# Immingham Green Energy Terminal Green Hydrogen Production Facility

EPR/VP3425SV/A001

Environmental Permit Application

Appendix K – Adapting to Climate Change Risk Assessment

Environmental Permitting (England and Wales) Regulations 2016

Applicant: Air Products BR Ltd

May 2024

**Environmental Permitting (England and Wales) Regulations 2016**

# Immingham Green Energy Terminal Green Hydrogen Production Facility

# Environmental Permit Application

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# Appendix D1 – Assessment of Best Available Techniques for Emissions

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

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|---|---|---|
| Revision 1 | 28 March 2024 | EPR Application |
| Revision 2 | 09 May 2024 | Final revision |
| Issue 1 | 17 May 2024 | Issue to Regulator |

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**Chapter** **Pages**

# 1.0 INTRODUCTION

## 1.1. Purpose of the Report

1.1.1 This report has been prepared by AECOM Limited ('AECOM') on behalf of Air Products (BR) Limited ("the Operator" or AP) and provides an assessment of the adaptation to climate change measures for the proposed Green Hydrogen ($H_2$) Production Facility (the 'installation'). The purpose of this report is to demonstrate that the proposed installation will be designed and operated in a manner that can adapt to climate change impacts.

1.1.2 The main Supporting Statement provides an overall summary of the management arrangements for the proposed installation which includes the climate change adaption measures proposed and confirmation that these will be maintained as part of the site Environmental Management System (EMS).

## 1.2. Proposed Installation Description

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 comprises 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 Associated British Ports (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.

1.2.4 With regards to emissions associated with the process, these are detailed in full in section 5, of the Supporting Statement (document ref: VP3425SV/APP/SS) and include:

- Point source releases to air from Reformer flue gas stacks (x6), $H_2$ Production Unit (HPU) Flares and pilots (x6), $NH_3$ storage flare and pilot and $H_2$ vent stack;
- Point source release of uncontaminated surface water to the ditch network around the site which eventually discharges to the Humber Estuary; and
- Point source release to sewer of process blowdown and condensate waters.

# 2.0 RISK ASSESSMENT METHODOLOGY

## 2.1. Approach

2.1.1. The methodology employed is the approach previously produced by the Environment Agency (EA).

## 2.2 Risk Assessment Scoring

| Description | Score |
|---|---|
| ***Likelihood*** | |
| Unlikely : - circumstances are such that it is improbable the event would occur even in the long term. | 1 |
| Low likelihood : - circumstances are such that an event could occur, but it is not certain even in the long term that an event would occur, and it is less likely in the short term. | 2 |
| Likely : - it is probable that an event will occur, or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term. | 3 |
| Highly likely: - event appears very likely in the short term and almost inevitable over the long-term, or there is evidence of the event already happening. | 4 |
| ***Severity of Impact*** | |
| Minor impact : - short or long-term impact to operations resulting in additional measures for compliance. | 1 |
| Mild impact: - short-term, acute impact to operations resulting in single temporary compliance breach. | 2 |
| Medium impact: - short-term, acute impact to operations resulting in multiple temporary compliance breaches. | 3 |
| Severe impact: - short-term, acute impact to operations resulting in permanent compliance breaches. | 4 |
| ***Risk Categories*** | |
| Score is 1 to 3 | Low |
| Score is 4 to 6 | Low - Moderate |
| Score is 8 to 9 | Moderate - High |
| Score is 12 to 16 | High |

## 2.3 Risk Scoring Matrix

2.3.1. The impacts are scored using the scoring matrix above and the risk is then scored using the risk scoring matrix shown in the table on the following page by:

Risk = Likelihood x Severity

| | | SEVERITY | | | |
|---|---|---|---|---|---|
| | | **Severe Impact (score 4)** | **Medium Impact (score 3)** | **Mild Impact (score 2)** | **Minor Impact (score 1)** |
| **LIKELIHOOD** | Highly Likely (score 4) | 16 | 12 | 8 | 4 |
| | Likely (score 3) | 12 | 9 | 6 | 3 |
| | Low Likelihood (score 2) | 8 | 6 | 4 | 2 |
| | Unlikely (score 1) | 4 | 3 | 2 | 1 |

## 2.4 Risk Assessment

2.4.1. The risk assessment considers how vulnerable the site is in current and future climates taking into consideration in site specific aspects. It has been completed on the EA risk assessment worksheet for the river basin where the site is located. The H2 Production Plant is situated in the Humber river basin and the completed risk assessment worksheet is presented in Section 3.

