

Permit with introductory note

The Environmental Permitting (England & Wales) Regulations 2016

Geopura Ltd

High Marnham Hydrogen
High Marnham Power Station
High Marnham
NG23 6SH

Permit number

EPR/DP3329SM

High Marnham Hydrogen

Permit number EPR/DP3329SM

Introductory note

This introductory note does not form a part of the permit

The main features of the permit are as follows. The installation produces green hydrogen by the electrolysis of water. The main activity falls under the following Schedule 1 listed activities of the Environmental Permitting Regulations:

- *Section 4.2 Part A(1)a(1): Producing inorganic chemicals such as gases: hydrogen.*

The installation is located at the site of the decommissioned High Marnham Power Station, centred around National Grid Reference SK 81007 70777 approximately 5km to the north of Sutton on Trent. The site is surrounded in other directions by agricultural land, with the River Trent situated less than 100m to the east at its nearest point. The site falls under the Bassetlaw Local Authority.

Process description

The main process is the alkaline electrolysis of water to generate hydrogen gas which is the primary product. The by-product oxygen gas is vented into the atmosphere.

The process steps involved are:

- Water purification (reverse osmosis and softening)
- Electrolysis
- Hydrogen purification, compression and export

Water purification

The process water is pumped at high pressure through an array of reverse osmosis (RO) tubes containing semi-permeable membranes. The applied pressure forces the water molecules through the membrane against the osmotic pressure, promoting its demineralisation. The demineralised water is collected for use in the process, whilst the ions retained by the RO membranes are concentrated and disposed of as an effluent ('RO elutriate').

Although the reverse osmosis is expected to produce very clean water an additional softening step has been added as extra security. The water softening will remove any residual "hard" cations such as calcium or magnesium. Hard cations are known to generate scale deposits which can interrupt flow in pipes, blind membranes and prevent valves fully seating. To minimise the possibility of such problems the cleaned water flows through a cartridge water softener in which the water passes through a bed of sodium chloride. The hard cations preferentially swap with the sodium cations and are trapped in the cartridge medium. The sodium ions do not precipitate or generate scale and so eliminate the potential problems of the hard cations.

After a period of time the cartridges become depleted in sodium and loaded with hard cations. At that point the old cartridge is removed and a new one installed. The old cartridge is returned to the suppliers to be regenerated.

Electrolysis

Electrolysis is carried out in identical electrolysis cells, each containing a conducting solution and anode and cathodes connected to the electrical supply.

The cell is filled with the potassium hydroxide conducting solution and the electrical supply to the electrodes is switched on. The electrical current dissociates the water into hydrogen and oxygen with hydroxyl as an intermediate.

The potassium hydroxide is used in a sealed unit in the electrolyser. The design and construction ensures that it does not need topping up during operation. Every 2 years, the electrolysis stacks are accessed for

service and maintenance. At that point the potassium hydroxide is decanted out of the stack into an IBC and on completion, the same material is decanted back into the stack.

Collection ducts above the electrodes collect the evolved gases.

Sixteen identical electrolyzers will be installed in parallel to give a production throughput of approximately 260 kg/h hydrogen, corresponding to an electrical input of approximately 13.8 MWe (excluding electrical power required by the compression).

Hydrogen purification, compression and export

The hydrogen gas is purified by the catalytic deoxo unit at the collection point where traces of oxygen are removed. The purified hydrogen passes over a physical desiccant chamber to remove residual traces of moisture. This purified hydrogen is compressed and pumped into industry standard arrays of hydrogen cylinders fitted to trailers with no interim storage. Once the arrays are full the trailer is driven from the site and replaced with an empty array.

