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**Parc Adfer - Carbon
Capture Facility**



enfinium Parc Adfer Operations Ltd

Environmental Risk Assessment

Document approval

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1 Introduction

An Environmental Permit (EP) (Ref: EPR/LP3132FX) was granted by Natural Resource Wales (NRW) for the Parc Adfer Energy Recovery Facility (herein referred to as the ERF) on 28 October 2015. The ERF comprises a single waste incineration line, and associated flue gas treatment systems.

The EP (EPR/LP3132FX) has been varied 7 times. The latest variation to the EP was granted by NRW to enfinium Parc Adfer Operations Ltd (enfinium) on 8 August 2023 to increase the capacity of the ERF from 200,000 tpa to 232,000 tpa.

Within this application, enfinium is applying for a variation to the EP to incorporate the proposed carbon capture facility (CC facility). The CC facility will capture carbon dioxide (CO₂) from the flue gas of the ERF, separating this from the other flue gases, and compressing the CO₂ for onward transport and geological storage. The captured CO₂ will be exported to a pipeline transmission and storage network for offshore sequestration.

The CC facility will have a capture efficiency of approximately 95%, and is expected to capture approximately 241,000 tonnes of CO₂ from the ERF flue gases per annum.

Within the EP application, the applicant is required to demonstrate that the necessary measures are in place to protect the environment and ensure that the Facility, throughout its life, will not pose an unacceptable risk to the environment. The aim of this Environmental Risk Assessment (ERA) is to assess the environmental risks associated with the proposed CC facility. This ERA considers the additional risks associated with the variation to include the CC facility and does not consider any environmental risk associated with the permitted ERF.

For the purpose of this ERA the following terms have been used:

- Hazard – something that could potentially cause harm.
- Risk – the chance that a hazard will cause harm and how serious that harm could be.

As such a hazard may not pose a risk to the environment if there are suitable control measures in place and the hazard this would not cause harm to a receptor, or the environment.

The aim of this document is to:

- a. identify potential risks that the activity may present to the environment;
- b. screen out those that are insignificant and don't require detailed assessment;
- c. identify potentially significant risks, where appropriate;
- d. choose the right control measures, where appropriate; and
- e. report the findings of the assessment.

This document has been developed to consider the requirements of Environment Agency Guidance Notes H1 Annexes A, C, H and F. It is acknowledged that these guidance documents have been withdrawn; however, it is understood that the requirements of the guidance are still applicable.

1.1 Risk Assessment Process

This ERA has been developed in accordance with the EA Guidance "*Risk assessments for your environmental permit*". Within this ERA, the following steps have been undertaken:

1. identify risks from the activity;
2. assess the risks and check that they are acceptable;
3. justify appropriate measures to control the risks; and
4. present the assessment.

1.1.1 Step 1 – Identify Risks

The following report will identify the activities that present different types of risk to the environment associated with the operation of the Installation, including:

- a. odour;
- b. noise;
- c. fugitive emissions; and
- d. accidents.

1.1.2 Step 2 – Assess the Risk

The report will include an assessment of risks associated with the operation of the Installation, and will identify the:

- a. hazard;
- b. receptor; and
- c. pathway.

1.1.3 Step 3 – Justify Appropriate Measures

This report will demonstrate that the risks associated with the operation of the Installation have been considered, and identify the control measures which will be in place to demonstrate that the risks are being appropriately managed.

1.1.4 Step 4 – Present the Assessment

The assessment will conclude by presenting the following:

- a. possibility of exposure;
- b. consequence; and
- c. the overall risk.

The report will present the overall risk applying the Environment Agency's H1 criteria, defined as:

- a. insignificant;
- b. not significant; and
- c. significant.

The assessment is presented in a tabular form with a supporting section summarising the detailed assessments carried out.

2 Table A1 – Odour Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage during the delivery and unloading of amine solution leading to a release of odours.	Amenity of the immediate area. The nearest residential receptors are located more than 2km to the northwest and/or to the southwest of the installation boundary.	Air.	The unloading of amine solution into storage tankers will be undertaken within dedicated chemical handling areas. The displaced air from the sealed storage tank will be vented back into the delivery tanker.	Unlikely given the distance to receptors and the measures in place to prevent releases to air.	Nuisance and loss of amenity for local residents.	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage during the transfer of reclaimers waste into road tankers for transport off-site leading to a release of odours.	Amenity of the immediate area. The nearest residential receptors are located more than 2km to the northwest and/or to the southwest of the installation boundary.	Air.	The transfer of spent amine solution into road tankers will be undertaken within dedicated chemical handling areas. The displaced air from the road tanker will be vented back into the sealed storage tank.	Unlikely given the distance to receptors and the measures in place to prevent releases to air.	Nuisance and loss of amenity for local residents.	Not significant.

