of reclaiming is used to remove degradation products • solvent formulations including secondary amines or other species that may have lower	The Applicant proposes to use Shell Cansolv solvent. The Applicant stated that Shell's Cansolv technology is a proprietary advanced amine-based solvent and that has reduced energy use and increased absorption rate which minimises overall energy consumption when compared to a generic monoethanolamine (MEA) solvent.	Y	N/A

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	regeneration heat requirements but may readily form nitrosamines with NOx in the flue gases in the PCC plant – for controls, see section 3.3 on features to control and minimise atmospheric and other emissions			
	The potential absorber stack emissions and resulting environmental impacts will depend on the selected solvent. Your air emissions risk assessment should assess your plant design and operation, taking into account local environmental factors. It should include: • direct emissions of solvent components • formation of additional substances in the PCC system and emissions of those substances • formation of further additional substances in the atmosphere from emissions from the PCC system	The air emissions risk assessment includes impacts from direct emissions of the solvent components, from substances formed from the solvent components and from substances formed due to degradation of the solvents in the atmosphere.	Y	Condition 3.1.1 with table S3.1 of the permit and improvement condition IC6.
	The potential for solvent reclaiming and other cleaning methods is also an important factor in solvent selection. You should make sure it is practicable to remove all non-solvent constituents from the solvent inventory as fast as they are added during operation, to avoid accumulation. Your assessment should demonstrate that you will: • recover a high fraction of the solvent in the feed to the reclaimer during reclaiming • minimise reclaimer wastes and that they can easily be disposed of	The proposed reclaiming system will remove non-solvent constituents from the solvent inventory as fast as they are added during operation, to prevent accumulation. Until operation commences, it will not be possible to determine how much solvent can be reclaimed. By maximising the amount of solvent reuse, the reclaimer waste is also minimised	Y	Conditions 2.3.1 and 3.5.1 with tables S1.2 and S3.3 of the permit and improvement condition IC5.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	You must work out the performance of your solvent, including reclaiming requirements and modelling emissions to atmosphere. Determine this through realistic pilot (or full scale) tests using fully representative (or actual) flue gases and power plant operating patterns over a period of at least 12 months. You do not need to do this for your plant if information on the solvent performance is already available from pilots, tests, or regular operation at a similar plant.	Shell has studied the solvent performance, reclaiming requirements and emissions to atmosphere at commercial scale on other plants. Additionally, the solvent has been commercially deployed since 2012 with the first large scale capture of CO_2 from a coal-fired power station (Boundary Dam) commencing in 2014.	Y	Condition 3.5.1 with table S3.3 of the permit and improvement condition IC5.
3.3 Features to control and minimise atmospheric and other emissions				
3.3.1 Flue gas cleaning	SOx and HCl in the flue gas will readily react with amines to produce heat stable salts. These products are typically stable under reclaimer conditions, but the heat stable salt formation with SOx can be, at least partly, reversed by alkali addition in the solvent reclaiming process. SOx levels will affect solvent consumption but are expected to have a limited effect on emissions. For most gas, biomass and waste fuels that have intrinsically low S levels, adding more upstream SOx removal (and HCl removal for EfW) is likely to be primarily an economic decision. SOx removal can be in the power plant flue gas desulphurisation unit, flue gas treatment system or in the PCC direct contact cooler. SOx levels in the existing flue gases from an amine PCC plant will be expected to be at extremely low levels.	The existing flue gas treatment systems at the Riverside 1 and Riverside 2 plants reduce the level of SOx in the flue gas to levels compliant with the environmental permits for each plant before it is directed to the CC plant. Shell has done testing to establish the levels of impurities entering the CC plant that are within the tolerances of their process and SOx levels. The DCC also includers scrubbing.	Y	Permits EPR/BK0825IU and EPR/EP3245QR before discharge of flue gases to the CC plant and also condition 3.5.1 with table S3.3 of this permit and improvement condition IC5.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	The impact of NOx in the flue gas will vary significantly with the solvent composition. If the amine blend will form significant amounts of stable nitrosamines with NOx in the flue gas, then you must reduce NOx to as low a level as practicably possible (see LCP BREF) using selective catalytic reduction (SCR). EfW plants may be fitted with selective non catalytic reduction (SNCR) which does not reduce NOx in flue gas as much as SCR. If you are retrofitting PCC plant to an EfW plant which has SNCR NOx abatement, you should make sure the selected solvent is compatible with the abated flue gas. Both SCR and SNCR can result in ammonia (NH_3) slip. If necessary, it is expected that (NH_3) slip could be addressed in a suitably designed PCC unit. In all cases, you must assess the effects of NOx in the flue gas on atmospheric degradation reactions and this may also affect the need for SCR. If SCR is not fitted to a new build power plant, it is generally considered BAT to maintain space so it could be retrofitted, should this be considered necessary to meet ELVs in the future.	The solvent is compatible with the expected levels of NOx in the flue gas. Riverside 1 EfW plant has selective non-catalytic reduction (SNCR) to reduce NOx levels in the flue gas. Riverside 2 is currently under construction and will utilise Selective Catalytic Reduction (SCR) to abate NOx levels. The processes have been optimised to reduce levels of NOx within the flue gas that will be compatible with the solvent. The flue gas from Riverside 1 and Riverside 2 can contain traces of ammonia (NH3) as both SCR and SNCR can result in ammonia slip. This will be addressed in the CC plant design. Solvent pilot testing has demonstrated very low ammonia emissions, in some instances even lower than before treatment by the CC plant.	Y	EPR/BK0825IU and EPR/EP3245QR before discharge of gases to the CC plant.
	Sulphur trioxide (SO_3) droplets and fine particulates should not be present in the flue gas. If they arise in the PCC process they can cause significant amine emissions. The level of emissions (mainly solvent amines) are not directly related to aerosol measurements. Monitoring aerosols is difficult and aerosol quantities may also vary significantly over time. Aerosols might be present, for example, because of significant SOx in the flue gas. Where this is the case,	Mist elimination will be added to the top of the Absorber Columns if required to remove aerosols. Regular sampling will be carried out in the operational CC plant to assess total vapour and droplet emission levels.	Y	Condition 2.3.1and 3.1.1 with tables S1.2 and S3.1 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	you should carry out long-term testing on a pilot plant or the actual plant, with all planned countermeasures in place, to show satisfactory operation. You should also carry out regular isokinetic sampling in the operational plant to assess total vapour and droplet emission levels. Other amine aerosol emission abatement techniques include: • cooling the flue gas gradually through the acid dewpoint • Brownian Demister Units • wet electrostatic precipitators • high lean solvent temperatures These techniques can reduce aerosol emission by enhancing aerosol growth in the top of the column, and the water wash. You may need to use a combination of these or other techniques.			
	You may need to remove materials in the flue gas that would accumulate as impurities in the solvent (such as metals, chlorine and fly ash) to lower concentrations than is required under the relevant BAT AELs. This is to ensure satisfactory PCC plant operation. Whether you need to do this will depend on the specific solvent properties and the effectiveness of the solvent management equipment (such as filtering and reclaiming). You should assess the effects of flue gas impurities through realistic, long term pilot testing. In general, your PCC plant must abate these types of flue gas impurities before the residual flue gases are finally released to atmosphere.	Flue gas impurities have been considered in the CC plant design, and it has not been deemed necessary to provide further abatement, at this stage of the design.	Y	Permits EPR/BK0825IU and EPR/EP3245QR and condition 3.5.1 with table S3.3 of the permit and improvement condition IC5.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
3.3.2 PCC system operation				
