Immingham Green Energy Terminal Green Hydrogen Production Facility

EPR/VP3425SV/A001

Environmental Permit Application

Appendix I – Qualitative Environmental Risk Assessment

Environmental Permitting (England and Wales) Regulations 2016

Applicant: Air Products BR Ltd

May 2024

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Regulation Reference	EPR Regulations, Part 2, Chapter 1 R12
Environmental Permit Reference	EPR/VP3425SV/A001
Application Document Reference	VP3425SV/APP/QERA
Author	Air Products (BR) Limited

Version	**Date**	**Status of Version**
Revision 1	27 March 2024	EPR Application
Revision 2	09 May 2024	Final revision
Issue 1	17 May 2024	Issue to Regulator

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1 Report Context

1.1 Introduction

1.1.1 This document has been prepared by AECOM Limited ('AECOM') on behalf of Air Products (BR) Limited ('APBRL'), referred to as 'the Operator', in support of an Environmental Permit application for the proposed Green Hydrogen (H_2) Production Facility ('proposed installation') which forms part of the wider Immingham Green Energy Terminal ('IGET') Nationally Significant Infrastructure Project (NSIP) being developed by Associated British Ports ('ABP') on the eastern side of the Port of Immingham, situated in northeast Lincolnshire on the south bank of the Humber Estuary.

1.1.2 This qualitative risk assessment considers the environmental impact of potential fugitive or accidental releases from the operational installation that fall under the remit of Environmental Permitting. It does not consider risks to human health or environmental receptors from major accident hazards that are covered under other relevant legislation.

1.2 Proposed Installation

1.2.1 The proposed installation comprises the development of a green H_2 production facility which includes infrastructure for the offloading and transfer of green ammonia (NH_3) from ships to ammonia storage facilities, the main H_2 production facility and vehicle and trailer H_2 refuelling facilities.

1.2.2 The proposed installation will be located in North East Lincolnshire on the south bank of the Humber Estuary on the eastern side of the Port of Immingham. The installation location will be approximately centred on National Grid Reference (NGR) E520783 N415271.

1.2.3 The environmental permit application is therefore for an H_2 production facility which will comprise the following within the installation boundary:

- NH_3 ship offloading infrastructure to facilitate the receipt of NH_3 for H_2 production. The offloading infrastructure will be located on a new jetty being constructed by ABP. Only the offloading infrastructure is incorporated in the application and the jetty itself remains outside the installation boundary.

- NH_3 transfer pipeline which links the ship offloading infrastructure with the NH_3 storage tanks located on the east site.

- East site which comprises:
  - (a) a NH_3 storage tank and related plant including an NH_3 tank flare stack and oil-off gas compression system to liquefy the generated boil-off gas during offloading from Ship and static boil-off from Ammonia Tank .
  - (b) H_2 production facility comprising up to three H_2 production units including associated flue gas and flare stacks.
  - (c) Power distribution buildings for NH_3 and H_2 production plant.
  - (d) Instrumentation buildings for NH_3 and H_2 processes.
  - (e) Analyser shelters for the H_2 production plant.

(f) Pipe-racks, pipelines, pipes, utilities and other infrastructure associated with both NH_3 and H_2 equipment.
(g) Welfare facility.

- West site which comprises:
  (a) H_2 production facility comprising up to three H_2 production units including associated flue gas and flare stacks.
  (b) Up to four liquefier units.
  (c) H_2 storage tanks.
  (d) H_2 trailer filling stations.
  (e) H_2 vent stack and associated process equipment.
  (f) H_2 vehicle and trailer filling stations.
  (g) H_2 compressors and associated process equipment.
  (h) Control room and workshop building.
  (i) Security and visitor building.
  (j) Contractor building.
  (k) Warehouse.
  (l) Driver administration building.
  (m) Safe haven building.
  (n) Electrical substation and metering station.
  (o) Power distribution buildings.
  (p) Process instrumentation buildings.
  (q) Analyser buildings.
  (r) Process and utility plant including cooling towers and pumps, fire water tank, instrument air equipment, pipe racks, pipelines, pipes, cable racks, utilities and other infrastructure nitrogen generation package (HPN) with LIN Tank and LIN Vaporizers and steam generation package.
- Pipeline corridor for underground pipelines, pipes, cables and other conducting media for the transfer of NH_3, H_2, nitrogen (N_2) and utilities, with cathodic protection against saline corrosion.