Emissions

Emissions to air: The emissions to air include

- by-product oxygen gas from each electrolysis cell
- nitrogen gas used for purging the system to make safe flammable atmosphere prior to maintenance or engineering work
- hydrogen gas as vent losses around seals, releases during electrolyser maintenance and during compressor maintenance to purge system

Emissions to water: The electrolysis cells and associated equipment are being installed on the site of one of the old power station cooling towers. Infrastructure was constructed for the whole power station which transported collected rainwater to discharge via an engineered channel into the River Trent. This engineered channel and discharge is still in existence and operational. As such use is being made of existing site infrastructure with respect to water discharges. The RO discharge will be introduced to the overall area run-off system downstream of the rainwater hydrobrake. A hydrobrake is a self-activated fixed structure that controls the flow of water by generating a vortex within the centre of the structure, depending on the upstream flow conditions.

Site run-off – clean rainwater – will be discharged to river via the existing overall area run-off system. An attenuation pond and hydrobrake will maintain acceptable flowrates. There is no process release to sewer.

Emission to land: There are no direct emissions to land.

The nearest residential receptor is at a distance of 550m. There are no SACs, SPAs, SSSIs or Ramsar sites within their respective screening distances. The site is within flood zone 1 which means it has a low probability of flooding. The site is not located within an Air Quality Management Area (AQMA).

The status log of the permit sets out the permitting history, including any changes to the permit reference number.

Status log of the permit		
Description	Date	Comments
Application EPR/DP3329SM/A001	Duly made 05/03/2024	Application for hydrogen gas production by electrolysis of water.
Additional information received	26/04/2024	Received information against the Schedule 5 Notice sent on 12/04/2024
Additional information received	22/05/2024	Received information against the Schedule 5 Notice sent on 08/05/2024.
Additional information received	16/08/2024	Received information in response to the applicant's request for increasing water flowrate. New energy mass balance flowsheet submitted.

Status log of the permit		
Description	Date	Comments
Additional information received	29/08/2024	Received updated site plan in response to applicant's request for changing the site boundary which in effect decreases the installation boundary.
Permit determined EPR/DP3329SM	29/08/2024	Permit issued to Geopura Ltd.

End of introductory note

Permit

The Environmental Permitting (England and Wales) Regulations 2016

Permit number

EPR/DP3329SM

The Environment Agency hereby authorises, under regulation 13 of the Environmental Permitting (England and Wales) Regulations 2016

Geopura Ltd (“the operator”),

whose registered office is

Alexandra Street

Nottingham

NG5 1AY

company registration number 11855286

to operate an installation at

High Marnham Hydrogen

High Marnham Power Station

High Marnham

NG23 6SH

to the extent authorised by and subject to the conditions of this permit.

Name	Date
Eleanor Blackeby	29/08/2024

Authorised on behalf of the Environment Agency

Conditions

1 Management

1.1 General management

1.1.1 The operator shall manage and operate the activities:

- (a) in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances, closure and those drawn to the attention of the operator as a result of complaints; and
- (b) using sufficient competent persons and resources.

1.1.2 Records demonstrating compliance with condition 1.1.1 shall be maintained.

1.1.3 Any person having duties that are or may be affected by the matters set out in this permit shall have convenient access to a copy of it kept at or near the place where those duties are carried out.

1.2 Energy efficiency

1.2.1 The operator shall:

- (a) take appropriate measures to ensure that energy is used efficiently in the activities;
- (b) review and record at least every four years whether there are suitable opportunities to improve the energy efficiency of the activities; and
- (c) take any further appropriate measures identified by a review.

1.3 Efficient use of raw materials

1.3.1 The operator shall:

- (a) take appropriate measures to ensure that raw materials and water are used efficiently in the activities;
- (b) maintain records of raw materials and water used in the activities;
- (c) review and record at least every four years whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw material and water use; and
- (d) take any further appropriate measures identified by a review.

1.4 Avoidance, recovery and disposal of wastes produced by the activities

1.4.1 The operator shall take appropriate measures to ensure that:

- (a) the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste by the activities; and
- (b) any waste generated by the activities is treated in accordance with the waste hierarchy referred to in Article 4 of the Waste Framework Directive; and
- (c) where disposal is necessary, this is undertaken in a manner which minimises its impact on the environment.