Operating temperatures	You must establish and maintain optimum temperature and appropriate limits in the solvent stripping process. Elevated temperatures can cause some thermal degradation of the solvent. But higher peak average temperatures during regeneration will also likely promote reduced energy requirements and higher CO_2 capture levels. You must balance both to ensure the right environmental outcome. Where feasible, you should avoid locally higher metal skin temperatures, such as from the use of superheated steam in heaters, as this provides no benefit and can result in degradation.	The CC plant will be designed to operate consistently at the optimum conditions for the solvent. Steam will be supplied to the CO_2 stripper at a temperature that will minimise degradation of the solvent.	Y	Condition 2.3.1 with table S1.2 of the permit.
Solvent degradation	You should minimise oxidative degradation of the solvent by reduced solvent residence times in the absorber sump and other hold-up areas. Direct O_2 removal from rich solvent may be developed in the future but has not yet been proven at scale.	The CC plant will be designed to optimise the conditions for the solvent, including consideration of residence times.	Y	Condition 3.5.1 with table S3.3 of the permit and improvement condition IC5.
3.3.3 Absorber emissions abatement				
Water wash	You must use one or two water washes or a scrubber to return amine and other species to the solvent inventory. Capture levels are limited by vapour or liquid equilibria, with volatile amines captured less effectively. Any aerosols present will also not be captured effectively. Water washes alone are ineffective in preventing NH_3 emissions, as concentrations will increase until the rate of release balances the rate of formation (and possibly addition from SCR or SNCR slip).	There will be a water wash at the top of the absorber columns, to help retain solvent, reduce levels of amines, and soluble amine degradation products i.e. nitrosamines, and nitramines in the CC plant emissions. Both the amine solvent and its main degradation products have low volatility, meaning that a single stage water wash is anticipated to be sufficient	Y	Condition 2.3.1 with table S1.2 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
		to limit emissions of these components well below ppm levels and thus are expected to ensure compliance with ELVs. Where required, mist elimination will be installed at the top of the Absorber Column(s) to remove aerosols and minimise solvent carryover. Some levels of ammonia may be removed in the capture process through the water washing processes. Ammonia emissions will be minimal from the operational CC plant. Therefore, no additional abatement is required.		
Acid wash	An acid or other chemically active wash or scrubber after the water wash will react with amines, NH_3 and other basic species and reduce them to very low levels (for example, 0.5 to 5mg per m^3 per species or lower). You should implement an acid wash as it is considered to be BAT, unless: • emission levels are already at acid wash levels with a water wash • you can show that the need to dispose of the acid wash waste outweighs the benefits of the additional reduction in emissions to atmosphere Depending on PCC system configuration, an absorber acid wash can also counteract NH_3 slip from an SCR system. If an acid wash is not fitted, you should consider a	An acid wash is not expected to be necessary to further reduce amine, ammonia or other pollutants from the process, based on the anticipated emission concentrations. However, this will be reviewed at detailed design. The solvent supplier has stated that the both the amine solvent and its main degradation products have low volatility, meaning that a single stage water wash is anticipated to be sufficient to limit emissions of these components well below ppm levels and thus are expected to ensure compliance with ELVs. However, this is dependent on the characteristics of the incoming flue gas, which will be fully evaluated as part of the detailed design. If required, a “mist	Y	Condition 3.5.1 with table S3.1 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	second water wash as an acid wash if: • emissions performance is worse than expected • you wish to change to a more volatile solvent An acid wash is not likely to trap aerosols.	elimination" system will be included at the top of the absorbers, to provide further mitigation against aerosol emissions.		
Droplet removal	You must prevent emissions of aerosols. To do this you could use standard droplet removal sections after washes. These will prevent droplet carryover from the wash. However, they are not effective against very fine aerosols arising from SO_3 or other aerosol mists.	If required, mist elimination will be located at the top of water wash section to remove droplets and aerosols from the residual flue gas from the CC plant before emission.	Y	Condition 2.3.1 with table S1.2 of the permit.
Stack Height	Where modelling predicts that you may need to raise the temperature at the point of release to aid dispersion, you can: • increase the design stack height • add flue gas reheating Flue gas reheating can also reduce the plume visibility. Heat from cooling the flue gas before the PCC plant or waste heat from the PCC process should be used for flue gas reheating (see section 4 on cooling)	Detailed dispersion modelling has been carried out to identify the optimal stack height and temperature required to enable adequate dispersion of the flue gas. The incoming flue gas to the CC plant will be cooled by/used to reheat the outgoing flue gas to the required temperature. This will have the added benefit of reducing plume visibility.	Y	Condition 2.3.1 with table S1.2 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
3.4 Process and emissions monitoring				
3.4.1 Role of monitoring	The main purpose of monitoring the PCC process is to show that the emissions from the process, primarily to air, are not causing harm to the environment. You must also carry out monitoring to show that resources are being used efficiently. This includes: • energy and resource efficiency • CO_2 capture rate • verification that the CO_2 product is suitable for safe transport and storage You will need to develop a monitoring plan for both a commissioning phase and routine operation. During the commissioning phase you will need to optimise the operating envelope for the process. When you have achieved this the process operation will then become routine, along with the monitoring. It's likely you'll need to do more extensive monitoring during commissioning than during routine operation. As PCC is an emerging technique, you will need to develop monitoring methods and standards. You should include proposals for this in your permit application.	The CC plant energy and resource efficiency, and levels of CO_2 treated and captured, and associated capture rate will be continuously monitored and periodically reported. The CO_2 product will be monitored to ensure that it is of a quality suitable for onsite storage and onward transport by ship. Commissioning and operational monitoring plans will be developed during the detailed design process for provision to the EA as a Pre-operational Condition of the Environmental Permit.	Y	Conditions 2.4.1, 2.5.1, 3.1.1 and 3.5.1 with tables S3.1 and S3.3 of the permit, improvement conditions IC3 and IC4 and pre-operational conditions PO1 and PO5.
	You must demonstrate compliance with ELVs in the permit by monitoring emissions at authorised release points. You must also show that you are managing the process to prevent (or minimise) the formation of solvent degradation products.	Monitoring proposals set out in the Application and set in the Permit. A number of process monitoring measures will be in place to demonstrate management of the process and minimise the formation of solvent degradation products.	Y	Condition 3.5.1 with table S3.1 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	Where monitoring shows that degradation products are being formed (and may be released), you must reduce these and any solvent emissions to the permitted level. This process control monitoring will also be part of the permit conditions.	The design of the CC plant incorporates a number of measures to monitor solvent quality including gas chromatography to determine the composition of the solvent; visual inspection to inspect for signs of colour change and degradation; periodic sampling of rich and lean solvent; measurements of solvent density. The Solvent Processing System consists of a filtration and reclamation system, to remove any heat stable salts and degradation products in the amine-based solvent.	Y	Conditions 2.4.1, 2.5.1 and 3.5.1 with table S3.3 of the permit and pre-operational condition PO5 and improvement condition IC5.
3.4.2 Point source emissions to air	You must include monitoring to demonstrate compliance with: • IED Chapter IV • WI BREF BAT AELs at normalised conditions You must also monitor for: • ammonia • volatile components of the capture solvent • likely degradation products such as nitrosamines and nitramines Your monitoring may be by either: • continuous emissions monitoring (‘on line’) • periodic extractive sampling (‘off line’) –	Monitoring will be carried out by Riverside 1 and Riverside 2 to demonstrate compliance with the IED Chapter IV and WI BREF BAT AELs prior to the flue gas being transported to the CC unit. Continuous emissions monitoring systems (CEMS) will be installed to monitor flue gases from the CC Plant. It is intended that CEMs monitoring of the listed species will be included for the CC Plant. However, the exact specification of equipment to monitor the amines and degradation products is yet to be confirmed. If no suitable equipment is available, these will be monitored by periodic extractive monitoring.	Y	Permits EPR/BK0825IU and EPR/EP3245QR before discharge of gases to the CC plant. Conditions 2.5.1 and 3.5.1 with table S3.1 of the permit and pre-operational condition PO4.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	where aerosol formation is expected, this must be isokinetic			