3 Table A2 – Noise and Vibration Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Noise from process equipment and plant.	Amenity of the immediate area. The nearest residential receptors are located more than 2km to the northwest and/or to the southwest of the installation boundary.	Sound propagation through air and the ground.	Noisy plant items, where practicable, will be installed inside buildings rather than outside. Where it is not possible to install noisy plant within a building, appropriate noise attenuation measures will be installed to mitigate noise impacts at receptors. Regular maintenance of process plant will be undertaken in accordance with documented maintenance procedures.	Unlikely (due to the industrial location of the site and distance to receptors).	Annoyance and loss of amenity.	Negligible. Refer to Annex E of the Application Pack.

4 Table A3 – Fugitive Emissions Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage of chemicals during delivery and offloading activities leading to fugitive releases of chemicals.	Amenity of the immediate area	Air	Chemical unloading activities will be undertaken within dedicated chemical storage and handling areas. Chemical unloading areas will have contained drainage systems to contain the chemicals in event of a spill/leak. Spillages of chemicals will be cleaned up in accordance with the existing documented management systems. The drainage systems are designed to contain any spills of chemicals within the site drainage systems.	Unlikely.	Nuisance.	Not significant.
	Residential residents located more than 2km from the installation boundary. refer to section 6.1.	Air		Unlikely.	Health effects	Not significant.
	Nearby ecological receptors, refer to section 6.2.	Air		Unlikely.	Changes to the ecosystems	Not significant.
	Local watercourses	Run-off		Unlikely.	Changes to the ecosystems	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Chemical discharges when filling chemical storage tanks leading to fugitive releases of chemicals.	Land and ground water	Run-off	Chemical unloading activities will be undertaken within dedicated chemical storage and handling areas. Chemical unloading areas will have contained drainage systems to contain the chemicals in event of a spill/leak. Spillages of chemicals will be cleaned up in accordance with documented management systems. The drainage systems are designed to contain any spills of chemicals within the site drainage systems.	Unlikely.	Changes to the ecosystems	Not significant.
	Residential residents located more than 2km from the installation boundary. refer to section 6.1.	Air		Unlikely.	Health effects	Not significant.
	Nearby ecological receptors, refer to section 6.2.	Air		Unlikely.	Changes to the ecosystems	Not significant.
	Local watercourses	Run-off		Unlikely.	Changes to the ecosystems	Not significant.
	Land and ground water	Run-off		Unlikely.	Changes to the ecosystems	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage of amine solution/ spent solvent when transferring to tankers for transfer off-site.	Land and ground water	Run-off	Chemical unloading activities will be undertaken within dedicated chemical storage and handling areas. Chemical unloading areas will have contained drainage systems to contain the chemicals in event of a spill/leak. Spillages of chemicals will be cleaned up in accordance with documented management systems. The drainage systems are designed to contain any spills of chemicals within the site drainage systems.	Unlikely.	Changes to the ecosystems	Not significant.
	Residential residents located more than 2km from the installation boundary. refer to section 6.1.	Air		Unlikely.	Health effects	Not significant.
	Nearby ecological receptors, refer to section 6.2.	Air		Unlikely.	Changes to the ecosystems	Not significant.
	Local watercourses	Run-off		Unlikely.	Changes to the ecosystems	Not significant.
	Land and ground water	Run-off		Unlikely.	Changes to the ecosystems	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Chemical discharges when transferring of amine solution/ reclaimer waste from sealed storage tanks to tankers for transfer off-site.	Immediate area – air.	Air, surface runoff, direct contact.	Reclaimer waste will be transferred to sealed tankers and off-loaded via a standard hose connection. Air displaced from the tanker will be vented back into the sealed storage tank. Unloading activities will only be undertaken in areas of hardstanding with contained drainage. Unloading activities will be supervised by suitably trained personnel.	Unlikely.	Nuisance.	Not significant.