## 3.0 CLIMATE CHANGE RISK ASSESSMENT

**Humber river basin district: climate change risk assessment**

Name (as on your part A application form): **Air Products (BR) Limited**

Our permit reference number (if you have one): **EPR/VP3425SV/A001**

Your document reference number: **EPR/VP3425SV/APP/CCRA**

| Potential changing climate variable | A<br>Impact | B<br>Likelihood | C<br>Severity | D<br>Risk<br>(BxC) | E<br>Mitigation<br>(what will you do to mitigate this risk) | F<br>Likelihood<br>(after mitigation) | G<br>Severity<br>(after mitigation) | H<br>Residual risk<br>(after mitigation) |
|---|---|---|---|---|---|---|---|---|
| 1. 1. Summer daily maximum temperature may be around 6°C higher compared to average summer temperatures now. | Potential expansion and stress of plant, pipework and fittings | 2 | 1 | 2 | • Plant subject to planned preventative maintenance. | 2 | 1 | Low |
| | Potential increase in dust emissions | 2 | 1 | 2 | • High housekeeping standards<br>• Materials handled/generated unlikely to produce dust. | 2 | 1 | Low |
| | Potential increase in odour | 2 | 1 | 2 | • Site low potential for odour generation.<br>• Odour management plan will be in place<br>• Plant subject to planned preventative maintenance. | 2 | 1 | Low |
| | Potential increase in fugitive or diffuse emissions | 2 | 1 | 2 | • Plant subject to planned preventative maintenance. | 2 | 1 | Low |
| | Increase in water required for cooling purposes | 2 | 1 | 2 | • cooling system includes water recirculation | 2 | 1 | Low |
| | Potential increase in energy consumption due to the added pumping of cooling water around the site | 2 | 1 | 2 | • Choice of cooling system is more energy efficient than alternative.<br>• Plant subject to planned preventative maintenance.<br>• Energy will be monitored as a key performance indicator | 2 | 1 | Low |
| 2. Winter daily maximum temperature could be 4°C more than the current average, with the potential for more extreme temperatures, both warmer and colder than present. | Risk of trace heating systems failing and cooling water freezing and causing blockage or process failure. | 2 | 3 | 6 | • Monitoring of temperatures.<br>• Using lagging, but in a manner that accounts for high temperature changes between seasons.<br>• Use of steam system to de-ice. | 2 | 2 | Low |
| | Increased risk of pipework rupture affecting process systems. | 2 | 3 | 6 | • Using lagging, but in a manner that accounts for high temperature changes between seasons.<br>• Use of steam system to de-ice.<br>• Minimising dead-legs during plant design.<br>• Developing operating and maintenance procedures that leads to pipework being full of static water. | 2 | 2 | Low |
| | Frozen onsite roadways restricting access for staff and emergency services. | 2 | 3 | 6 | • Regular inspection and maintenance of roadways. | 2 | 2 | Low |