- 1.4.2 The operator shall review and record at least every four years whether changes to those measures should be made and take any further appropriate measures identified by a review.

2 Operations

2.1 Permitted activities

- 2.1.1 The operator is only authorised to carry out the activities specified in schedule 1 table S1.1 (the “activities”).

2.2 The site

- 2.2.1 The activities shall not extend beyond the site, being the land shown edged in green on the site plan at schedule 7 to this permit.

2.3 Operating techniques

- 2.3.1 The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in schedule 1, table S1.2, unless otherwise agreed in writing by the Environment Agency.
- 2.3.2 If notified by the Environment Agency that the activities are giving rise to pollution, the operator shall submit to the Environment Agency for approval within the period specified, a revision of any plan or other documentation (“plan”) specified in schedule 1, table S1.2 or otherwise required under this permit which identifies and minimises the risks of pollution relevant to that plan, and shall implement the approved revised plan in place of the original from the date of approval, unless otherwise agreed in writing by the Environment Agency.
- 2.3.3 Any raw materials or fuels listed in schedule 2 table S2.1 shall conform to the specifications set out in that table.
- 2.3.4 The operator shall ensure that where waste produced by the activities is sent to a relevant waste operation, that operation is provided with the following information, prior to the receipt of the waste:
- (a) the nature of the process producing the waste;
 - (b) the composition of the waste;
 - (c) the handling requirements of the waste;
 - (d) the hazardous property associated with the waste, if applicable; and
 - (e) the waste code of the waste.
- 2.3.5 The operator shall ensure that where waste produced by the activities is sent to a landfill site, it meets the waste acceptance criteria for that landfill.

2.4 Improvement programme

- 2.4.1 The operator shall complete the improvements specified in schedule 1 table S1.3 by the date specified in that table unless otherwise agreed in writing by the Environment Agency.
- 2.4.2 Except in the case of an improvement which consists only of a submission to the Environment Agency, the operator shall notify the Environment Agency within 14 days of completion of each improvement.

2.5 Pre-operational conditions

- 2.5.1 The activities shall not be brought into operation until the measures specified in schedule 1 table S1.4 have been completed.

3 Emissions and monitoring

3.1 Emissions to water, air or land

- 3.1.1 There shall be no point source emissions to water, air or land except from the sources and emission points listed in schedule 3 tables S3.1 and S3.2.
- 3.1.2 The limits given in schedule 3 shall not be exceeded.
- 3.1.3 Periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination.

3.2 Emissions of substances not controlled by emission limits

- 3.2.1 Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions.
- 3.2.2 The operator shall:
- (a) if notified by the Environment Agency that the activities are giving rise to pollution, submit to the Environment Agency for approval within the period specified, an emissions management plan which identifies and minimises the risks of pollution from emissions of substances not controlled by emission limits;
 - (b) implement the approved emissions management plan, from the date of approval, unless otherwise agreed in writing by the Environment Agency.
- 3.2.3 All liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container.

3.3 Odour

- 3.3.1 Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Environment Agency, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable to minimise the odour.
- 3.3.2 The operator shall:
- (a) if notified by the Environment Agency that the activities are giving rise to pollution outside the site due to odour, submit to the Environment Agency for approval within the period specified, an odour management plan which identifies and minimises the risks of pollution from odour;
 - (b) implement the approved odour management plan, from the date of approval, unless otherwise agreed in writing by the Environment Agency.

3.4 Noise and vibration

- 3.4.1 Emissions from the activities shall be free from noise and vibration at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Environment Agency, unless the operator has used appropriate measures, including, but not limited to, those specified in any

approved noise and vibration management plan to prevent or where that is not practicable to minimise the noise and vibration.