2 Assessment of Fugitive Emission Risks

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
Releases to Air						
Windblown dust from external roads, pathways, and other surfaces	Local residents/ businesses beyond the installation boundary	Dust carried on wind leading to the development of flammable atmospheres	Nuisance issue	• A hard surfaced access road will be provided from the installation entrance. • Road and yard surfacing will be subject to routine inspection and maintenance – any accumulation of materials is removed promptly. • Speed restrictions of 10mph will be imposed for all vehicles driving on the site, in order to minimise emissions of dust from internal road surfaces	Probability of exposure is considered to be very low by application of appropriate management procedures which will be developed prior to the commencement of operation of the installation.	Very Low
Leaks from valves and flanges	Local residents/ businesses beyond the installation boundary	Gas carried on wind leading to the development of hazardous or flammable atmospheres	Potential flammable or odorous hazardous vapour in the vicinity of local receptors	• Flanged connections will be kept to a minimum. • All pipes and valves will be designed to appropriate industry standards. • All pipes and valves will have a preventative maintenance programme to ensure ongoing integrity and effectiveness.	Probability of exposure is considered to be low by application of appropriate management procedures which will be developed prior to the commencement of operation of the installation.	Low
Escape of natural gas	Local residents/ businesses beyond	Gas carried on wind leading to the	Potential flammable vapour in the vicinity of local receptors	No on-site gas storage facilities, minimising the likelihood of large gas release and the development of an explosive atmosphere on site. If there is	Probability of exposure is considered to be very low by application of appropriate management procedures	Very low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
	the installation boundary	development of flammable atmospheres		a leak in the gas supply pipeline, the quantity released is expected to be dispersed and not lead to the development of an explosive atmosphere. There is emergency isolation valve (automated) which can isolate the natural gas flow in to the when deemed necessary.	which will be developed prior to the commencement of operation of the installation.	
Releases to Land or Water						
Spillage of waste and materials during maintenance activities.	Local surface water and/ or groundwater	Flow by gravity through drainage systems or unsurfaced areas. Cracked drains/ hardstanding leading to soil and groundwater.	Localised pollution of surface water and groundwater. .	• Operator checks daily for signs of leak and repairs are dealt with promptly if identified. • High standards of housekeeping are maintained across the site. • Spill kits are available to deal with any leaks. • All waste storage areas are clearly marked and signed, and storage containers are secure and clearly labelled. • Operator will ensure procedures are in place to implement any necessary remedial measures.	Fugitive releases could reach surface water and/ or groundwater but appropriate design and management actions should prevent this from happening. Site will have sealed drainage system and concrete floors. Probability is therefore low.	Low
Contamination of groundwater	Local surface water and/ or groundwater	Flow through unsurfaced areas.	Localised pollution of surface water and groundwater.	• Site surfacing for all areas accessed by vehicles will be concrete designed to an appropriate standard.	Fugitive releases could reach surface water and/ or groundwater but appropriate	Low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
		Cracked drains/ hardstanding leading to soil and groundwater.		• Operator will carry out an annual survey of the integrity of all bunded areas and impermeable surfacing where there's potential for accidents to occur due to loss of containment.	design and management actions should prevent this from happening. All chemical storage tanks will be bunded to provide sufficient containment in the event of a tank/ containment failure. Probability is therefore low.	
Contaminated surface run-off	Local surface water and/ or groundwater	Flow by gravity through drainage systems/ and unsurfaced areas. Cracked drains/ hardstanding leading to soil and groundwater.	Localised pollution of surface water and groundwater. Localised fire with potential for injury / loss of life, damage to plant / equipment.	• Engineered site drainage system developed in line with EA guidance. • Drainage system equipped with separators. • Drainage system subject to routine inspection along with a preventative maintenance regime. • Emergency spills kits used in conjunction with a site emergency plan will help mitigate the effects of any contamination. • Site surfacing for all areas accessed by vehicles will be concrete designed to an appropriate BS. • Operator daily checks for signs of leak. • High standards of housekeeping will be maintained	Fugitive releases could reach surface water and/ or groundwater but appropriate design and management actions should prevent this from happening. All chemical storage tanks will be bunded to provide sufficient containment in the event of a tank/ containment failure. Probability is therefore low.	Low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