| Potential changing climate variable | A<br>Impact | B<br>Likelihood | C<br>Severity | D<br>Risk<br>(BxC) | E<br>Mitigation<br>(what will you do to mitigate this risk) | F<br>Likelihood<br>(after mitigation) | G<br>Severity<br>(after mitigation) | H<br>Residual risk<br>(after mitigation) |
|---|---|---|---|---|---|---|---|---|
| | | | | | • Design roadways to avoid standing water and remove this if it collects.<br>• Monitoring of temperatures and applying grit to treat road and yard surfaces.. | | | |
| | Externally situated plant or equipment freezing | 2 | 3 | 6 | • Monitoring of temperatures.<br>• Using lagging, but in a manner that accounts for high temperature changes between seasons.<br>• Use of steam system to de-ice. | 2 | 2 | Low |
| 3. 3. The biggest rainfall events are up to 20% more intense than current extremes (peak rainfall intensity)*. | Flash flood leading to access restrictions or overloading of surface water system | 2 | 3 | 6 | • Drainage has been designed considering appropriate rainfall events but can be increased in the future if necessary.<br>• Inspection and maintenance of site drainage systems.<br>• Whole site raised to account for flooding.<br>• If necessary in future, emergency pumps can be provided and additional protection for control and electrical systems will be considered. | 2 | 2 | Low-Moderate |
| | Bunding capacity reduced due to flooding | 1 | 2 | 2 | • Containment designed to the appropriate capacity and standards.<br>• Bunds subject to visual inspections to ensure that there is no damage.<br>• Bund level detection systems to be installed.. | 1 | 2 | Low |
| 4. 4. Average winter rainfall may increase by 29% on today's averages | Flash flood leading to access restrictions or overloading of surface water system | 2 | 3 | 6 | • Drainage has been designed considering appropriate rainfall events and capacity can be increased in the future if necessary.<br>• Inspection and maintenance of site drainage systems.<br>• Whole site raised to account for flooding.<br>• If necessary in future, emergency pumps can be provided and additional protection for control and electrical systems will be considered. | 2 | 2 | Low-Moderate |
| | Bunding capacity reduced due to flooding | 1 | 2 | 2 | • Containment designed to the appropriate capacity and standards.<br>• Bunds subject to visual inspections to ensure that there is no damage.<br>• Bund level detection systems can be installed.<br>• Increase bunding if necessary. | 1 | 2 | Low |
| 5. 5. Sea level could be as much as 0.6m higher compared to today's level . | Increased risk of tidal flooding | 2 | 3 | 3 | • Drainage has been designed considering appropriate tidal flooding and capacity can be increased in the future if necessary.<br>• Critical equipment is raised to account for flooding. | 2 | 2 | Low-Moderate |

| Potential changing climate variable | A<br>Impact | B<br>Likelihood | C<br>Severity | D<br>Risk<br>(BxC) | E<br>Mitigation<br>(what will you do to mitigate this risk) | F<br>Likelihood<br>(after mitigation) | G<br>Severity<br>(after mitigation) | H<br>Residual risk<br>(after mitigation) |
|---|---|---|---|---|---|---|---|---|
| | | | | | • If necessary in future, emergency pumps can be provided and additional protection for control and electrical systems will be considered. | | | |
| 6. 6. Drier summers, potentially up to 34% less rain than now. | Increased use or reliance on mains water for dust suppression and cleaning | 1 | 2 | 2 | • Materials handled/generated unlikely to produce dust.<br>• Dust suppression if required would be sourced from non-potable supplies. | 1 | 2 | Low |
| | Potential increase in dust emissions | 2 | 1 | 2 | • High housekeeping standards<br>• Materials handled/generated unlikely to produce dust. | 2 | 1 | Low |
| 7. 7. At its peak, the flow in watercourses could be 50% more than now, and at its lowest it could be 80% less than now. | Reduced dilution available in receiving watercourse for discharge of effluent, resulting in increased pollution | N/A | N/A | N/A | Only uncontaminated surface water is discharged. | N/A | N/A | N/A |
| 8. 8. Storms: frequency and intensity can increase. | Could damage buildings and site structures | 2 | 3 | 6 | • Buildings and site infrastructure are subject to inspection and maintenance.<br>• Review the design of vulnerable tall structures and buildings.<br>• Review wind loading calculations during design, providing reinforcement if necessary. | 1 | 2 | Low |
| *Indicates data has come from climate change allowances as part of the spatial planning process. Evidence from your planning submission is acceptable evidence for this worksheet. | | | | | | | | |