3.4.2 The operator shall:

- (a) if notified by the Environment Agency that the activities are giving rise to pollution outside the site due to noise and vibration, submit to the Environment Agency for approval within the period specified, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration;
- (b) implement the approved noise and vibration management plan, from the date of approval, unless otherwise agreed in writing by the Environment Agency.

3.5 Monitoring

3.5.1 The operator shall, unless otherwise agreed in writing by the Environment Agency, undertake the monitoring specified in the following tables in schedule 3 to this permit:

- (a) point source emissions specified in tables S3.2;
- (b) process monitoring specified in table S3.3.

3.5.2 The operator shall maintain records of all monitoring required by this permit including records of the taking and analysis of samples, instrument measurements (periodic and continual), calibrations, examinations, tests and surveys and any assessment or evaluation made on the basis of such data.

3.5.3 Monitoring equipment, techniques, personnel and organisations employed for the emissions monitoring programme and the environmental or other monitoring specified in condition 3.5.1 shall have either MCERTS certification or MCERTS accreditation (as appropriate), where available, unless otherwise agreed in writing by the Environment Agency.

3.5.4 Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in schedule 3 table S3.2 unless otherwise agreed in writing by the Environment Agency.

4 Information

4.1 Records

4.1.1 All records required to be made by this permit shall:

- (a) be legible;
- (b) be made as soon as reasonably practicable;
- (c) if amended, be amended in such a way that the original and any subsequent amendments remain legible, or are capable of retrieval; and
- (d) be retained, unless otherwise agreed in writing by the Environment Agency, for at least 6 years from the date when the records were made, or in the case of the following records until permit surrender:
 - (i) off-site environmental effects; and
 - (ii) matters which affect the condition of the land and groundwater.

4.1.2 The operator shall keep on site all records, plans and the management system required to be maintained by this permit, unless otherwise agreed in writing by the Environment Agency.

4.2 Reporting

- 4.2.1 The operator shall send all reports and notifications required by the permit to the Environment Agency using the contact details supplied in writing by the Environment Agency.
- 4.2.2 A report or reports on the performance of the activities over the previous year shall be submitted to the Environment Agency by 31 January (or other date agreed in writing by the Environment Agency) each year. The report(s) shall include as a minimum:
- (a) a review of the results of the monitoring and assessment carried out in accordance with the permit including an interpretive review of that data;
 - (b) the annual production /treatment data set out in schedule 4 table S4.2; and
 - (c) the performance parameters set out in schedule 4 table S4.3 using the forms specified in table S4.4 of that schedule.
- 4.2.3 Within 28 days of the end of the reporting period the operator shall, unless otherwise agreed in writing by the Environment Agency, submit reports of the monitoring and assessment carried out in accordance with the conditions of this permit, as follows:
- (a) in respect of the parameters and emission points specified in schedule 4 table S4.1;
 - (b) for the reporting periods specified in schedule 4 table S4.1 and using the forms specified in schedule 4 table S4.4 ; and
 - (c) giving the information from such results and assessments as may be required by the forms specified in those tables.
- 4.2.4 The operator shall, unless notice under this condition has been served within the preceding four years, submit to the Environment Agency, within six months of receipt of a written notice, a report assessing whether there are other appropriate measures that could be taken to prevent, or where that is not practicable, to minimise pollution.

4.3 Notifications

- 4.3.1 In the event:
- (a) that the operation of the activities gives rise to an incident or accident which significantly affects or may significantly affect the environment, the operator must immediately—
 - (i) inform the Environment Agency,
 - (ii) take the measures necessary to limit the environmental consequences of such an incident or accident, and
 - (iii) take the measures necessary to prevent further possible incidents or accidents;
 - (b) of a breach of any permit condition the operator must immediately—
 - (i) inform the Environment Agency, and
 - (ii) take the measures necessary to ensure that compliance is restored within the shortest possible time;
 - (c) of a breach of permit condition which poses an immediate danger to human health or threatens to cause an immediate significant adverse effect on the environment, the operator must immediately suspend the operation of the activities or the relevant part of it until compliance with the permit conditions has been restored.
- 4.3.2 Any information provided under condition 4.3.1 shall be confirmed by sending the information listed in schedule 5 to this permit within the time period specified in that schedule.
- 4.3.3 Where the Environment Agency has requested in writing that it shall be notified when the operator is to undertake monitoring and/or spot sampling, the operator shall inform the Environment Agency