Escape of liquid raw materials including hazardous chemicals	Local surface water and/ or groundwater	Flow by gravity/ drainage systems/unsurfaced areas. Cracked drains/ hardstanding leading to soil and groundwater. Damaged storage tanks. Areas of tanker loading/vehicle parking.	Localised pollution of surface water and groundwater. Localised fire with potential for injury / loss of life, damage to plant / equipment.	• Storage arrangements appropriate to materials being stored; • impermeable surfacing across site; bunded storage facilities; • segregated drainage systems for process areas more likely to be contaminated and isolation points; and • inspection and maintenance at regular intervals including infrastructure, bunds, drains and hardstanding areas etc. • All raw materials stored on Site will be stored in appropriate containers, provided with sufficient spillage containment, in accordance with the relevant material specifications. • The possible oil contaminated areas drain in to an Oil Water Separator (OWS) and ends up in the retention pond before outfall in to a water body. • Ammonia contaminated areas drain to an ammonia detection sump to ensure any escaped ammonia is caught and treated before outfall. The ammonia tanks have double walled secondary containment to allow for accidental overfilling/leakage and are	Fugitive releases could reach surface water and/ or groundwater but appropriate design and management actions should prevent this from happening. All chemical storage tanks will be bunded to provide sufficient containment in the event of a tank/ containment failure. Probability is therefore low.	Low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
				located in a hardstanding drainage system. • Leaks experience in the pipeline between the jetty head and storage tank will be detected by mass balance. A high difference in the mass balance will result in an alarm to the operator, the operator will be responsible for the decision to shut down the import.		
Nuisance						
Mud/litter carried onto highway	Local residents/ businesses beyond the installation boundary	Mud carried onto highway by vehicles and/or litter borne by wind	Nuisance issue	• All internal roads, storage and processing areas are hard surfaced with concrete or tarmac. • All waste storage areas are clearly marked and signed, and storage containers are secure and clearly labelled. • High standards of housekeeping are maintained across the site.	The installation is not anticipated to be a notable source of mud or litter given the storage controls, housekeeping management and nature of the processes.	Very low
Pests and scavengers	Local residents/ businesses beyond the installation boundary	Over land or via drainage channels	Nuisance issue	Use of registered pest control contractors to monitor site and rodenticide will be considered if required.	High housekeeping standards will be maintained. The nature of the processes have a very low risk of attracting pests or vermin a	Very low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
Odour						
Escape of odour from stored chemicals including ammonia	Local residents/ businesses beyond the installation boundary	Vapours/ odour carried on wind	Complaints of odours/ smells in vicinity of local receptors.	• The Site will use and store chemicals, which will be managed in accordance with appropriate management procedures. • All raw materials will be stored in suitable sized above ground tanks and containers, provided with sufficient spillage containment, in accordance with the relevant material specifications. • Site will implement an Odour Management Plan.	The installation is not anticipated to be a notable source of odour – the onsite process operates with full containment and only in the event of an emergency if other prior measures such as control and containment fail would any NH_3 emissions be flared. Any odour as a result of fugitive emissions from leaks will be managed and maintained according to procedures at the installation will reduce the risk of leaks.	Very low
Noise and Vibration						
Noise from onsite machinery and plant (pumps, motors, cooling systems, boilers, and transformers)	Local residents/ businesses beyond the installation boundary	Noise carried on wind	Complaints of noise in vicinity of local receptors.	• Staff training includes raising employee awareness with respect to normal plant operational noise levels and actions to be taken to rectify any faults. • Site plant will be maintained in line with manufacturer's recommendations this will include the checking for deterioration of plant condition (e.g. bearings becoming worn). Repairs will be undertaken as appropriate to rectify any identified defects.	Consideration of low noise equipment and use of additional screening as identified through detailed design coupled with the implementation of noise management plan during operations means exposure should be low.	Low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
				• Noise Moise Management Plan		
Noise from vehicles.	Local residents/ businesses beyond the installation boundary	Noise carried on wind	Complaints of noise in vicinity of local receptors.	• Reversing will be minimised where possible. • Engines will be switched off when not in use. • Vehicles will arrive/depart from the site in accordance with the hours permitted by planning.	Implementation of the identified measures and the Noise Management Plan means exposure should be low.	Very low
Visible Plumes						
Plumes from the operation of the flares, vent stack, heaters, and emergency generators	Local residents/ businesses beyond the installation boundary	Visual impact	Complaints of smoke	• Plant operates primarily on natural gas and/or H2 rich tail gas so it is unlikely that operation will lead to a visible plume. • Visibility check will take place during venting. • During operation of emergency generators on diesel or HVO, a check will be completed each shift for visibility of a plume – visibility of plume is likely to be due to incomplete combustion of fuel and plant will be stopped and maintenance inspection will be undertaken.	Probability of exposure is considered to be low by application of appropriate management procedures which will be developed prior to the commencement of operation of the installation.	Low