	Emission sampling point must also comply with M1 sampling requirements for stack emission monitoring.	Emission sampling points will comply with EA web guidance previously known as M1 sampling requirements for stack emission monitoring.	Y	Conditions 2.3.1, 2.4.1 and 2.5.1 with table S1.2 of the permit and improvement condition IC2 and pre-operational condition PO4.
3.4.3 Process control monitoring	You should use process control monitoring or periodic sampling with off-line analysis to control the CO_2 capture and the solvent reclaiming performance. Parameters you should consider monitoring include: • absorber solvent quality – percentage active solvent • CO_2 loading both rich and lean solvent • maximum solvent temperature • heat stable solvent content • solvent colour or opacity • soluble iron and other metals and degradation products • in water or acid washes and scrubbers – pH, conductivity, loading of abated substances, flow rate	The CC Plant will include instrumentation to monitor and record CO_2 capture rates and purity. Sampling points will be provided to collect fluid samples of the solvent to ensure the quality of solvent reclaiming. Process monitoring is expected to include: Gas chromatography to determine solvent composition. Visual inspection of solvent colour to assess the level of degradation products. Periodic sampling, Coriolis flowmeters and chromatography to determine density, indicating amine loading and levels of degradation products, heavy metals and soluble iron. Solvent temperature will be controlled at consistent temperatures, within the Absorber Column(s) and stripper to minimise solvent degradation. Solvent colour (indication of degradation products), pH, conductivity etc. will be	Y	Conditions 2.4.1, 2.5.1 and 3.5.1 with table S3.3 of the permit, improvement condition IC4 and pre-operational condition PO5.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
		checked regularly. Periodic laboratory testing for contaminants such as heat stable salts and amine degradation products. Further monitoring arrangements will be determined during detailed design.		
3.4.4 Monitoring of CO_2	You should also include: • CO_2 mass balance • CO_2 in fuel combusted • CO_2 capture rate (as a percentage) • CO_2 released to the environment • CO_2 quality	These parameters will be monitored as part of the CC plant operation. The CO_2 capture rate is designed to capture at least 95% of the CO_2 in normal operation. The incoming flue gas will contain 197.2 tph CO_2 on average. Of this, approximately 9.9 tph will be released to the environment. The CO_2 stream sent for storage will contain >99mol% CO_2.	Y	Conditions 2.4.1, 3.1.1 and 3.5.1 of the permit with tables S3.1 and S3.3 of the permit and improvement condition IC4.
3.4.5 Monitoring Standards	The person who carries out your monitoring must be competent and work to recognised standards such as the Environment Agency's monitoring certification scheme (MCERTS). MCERTS sets the monitoring standards you should meet. The Environment Agency recommends that you use the MCERTS scheme where applicable. You can use another certified monitoring standard, but you must provide evidence that it is equivalent to the MCERTS standards. There are no prescriptive BAT requirements for how to carry out monitoring. Monitoring methods need to be flexible to meet specific site or operational conditions. You must use a laboratory accredited by the United	Any extractive monitoring carried out on the emissions from the CC plant will be carried out by competent contractors to certified monitoring standards equivalent to MCERTS. UKAS accredited laboratories will be used for sample analysis for any monitoring.	Y	Condition 3.5.3 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	Kingdom Accreditation Service (UKAS) to carry out analysis for your monitoring.			
3.5 Unplanned emissions to the environment	You should propose a leak detection and repair programme that is appropriate to the solvent composition. This should use industry best practice to manage releases, including from joints, flanges, seals and glands. Your hazard assessment and mitigation for the plant must consider the risks of accidental releases to environment. This should also consider the actual composition of the fluids, gases and vapours that could be released from the plant after an extended period of operation. (Not only fresh solvent as initially charged.)	A leak detection and repair programme based on industry best practice will be developed during detailed design. Oxygen sensors will be installed to detect oxygen depletion indicating CO_2 leakage. The locations of these will be subject to detailed design. Pressure sensors in CO_2 streams/ storage will be installed to detect pressure loss in the case of leakage. In the case of solvent leakage, there will be level detection in the relevant bunds. A hazard and mitigation assessment for the plant, considering the composition of substances that could be released from the CC plant operation will be developed as part of detailed design. Appropriate alarms will be linked back to the control room. The control and alarm philosophies will be developed during detailed design.	Y	Condition 1.1.1 and 3.2.3 of the permit and pre-operational condition PO10.
3.6 Capture level, including during flexible operation	Capturing at least 95% of the CO_2 in the flue gas during normal operating conditions is considered BAT. You can base this on average performance over an extended period (for example, a year). To achieve this, you should make sure the design capture level for flue gas passing through the Absorber Column(S) equates to at least 95% of the CO_2 in the total flue gas from the plant. Over the averaging period, your capture level may vary up or down. You should set out any potential 'other than	The CC plant capture rate is designed to be 95% during normal operation. 'Other than normal operating conditions' (OTNOC) will include SU/SD of the Riverside 1 and Riverside 2 plants and CC plant, off specification flue gas being provided by the Riverside 1 and Riverside 2 plants, and constraint or unavailability of the onward CO_2 transport. A CC OTNOC	Y	Condition 3.5.1 with table S3.3 of the permit and improvement condition IC4.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	normal operating conditions' (OTNOC) for the CO_2 capture plant in your permit application. You should include a PCC OTNOC management plan in your management system to measure and minimise occurrence and impact of these periods. OTNOC includes periods of start-up and shut down. Your PCC OTNOC management plan must compliment any OTNOC management plan for the facility it serves and consider internal and external causes of OTNOC. An example of OTNOC would be when the CO_2 transport and storage network is down. As the fraction of intermittent renewable generation in the UK rises, many CCS enabled plants will need to start and stop more often, and possibly also operate at variable loads. It is therefore important, for current or future intermittent operation plant, that you aim to maximise CO_2 capture during these periods, including during start-up and shutdown, to maintain high average capture levels. You should therefore capture CO_2 during plant start-up and shutdown as part of using BAT. A method to maintain capture during start-up and shutdown using solvent storage has been identified in chapter 7 of the PCC evidence review. This, or alternatives that can achieve equivalent results, is considered BAT. You will need to provide justification and a cost benefit analysis if you are not proposing capture during start-up and shutdown.	management plan to measure and minimise occurrence and impact of these periods will be developed during detailed design, with consideration of the Riverside 1 and Riverside 2 plants operating under OTNOC. The Riverside 1 and Riverside 2 plants are primarily in place to treat waste; therefore, they operate at baseload rather than operating at variable loads, and do not frequently SU/SD, nor will they as the fraction of intermittent generation rises. SU/SD for the CC is dependent on the availability of utilities, in particular power and steam. Cold start for each train takes approximately six hours, with a hot start/standby mode cutting that down to two hours. Therefore, the benefit of capturing CO_2 during SU/SD will be very limited. SU/SD. When the transport and storage system is constrained or not available, it will not be appropriate to capture CO_2 beyond what can be stored onsite. Therefore, the CC plant will be partially or fully bypassed as appropriate so that electricity generation and waste treatment can continue.		
3.7 Compression	You should select CO_2 compressors based on the expected duty. You should consider how any waste heat arising may be used. For base load operation, you should use integrally geared units because they give the: • maximum full-load efficiency	The type of compressor and configuration of each compressor train will not be confirmed until detailed design. However, the design of the CO_2 compression system, such as the use of integrally geared units or smaller compressor frame sizes, will be based on the specific project	Y	Condition 2.5.1 . Pre-operational condition PO11