when the relevant monitoring and/or spot sampling is to take place. The operator shall provide this information to the Environment Agency at least 14 days before the date the monitoring is to be undertaken.

4.3.4 The Environment Agency shall be notified within 14 days of the occurrence of the following matters, except where such disclosure is prohibited by Stock Exchange rules:

Where the operator is a registered company:

- (a) any change in the operator's trading name, registered name or registered office address; and
- (b) any steps taken with a view to the operator going into administration, entering into a company voluntary arrangement or being wound up.

Where the operator is a corporate body other than a registered company:

- (a) any change in the operator's name or address; and
- (b) any steps taken with a view to the dissolution of the operator.

In any other case:

- (a) the death of any of the named operators (where the operator consists of more than one named individual);
- (b) any change in the operator's name(s) or address(es); and
- (c) any steps taken with a view to the operator, or any one of them, going into bankruptcy, entering into a composition or arrangement with creditors, or, in the case of them being in a partnership, dissolving the partnership.

4.3.5 Where the operator proposes to make a change in the nature or functioning, or an extension of the activities, which may have consequences for the environment and the change is not otherwise the subject of an application for approval under the Regulations or this permit:

- (a) the Environment Agency shall be notified at least 14 days before making the change; and
- (b) the notification shall contain a description of the proposed change in operation.

4.3.6 The Environment Agency shall be given at least 14 days notice before implementation of any part of the site closure plan.

4.3.7 Where the operator has entered into a climate change agreement with the Government, the Environment Agency shall be notified within one month of:

- (a) a decision by the Secretary of State not to re-certify the agreement;
- (b) a decision by either the operator or the Secretary of State to terminate the agreement; and
- (c) any subsequent decision by the Secretary of State to re-certify such an agreement.

4.4 Interpretation

4.4.1 In this permit the expressions listed in schedule 6 shall have the meaning given in that schedule.

4.4.2 In this permit references to reports and notifications mean written reports and notifications, except where reference is made to notification being made "immediately", in which case it may be provided by telephone.

Schedule 1 – Operations

Table S1.1 activities			
Activity reference	Activity listed in Schedule 1 of the EP Regulations	Description of specified activity	Limits of specified activity
AR1	Section 4.2 Part A(1)(a)(i) Producing inorganic chemicals: hydrogen	Production of hydrogen gas by electrolysis of water in 16 alkaline electrolyzers with a total installed capacity of approximately 13.8 MWe.	Receipt of raw materials to final hydrogen product storage in tube trailers and dispatch off-site.
Directly Associated Activity			
AR2	Water demineralisation plant	<u>Reverse Osmosis (RO)</u> - pumping potable water through a tube array of RO membranes into a collection pipe. <u>Ion exchanger</u> – additional softening of demineralised water from RO unit in cartridge softener for removing any residual hardness cations.	From the production of demineralised water to consumption in the electrolysis process, including generation of RO effluent discharged into River Trent.
AR3	Hydrogen purification and compression	Purification by removing trace oxygen and residual moisture followed by compression.	From collection of hydrogen gas at cathode, purification with deoxo catalytic process, moisture removal to its compression.
AR4	Storage of hydrogen	Compressed hydrogen gas pumped to cylinders on the trailer.	From receiving compressed hydrogen gas to pumping into cylinders without intermediate storage. At any given time, the maximum hydrogen must not be in excess of 4.5 tonnes.
AR5	Electrolyser cooling system	Air-cooled, closed loop cooling system serving the electrolyzers.	-
AR6	Surface water drainage system	Collection of uncontaminated surface run-off	From collection of uncontaminated surface water through its drainage to the River Trent via an attenuation pond and hydro-brake system.