5 Table A4 – Accidents Risk Assessment and Management Plan

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Uncontrolled release of CO ₂ due to failure of the CO ₂ pipeline infrastructure.	Immediate area, workers onsite, residential properties.	Air.	The CO ₂ pipeline infrastructure will be installed with leak detection systems. A planned preventative maintenance system will be implemented on the CO ₂ pipeline infrastructure.	Unlikely	Vapour release. Unsafe atmospheres if humans (employees or local residents) are exposed.	Not significant.
Leaks from the amine solution/ solvent storage facilities.	Immediate area – land, water.	Land, water.	The amine storage facilities will be located above ground, sealed, and in a dedicated bund. In the event of a leak the discharge will be collected and tankered offsite. The surface water drainage system includes a system to ensure this discharge to surface water is un-contaminated	Unlikely	Liquid or vapour release.	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage/leak of spent amine solution/ solvent when transferring to tankers for transfer off-site.	Immediate area – land, water.	Land, water.	The amine storage facilities will be located above ground in a dedicated bund and sealed. In the event of a leak the discharge will be collected and tankered offsite. The surface water drainage system includes a system to ensure this discharge to surface water is un-contaminated	Unlikely.	Liquid or vapour release.	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Spillage/leak of liquid chemicals when tanker off-loading.	Immediate area – air, land.	Air, direct contact.	Off-loading of liquid chemicals will be from sealed tankers and off-loaded via dedicated hoses. Spillages will be prevented by good operating procedures, high tank level alarm/trips etc. Storage tanks will be sealed and located within suitably designed secondary containment. Unloading of liquid chemicals will be undertaken on areas of contained drainage to prevent the release of contaminated effluent off-site through any spillages.	Unlikely	Liquid or vapour release.	Not significant.

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Start up and shutdown of the CC facility	Immediate area, air land, health of local residents	Air	Release of CO ₂ via the venting system until the CC facility achieves steady state or shut-down. However, this is released via the vent stack at height in order to promote dispersion.	Unlikely	Vapour release, unsafe atmosphere if humans are exposed.	Not significant

What Do You Do That Can Harm and What Could Be Harmed?			Managing The Risk	Assessing The Risk		
Hazard	Receptor	Pathway	Risk Management	Possibility of Exposure	Consequence	What is the Overall Risk?
What has the potential to cause harm?	What is at risk? What do I wish to protect?	How can the hazard get to the receptor?	What measures will you take to reduce the risk? If it occurs who is responsible for what?	How likely is this contact?	What is the harm that can be caused?	What is the risk that still remains? The balance and probability and consequence.
Catastrophic failure of the storage vessels and process tanks.	Immediate area, water, land.	Land, water, direct contact.	All storage vessels and process tanks will be located above ground within a dedicated containment systems. In the event of catastrophic failure of the storage vessels or process tanks the chemicals will be contained within the secondary containment. The liquid that collects within the containment will either be pumped back into the storage vessel/tank, or pumped into a road tanker for transfer to a suitably licensed waste management facility.	Unlikely	Liquid release.	Not significant

6 Detailed Assessment

6.1 Emissions to air

Detailed air quality assessments, including a Dispersion Modelling Assessment and Dioxin Pathway Assessment, have been undertaken to assess the air quality impacts associated with the implementation of the CC facility. The assessments are presented in Annex D (Dispersion Modelling Assessment) and Appendix E (Dioxin Pathway Assessment) of the Application Pack.

As concluded in the Dispersion Modelling Assessment:

1. *In relation to the impact on human health:*
 - a. *Emissions from the operation of the CC facility will not cause a breach of any AQAL.*
 - b. *There is predicted to be an increase in the impacts as a result of the operation of the CC facility. For all pollutants already emitted by the ERF, the change in impact can be screened out as ‘insignificant’, and the overall impact of the emissions from the CC facility is not significant.*
 - c. *For additional products released from the CC facility such as amines, nitrosamines and nitramines the impact can either be screened out as ‘insignificant’ or is considered ‘not significant’ when baseline concentrations are taken into consideration.*
 - d. *There are no likely significant cumulative effects from other local plans or projects.*

This assessment has considered the impact of the additional products released from the CC facility such as amines, nitrosamine and nitramines.

6.2 Habitats assessment

The ecological receptors which are within the relevant screening distances from the installation, are presented in Table 1.