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	• minimum number of compression trains For flexible and part-load operation, smaller compression trains (for example 2 at 50% compared to 1 at 100%) may be preferable. The use of different types of compressor or pump in series may also be preferable, to give greater flexibility at the expense of slightly lower full-load efficiencies.	requirements to maximise efficiency as much as reasonably practicable.		
3.8 Noise and odour	The LCP BREF and EfW BREF already cover noise impacts for the main power plant. You only need to consider additional process steps in PCC technology that have high potential for noise and vibration. In particular, CO_2 compression could be an area of concern. Once you've identified the main sources and transmission pathways, you should consider the use of common noise and vibration abatement techniques and mitigation at source wherever possible. For example: • use of embankments to screen the source of noise • enclosure of noisy plant or components in sound-absorbing structures • use of anti-vibration supports and interconnections for equipment • orientation and location of noise-emitting machinery • change of the frequency of the sound	The Applicant submitted a noise impact assessment with the Application. The noise impact assessment is considered in section 5.4.2.	Y	Conditions 2.5.1, 3.4.1 and 3.4.2 of the permit and pre-operational condition PO8.
	The handling, storage and use of some amines may result in odour emissions, so you should always use best practice containment methods. Where there is increased risk that odour from activities will cause pollution beyond	Odour is discussed in Section 6.5 and assesses potential odours as well the management and control measures associated with them. As suitable controls	Y	Conditions 3.3.1 and 3.3.2 of the permit.