3 Assessment of Accident Risks

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
Fire	Local residents/ businesses and other installations beyond the installation boundary. On-site personnel and infrastructure. Potential for direct harm to the environment from thermal radiation such as impact on flora and fauna near to Site. Also, harm to the environment via release of	Emissions of smoke to the air.	Air quality impacts; Complaints of smoke/ smells in vicinity from local residential receptors. Possible damage to neighbouring installations.	• Engineering design by competent personnel to industry codes and standards using 'fit for purpose' equipment. • Storage of hazardous materials away from receptors. • HAZID and HAZOP studies carried out for the site. • Engineering design risk assessments and QRA carried out to demonstrate ALARP as required by the COMAH Regulations. • Engagement with neighbouring COMAH facilities • Use of fully welded connections rather than flanged connections for gaseous systems. Flange guards only where welding is not practical. • Detailed inspection and testing of the equipment and pipework to prevent loss of containment. • Control systems to be installed to continuously monitor process parameters including pressure and temperature. • Safety instrumented systems designed, operated, and maintained in accordance with guidance documents. • Fire and gas detection and alarm systems. • Passive and active fire suppression systems.	Appropriate design and management actions should allow the prevention and early detection of/ minimise the risk of fire spreading.	Low
		Firewater, foam, etc. to site drainage soil.	Localised pollution of soils.		Containment infrastructure is in place for firewater management.	
		Firewater, foam, etc. to groundwater and/ or controlled waters.	Localised pollution to surface and/or groundwater		Containment infrastructure is in place for firewater management.	

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
	contaminated firewater to environmental receptors including the Humber Estuary.			• Site is underlaid with hardstanding which is kerbed to prevent contaminated surface water and firewater to run-off. • Ammonia and natural gas systems will be routed to a flare system for safe disposal. • In the event of a process upset, hydrogen would be safely routed to a vent system for disposal. • All process areas of Site would be subject to hazardous area classification. • Anhydrous ammonia would be stored and handled as a liquid in a cold/refrigerated condition. • Operation and management of the facility by experienced, qualified personnel. • Security systems to be deployed including perimeter fencing, CCTV, and cyber security. • Operability risk assessments carried out during design phase. • An SMS would be developed and in place prior to operation, incorporating Management of Change (“MoC”) procedures. • Planned preventative maintenance systems to prevent equipment defects and failures. • Inspection regimes to detect corrosion and other mechanisms which could lead to equipment defects.		