Table S1.2 Operating techniques		
Description	Parts	Date Received
Application	<ul style="list-style-type: none"> BAT Assessment against CWW BAT Conclusions ('COMMISSION IMPLEMENTING DECISION (EU) 2016/902 of 30 May 2016 establishing best available techniques (BAT) 	09/02/2024

Table S1.2 Operating techniques		
Description	Parts	Date Received
	<p>conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for common waste water and waste gas treatment/ management systems in the chemical sector')</p> <ul style="list-style-type: none"> • Site Information – P207-R01-F1 • RFI response email dated 09/02/2024 received from Mr D. Green - Subject: 'High Marnham Project'. 	
Application	<ul style="list-style-type: none"> • Form Part B3 • RFI response email dated 19/02/2024 – legal operator checks 	19/02/2024
Application	<ul style="list-style-type: none"> • Form Part B2 & B6, Part F1 • Location Plan – site and discharge point • Emissions to River Trent- risk assessment report 	Duly made 05/03/2024
Response to Schedule 5 Notice dated 12/04/2024	<ul style="list-style-type: none"> • Schedule 5 Notice response email, received from Mr D. Green - Subject: 'EPR/DP3329SM/A001 Schedule 5 Notice CRM:0881049'. 	26/04/2024
Response to Schedule 5 Notice dated 08/05/2024	<ul style="list-style-type: none"> • Schedule 5 notice response email received from Mr D. Green – Subject: 'EPR/DP3329SM/A001 Schedule 5 Notice CRM:0881055' – <ul style="list-style-type: none"> - updated Environment Risk Assessment - P207-R02-F2- ERA - updated Site Condition Report - updated Site drainage plan 	22/05/2024
Application	<ul style="list-style-type: none"> • Request for further information response email received from Mr D. Green – Subject: 'EPR/DP3329SM/A001 Review of Draft Permit Documents' – updated energy mass balance flowsheet. 	16/08/2024

Table S1.3 Improvement programme requirements		
Reference	Requirement	Date
IC 1	<p><u>Emissions to surface water</u></p> <p>The operator shall submit a written report to the Environment Agency for technical assessment and written approval.</p> <p>The report must contain:</p> <ul style="list-style-type: none"> • Characterisation of the reverse osmosis effluent including any potential hazardous chemicals and elements that are likely to be in the discharge as the result of the concentration effect of the potable water fed to the reverse osmosis plant • The results from 12 months of sampling and monitoring of the reverse osmosis effluent discharge (emission point E1 in the site plan) at a frequency of a minimum of one sample a month • Evidence that the sampling and monitoring has been undertaken in line with the Environment Agency guidance: Surface water pollution risk assessment for your environmental permit - GOV.UK (www.gov.uk) and to standards in line with the Environment Agency guidance: Monitoring discharges to water: guidance on selecting a monitoring approach - GOV.UK (www.gov.uk) • The results of an updated H1 assessment, and raw monitoring data which informs this assessment, which takes into 	By 15 months from the beginning of operations of activity AR1