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	the site boundary, you will need to send an odour management plan with your permit application	are in place, an Odour Management Plan is not considered to be required for the proposed installation. This is consistent with the Regulator's previous permit determinations for carbon capture within this sector and aligns with the post-combustion carbon dioxide capture: Emerging techniques on how to prevent or minimise the environmental impacts of post-combustion carbon dioxide capture. Published 2 July 2021 (updated 27 March 2024).		
3.9 Hot potassium carbonate post combustion capture plant	Using electrically powered hot potassium carbonate as an alternative solvent to amines for capturing CO_2 is an emerging technique that may have some advantages where the on-site availability of steam supply is insufficient for amine regeneration. The configuration of the plant is similar with flue gas clean up, absorber and desorber columns and solvent reclamation. The process is carried out at pressures between 10 and 100 pounds per square inch (PSI) and so requires a flue gas compressor – see the PCC evidence review. Advantages include: • potentially less hazardous than other solvents • can be driven by electricity – no need to extract steam • pressurised capture process – smaller volumes of gases	The Operator is not using this capture process.	N/A	N/A

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	• higher tolerance to oxygen Disadvantages include: • requires a complex large compressor, expander, heat recovery or exchanger which is expensive and high maintenance • use of electricity is less efficient than steam • not as effective on flue gas with low CO_2 concentration – for example, combined cycle gas turbine (CCGT) • some CO_2 slip so achievable capture efficiency is likely to be 90% not 95% Where you choose to use this carbon capture technique you should justify why in your permit application.			
4. Cooling	You will be able to achieve the best power and CO_2 capture plant performance by using the lowest temperature cooling available. You should use the hierarchy of cooling methods as follows: • direct water cooling (such as seawater) • wet cooling towers • hybrid cooling towers • dry cooling – direct air-cooled condensers and dry cooling towers	Due to the limited water availability on site, direct water cooling and wet cooling are not possible. However, some water is expected to be available on site through the treatment of process effluent. This will allow a combination of hybrid and dry cooling to be utilised, to minimise the cooling footprint and optimise the cooling water temperature within the site water constraints compared to using dry cooling alone. The ETP conditions and dewaters the effluent stream by returning the vast majority of water from the process effluent back into the cooling system.	Y	N/A
	Power plants that are retrofitted with PCC using steam extraction, or are intended to be able to operate without capture, can share water cooling between the power	The Riverside 1 and Riverside 2 plants have direct air-cooled condensers; therefore, these cannot be shared with the	N/A	N/A