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
				• Emergency planning and response procedures including regular live tests. • A risk assessment in accordance with DSEAR would be produced prior to operation including Hazardous Area Drawings.		
Explosion/ Energy Release	Local residents/ businesses and other installations beyond the installation boundary. Surrounding infrastructure such as overhead power. On-site personnel and infrastructure.	Release of installation gases to the air. Projectiles in air and surface/ground water.	Impacts to all receptors including human and nature based. Destruction of part/all of installation and possibility of surrounding installation.	• Management is similar to those above for fire. • Measures involve preventing a loss of containment by applying industry standards and best practice to the engineering design of the facilities which would be subject to rigorous safety assessments. These measures are a fundamental requirement for legislative compliance, without which the facility would not be permitted to operate. • On Site occupied buildings will be designed to withstand explosion overpressures which will be determined using the Phast consequence modelling software and the Baker Strehlow Tang vapour cloud explosion model.	Low; appropriate design and management actions used to avoid an explosion/energy release, along with rigorous monitoring and safety assessments.	Low
Release of toxic gas	Local residents/ businesses and	Emissions from loss of containment through	Releases to air	• A gas detection system, with corresponding emergency alarm and procedures.	Gas detection systems would allow an early intervention by operators in the	Low

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
	installations beyond the installation boundary, air, and on-site personnel and infrastructure.	accidental or malicious damage or failure of containment systems		• Secondary containment of ammonia storage tanks that are designed to industry best practices. Annular space will have temperature sensors across the space to detect leakage from primary containment. Acoustic monitoring system will be deployed to ensure information is received of any developing cracks into the primary containment of liquid ammonia storage tank. Gas detectors across the annular space of ammonia storage tank. • Safe havens will be located on Site and on or at the foot of the jetty, to allow operators to shelter in the event of an ammonia release.	event of an accidental loss of containment of ammonia. Infrastructure will minimise the risk of ammonia release/leakage. The design of these facilities will be informed by the output of modelling studies but will be expected to provide a minimum of 30 minutes protection.	
Flooding of the Site and associated contamination of flood waters with chemicals/ fuel stored on site	Local surface water, soils and/ or groundwater; local ecological receptors.	Flow by gravity/ drainage systems/ unsurfaced areas.	Complaints of odours in the vicinity of local receptors. Localised pollution of surface water and groundwater.	The Environment Agency Flood Map for Planning shows the Site is located in Flood Zone 3a (tidal) (high risk of flooding) when the tidal flood defences are not accounted for. The Site benefits from the presence of flood defences up to and including the 0.5% AEP flood event, therefore the actual risk of flooding to the Site from tidal sources is low. However, there remains a residual risk of flooding should there be overtopping or a breach in the flood defences. Proposed mitigation measures that would reduce this effect would include the development of a Flood Response Plan which would be adhered to. A site induction would also be given to all site operatives and workforce, including outlining	Low; appropriate design and management actions used to avoid contamination of flood waters.	Medium

Hazard	Receptor	Pathway	Consequence	Risk Management	Probability of Exposure	Overall Risk
				evacuation routes, safe refuge, and access and egress areas. The operational Site would be registered with the Environment Agency Flood Warnings Direct Service. There will also be full closure of the Site and therefore no operatives/site visitors on site for the duration of a flood warning period.		
Vandalism to installation, equipment and infrastructure and associated loss of fuel/ chemicals from site	Local residents/ businesses beyond the installation boundary, air, land and water. On-site personnel and infrastructure.	Emissions resulting from failure/ reduced performance of vandalised plant, equipment and infrastructure	Potential pollution of surface water and groundwater from escape of chemicals.	Security fence, appropriate intruder alarms and CCTV cameras to be located at numerous locations on Site, with restricted entry; relevant signage; building envelope around a significant proportion of the operation/ process.	Negligible. Appropriate design and management actions should prevent vandalism happening.	Low