Table 1: Ecological receptors

ID	Name	Location		Distance from CC facility stack at closest point (km)
		X (m)	Y (m)	
European and UK designated sites				
E1	Dee Estuary SAC/SSSI/SPA/Ramsar	330795	372120	0.8
E2	Deeside and Buckley Newt Sites SAC	329890	368540	3.1
E3	Halkyn Mountain SAC	321620	369785	9.5
E4	River Dee and Bala Lake SAC/LWS	330505	369850	1.7
E5	Inner Marsh Farm SSSI	330720	372980	1.6
E6	River Dee SSSI	330505	369850	1.7
E7	Shotton Lagoons and Reedbeds SSSI ⁽¹⁾	330220	371055	0.8
Local nature sites				
E8	Dee Rifle LWS	330330	373300	2.0
<i>Note:</i>				
<i>(1) Also designated as Shotton Steelworks LWS.</i>				

As present within the air quality assessment, the impact of emissions from the installation on these ecological receptors has been summarised as follows:

2. *In relation to the impact on ecologically sensitive sites:*
 - a. *All impacts at local nature sites can be screened out as 'insignificant';*
 - b. *The change in impact due to the operation of the CC facility and overall impact of emissions from the CC facility at the Dee Estuary designated site cannot be screened out for airborne ammonia impacts and nitrogen deposition impacts. Further assessment of the spatial extent of impacts and the sensitivity of the affected habitats has shown that no significant effects are likely.*
 - c. *There are no likely significant cumulative effects from other local plans or projects.*

6.3 Emissions to water

All process effluents generated by the CC facility will be treated for re-use within the CCP. On this basis, there will be no process effluents discharged from the installation.

Clean surface water run-off from the CCP (building roofs and areas of hardstanding) will be discharged into the surface water drainage system. A penstock valve will be provided on the surface water drainage system for the CC facility, so that the surface water drainage system can be isolated when chemical off-loading activities are being undertaken. The penstock valve will only be re-opened when it has been confirmed that there have not been any spillages and run-off is not contaminated.

In the event of leakage or a spill, liquid and contaminated water collected within areas of containment will, if required, be contained, and is required would be transferred offsite, via tanker, for treatment at a suitably licensed waste management facility.

In the event of a fire, water used for fire-fighting will be contained on-site. When the fire has been extinguished, and it is safe to do so, the firewater will be tested and sampled to determine whether it is suitable for discharge to the aquatic environment. In the event that it is contaminated, and unsuitable for discharge, it will be transferred offsite for treatment at a suitably licensed waste management facility.

Where firewater is collected within the waste bunker, if it is practicable to do so, the waste will be combusted within the ERF.

6.4 Emissions to sewer

There will be no discharges of process effluent from the CC facility. The only discharges to sewer from the CC facility will be domestic effluents.

6.5 Noise

The change in noise impacts associated with the installation of the CCP plant and the ERF has been undertaken, and is provided in Appendix F of the Application Pack. To support the development of the noise assessment modelling has been undertaken using the Soundplan modelling software. The noise modelling files are provided within the Application Pack.

The conclusions of the noise assessment are summaries as follows:

Operation of the proposed Parc Adfer CC facility would result in impacts of no or negligible magnitude at 'noise sensitive receptors' (NSRs), with highest Rating Levels at least 9 dB

below the background sound level at all times. Consequently, significant adverse impacts would be very unlikely.

6.6 Visual impact

The visual impact of the Installation has not been considered in the EP application, since this is primarily a matter for the planning authorities. However, the potential for visible plumes from the CC facility has been considered in the Dispersion Modelling Assessment. The initial analysis showed that the exhausts from the absorber column is relatively dry and there are not predicted to be any visible plumes from the CC facility.

6.7 Odour

The CC facility is not anticipated to introduce any additional risk of odour impacts to the installation.

The EP for the Facility does not include a requirement for an Odour Management Plan. Therefore, as the odour impacts associated with the operation of the existing Facility are considered to be 'not significant', it is not proposed to develop an Odour Management Plan within this application.

In accordance with condition 3.4 of the EP, in the event that the Facility was to give rise to off-site odour impacts, enfinium is committed to developing an Odour Management Plan to manage and mitigate odour impacts from the Facility.

6.8 Global warming

The CC facility will remove emissions of CO₂ from the combustion of waste in the ERF. Therefore, the CC facility will have a positive impact on global warming.

6.9 Disposal of wastes and residues

The only residue which will be generated by the CC facility will be reclaimer waste consisting of degraded amine solution. This will be transferred for recovery or disposal at a suitably licensed waste treatment facility. Prior to transfer this will be stored in suitable tank which will be designed to account for the hazardous properties of the waste.

7 Conclusions

As presented in this report, the Facility is considered to contain appropriate control measures and management systems to ensure that the Facility does not have any significant impacts upon the local environment.

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