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
	plant and the PCC system. This is because the cooling load on the main steam condensers falls with increased steam extraction rate. This shift away from condenser cooling will not apply for systems with direct air-cooled condensers. It may also be possible to reuse cooling water after the main condensers for higher-temperature cooling applications in the PCC plant. However, site specific water discharge temperature limits may be an issue for direct cooling.	CC plant		
	A feature of PCC is that you have to remove heat from a flue gas stream that was originally not cooled. You can still achieve rejection of heat to atmosphere by heating the flue gas leaving the absorber, using heat from the incoming flue gas. You can do this either: • directly – such as using a rotary gas-gas heater • indirectly – such as using a heat transfer fluid or low-pressure steam	Direct cooling of the incoming flue gas using the outgoing flue gas via a rotary gas-gas heat exchanger is anticipated. This will be confirmed at detailed design.	Y	Condition 2.3.1 with table S1.2 of the permit.
	Lean and rich solvent storage may also help you achieve satisfactory PCC performance during periods of high cooling demand.	Lean and rich solvent storage has not been considered, cooling will be through hybrid coolers and air coolers to provide supplementary cooling capacity.	N/A	N/A
	You should refer to the Environment Agency's evidence on cooling water options for the new generation of nuclear power stations in the UK when considering options for cooling. This gives an overview of UK power station cooling water systems in use in the UK and abroad.	The Applicant has considered the cooling technologies that are appropriate for the CC plant and selected the hybrid cooling technology with supplemental air coolers.	Y	N/A