Table S1.3 Improvement programme requirements		
Reference	Requirement	Date
	<p>consideration relevant environmental standards as specified in Environment Agency guidance Surface water pollution risk assessment for your environmental permit - GOV.UK (www.gov.uk)</p> <ul style="list-style-type: none"> • A comparison of the conclusions of the updated H1 assessment against the conclusions of the H1 assessment submitted in permit bespoke application EPR/DP3329SM. • Where the results of the updated H1 assessment show that significant/adverse impact is likely from the emissions of any of the parameters, the operator shall cease further discharge of the site effluent to surface water and shall provide proposals and timescales on how to manage the effluent to ensure discharges have insignificant impact on receiving waters. • Confirmation supported by either monitoring data or engineering design data or a combination of these, that the annual emissions are below the applicability thresholds set out in Tables 1, 2 and 3 of the 'COMMISSION IMPLEMENTING DECISION (EU) 2016/902 of 30 May 2016 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for common waste water and waste gas treatment/ management systems in the chemical sector' for the following parameters: total organic carbon or chemical oxygen demand, total suspended solids, total nitrogen, total phosphorus, chromium, copper, nickel and zinc. <p>The Operator must implement the proposals in the report in line with the timescales are agreed in writing with the Environment Agency.</p>	
IC 2	<p><u>Fugitive emissions and LDAR (Leak Detection And Repair) programme</u></p> <p>The Operator shall submit a plan to the Environment Agency for assessment and written approval.</p> <p>The plan must contain:</p> <ul style="list-style-type: none"> • A proposal for a risk-based leak detection and repair (LDAR) programme implementing the principles of LDAR to eliminate or reduce fugitive emissions of hydrogen due to its global warming potential. • Details of the monitoring techniques proposed to detect and quantify fugitive emissions of hydrogen, demonstrating how these comply with state-of-the-art emission monitoring for hydrogen, including, when applicable, any guidance issued or recommended by the Environment Agency. <p>The Operator must implement the proposals in the plan in line with the Environment Agency's written approval.</p>	By 6 months from the beginning of operations of activity AR1
IC 3	<p><u>Venting emissions of hydrogen</u></p> <p>The Operator shall submit a written report to the Environment Agency for technical assessment and written approval.</p> <p>The report must contain the proposed methodology to quantify and report any venting emissions of hydrogen associated with the operations of the installation.</p> <p>The Operator must implement the proposals in the report in line with the Environment Agency's written approval.</p>	By 6 months from the beginning of operations of activity AR1

Table S1.4 Pre-operational measures	
Reference	Pre-operational measures
POC1	<p><u>Environmental Management System (EMS) and Accident Management Plan</u></p> <p>Prior to the commencement of commissioning, the Operator shall submit to the Environment Agency a summary report of the site Environment Management System (EMS) for assessment and written approval.</p> <p>The Operator shall make available for inspection all documents and procedures which form part of the EMS, including in particular the site's Accident Management Plan to cover environmental risks from potential accidental events associated with the operations of the installation.</p> <p>The EMS shall be developed in line with the requirements set out in Environment Agency web guide on developing a management system for environmental permits (found on www.gov.uk). The documents and procedures set out in the EMS shall form part of the written management system referenced in condition 1.1.1 (a) of the permit.</p> <p>The EMS shall be implemented in accordance with the Environment Agency's written approval.</p>

Schedule 2 – Waste types, raw materials and fuels

Table S2.1 Raw materials and fuels	
Raw materials and fuel description	Specification
-	-

Schedule 3 – Emissions and monitoring

Emission point ref. & location	Source	Parameter	Limit (including unit)	Reference period	Monitoring frequency	Monitoring standard or method
Hydrogen vents	16 electrolyzers	Hydrogen	No limit set	-	-	-
		Nitrogen	No limit set	-	-	-

Emission point ref. & location	Source	Parameter	Limit (incl. unit)	Reference Period	Monitoring frequency	Monitoring standard or method
E1 on site plan in schedule 7 emission to River Trent	Process effluent (RO elutriate) Note 10	Discharge flow rate	50 m ³ /day	24-hour total	Continuous	MCERTS Flow meter
		pH	6-9	Instantaneous	Continuous	BS ISO 10523
		Chemical oxygen demand (COD)	100 mg/l ^{Note 1}	Annual average	Daily (24-hour flow proportional sample) ^{Note 2}	BS ISO 15705
		Total suspended solids (TSS)	35 mg/l ^{Note 3}	Annual average	Daily (24-hour flow proportional sample) ^{Note 2}	BS EN 872
		Total nitrogen (TN)	25 mg/l ^{Note 4}	Annual average	Daily (24-hour flow proportional sample) ^{Note 2}	BS EN 20236
		Total phosphorus (TP)	3 mg/l ^{Note 5}	Annual average	Daily (24-hour flow proportional sample) ^{Note 2}	BS EN ISO 15681-1
		Chromium (expressed as Cr)	25 µg/l ^{Note 6}	Annual average	Monthly ^{Note 2}	BS EN ISO 15586
		Copper (expressed as Cu)	50 µg/l ^{Note 7}	Annual average	Monthly ^{Note 2}	BS EN ISO 15586