Reference*	Guidance	Applications proposals	Compliant Y/N	Delivered by
5. Discharge to water	For discharges to water, you should refer to the guidance on surface water pollution risk assessment for your environmental permit. For best practice in plume dispersal modelling, see the Joint Environmental Program report 'A protocol on projects modelling cooling water discharges into TrAC waters within power station developments'.	The CC installation will be zero liquid discharge with all process wastewater and cooling water blowdown being treated in the ETP, to recover water and produce a waste sludge. The waste sludge will be taken offsite for disposal, and the treated water re-used within the process, either directly or as cooling water make-up. As a result, there are no process emissions to water. Surface water collected in process areas, such as rainfall in bunds, will be tested for contamination prior to discharge to avoid any pollution of surface water systems. Contaminated water will be pumped out and disposed of in an appropriate manner. Domestic wastewater will be disposed via sewer.	Y	Conditions 2.4.1 and 3.1.1 with table S3.2 of the permit

Annex 2: Pre-Operational Conditions

Based on the information in the Application, we consider that we do need to impose pre-operational conditions. These conditions are set in the permit and referred to, where applicable, in the text of the decision document. We are using these conditions to require the Operator to confirm that the details and measures proposed in the Application have been adopted or implemented prior to the operation of the CC plant.

Annex 3: Improvement Conditions

Based in the information in the Application we consider that we need to set improvement conditions. These conditions are set out in the permit - justifications for these is provided at the relevant section of the decision document. We are using these conditions to require the Operator to provide the Environment Agency with details that need to be established or confirmed during and/or after commissioning.

Annex 4: Consultation Reponses

A) Advertising and Consultation on the Application

The Application has been advertised and consulted upon in accordance with the Environment Agency's Public Participation Statement. The way in which this has been carried out along with the results of our consultation and how we have taken consultation responses into account in reaching our draft decision is summarised in this Annex. Copies of consultation responses have been placed on the Environment Agency public register.

The Application was advertised on the Environment Agency website from 27/11/25 to 08/01/26 and in the Bexley Times on 26/11/25. The Application was made available to view at the Environment Agency's Public Register.

The following statutory and non-statutory bodies were consulted:

- Local Authorities - Environmental Protection Department
- Fire & Rescue
- UK Health Security Agency and Director of public health
- Health and Safety Executive
- Food Standards Agency
- London City Airport
- National Air traffic Services (NATS)

The CC Plant is located in Bexley London Borough, but is close to several other local authorities that we also consulted with: Barking and Dagenham London Borough, Havering London Borough and Greenwich London Borough. We also consulted with the Greater London Authority.

1) Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from UK Health Security Agency	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
The UKHSA assessed the suitability of the operator derived EALs for amines. Some concerns were expressed about the method used to derive the EALs but the that levels proposed on a site-specific basis shouldn't be of concern to public health. UKHSA also stated that based on the information contained in the application supplied to us, UKHSA has no significant concerns regarding the risk to the health of the local population from the installation.	No action required
Comment on whether sulphur dioxide and fine particulate matter ($PM_{2.5}$) exceed	The maximum modelled PCs for both these pollutants are above the insignificance

assessment criteria.	criteria however the PECs are below the assessment levels and we are satisfied that there is not a risk of any exceedances. In addition, the carbon capture plant will lower the maximum contribution to ground-level pollutant concentrations, due to combination of the higher stack height and changes to building impacts.
There are some contradictions in the exceedance criteria quoted in the air emissions risk assessment (namely for SO_2, but NOx and PM_{10} could also be affected) and the EA should confirm that the conclusions of the modelling for these pollutants remains valid.	We audited the modelling and are satisfied that the correct percentiles were used in the modelling of short term impacts.
Question over whether TOC was assumed to be benzene.	The applicant modelled TOC assuming it was all benzene. We have assessed emissions of VOCs as both benzene and 1,3-butadiene. Our maximum predicted VOC PCs are either insignificant, or the PECs are unlikely to exceed the benzene and 1,3-butadiene ES at relevant receptors.
Recommended that the carbon dioxide vent stack height is maximised.	The applicant modelled several stack heights for venting. The modelling showed that a 10 m stack would prevent significant pollution. Venting is subject to detailed design and pre-operational condition PO6 requires venting measures to be confirmed as well as a vent management plant to be prepared and submitted to us for approval.
Comment about whether short term metal impacts had been assessed.	Metals were assessed (including short term impacts) in the air dispersion modelling report and in additional information received on 31/10/25. We are satisfied that there will not be a significant impact

Response Received from Barking and Dagenham Council	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
Requested that residents are considered in any noise, odour and air risk assessments.	We assessed the risk to residents and are satisfied that there will not be a significant impact.

Response Received from National Air traffic Services (NATS)	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
Does not conflict with their safeguarding criteria	No action required.

Response Received from London City Airport (LCY)	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
Requested a plume and vent analysis once final number of stacks is confirmed. This related to appendix J the CO_2 venting study.	The applicant carried out a visible plume assessment. The assessment showed that there would be no additional risk from the current permitted site. Any impact due to air velocity changes would be low. CO_2 is denser than air and unlikely to rise to high levels. There will be some dispersion to minimise the impact from dense phase but it will be limited due to CO_2 density. The permit includes pre-operational condition PO6 which requires an updated CO_2 venting assessment after the final design (when final location of number of vent stacks will be confirmed) has been completed. We will send LCY a copy of the final assessment once received.

Response Received from Royal Borough of Greenwich	
Brief summary of issues raised:	**Summary of action taken / how this has been covered**
No concerns raised.	No action required.

2) Consultation Responses from Members of the Public and Community Organisations

a) Representations from Local MP, Councillors and Parish / Town / Community Councils

No responses received

b) Representations from Community and Other Organisations

No responses received.

c) Representations from Individual Members of the Public

No responses received.