Table S3.2 Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Emission point ref. & location	Source	Parameter	Limit (incl. unit)	Reference Period	Monitoring frequency	Monitoring standard or method
		Nickel (expressed as Ni)	50 µg/l ^{Note 8}	Annual average	Monthly ^{Note 2}	BS EN ISO 15586
		Zinc (expressed as Zn)	300 µg/l ^{Note 9}	Annual average	Monthly ^{Note 2}	BS EN ISO 15586
		Cadmium (expressed as Cd)	No limit set	-	Monthly ^{Note 2}	BS EN ISO 5961
		Lead (expressed as Pb)	No limit set	-	Monthly ^{Note 2}	BS EN ISO 15586
E1a on site plan in schedule 7 emission to River Trent	Combined effluent including uncontaminated surface runoff via attenuation pond	No parameters set	No limit set	-	-	-

- Notes:
1. Emission limit value for COD and associated monitoring requirements do not apply if emissions of COD are confirmed to be below the emission threshold of 10 tonnes/year in response to improvement condition IC1.
 2. The monitoring frequencies may be reduced with written agreement from the Environment Agency if the data series clearly demonstrate a sufficient stability.
 3. Emission limit value for TSS and associated monitoring requirements do not apply if emissions of TSS are confirmed to be below the emission threshold of 3.5 tonnes/year in response to improvement condition IC1.
 4. Emission limit value for TN and associated monitoring requirements do not apply if emissions of TN are confirmed to be below the emission threshold of 2.5 tonnes/year in response to improvement condition IC1.
 5. Emission limit value for TP and associated monitoring requirements do not apply if emissions of TP are confirmed to be below the emission threshold of 300 kg/year in response to improvement condition IC1.
 6. Emission limit value for Cr and associated monitoring requirements do not apply if emissions of Cr are confirmed to be below the emission threshold of 2.5 kg/year in response to improvement condition IC1.
 7. Emission limit value for Cu and associated monitoring requirements do not apply if emissions of Cu are confirmed to be below the emission threshold of 5 kg/year in response to improvement condition IC1.
 8. Emission limit value for Ni and associated monitoring requirements do not apply if emissions of Ni are confirmed to be below the emission threshold of 5 kg/year in response to improvement condition IC1.
 9. Emission limit value for Zn and associated monitoring requirements do not apply if emissions of Zn are confirmed to be below the emission threshold of 30 kg/year in response to improvement condition IC1.
 10. All emission limits and monitoring requirements are subject to review of response to improvement condition IC1.

Table S3.3 Process monitoring requirements				
Emission point reference or source or description of point of measurement	Parameter	Monitoring frequency	Monitoring standard or method	Other specifications
Electrolysis process	Energy efficiency (kWh/kgH ₂)	Continuous	-	To be reported on annual basis
Electrolysis process (including water demineralisation)	Water efficiency (Kg water /kg H ₂)	Continuous	-	To be reported on annual basis
Electrolysis process (including hydrogen purification and storage)	Emissions of hydrogen from venting (kg H ₂)	Event based	As agreed in writing by the Environment Agency in response to improvement condition IC3	To be reported on annual basis
Electrolysis process (including hydrogen purification and storage)	Fugitive emissions of hydrogen (kg H ₂)	Annual	As agreed in writing by the Environment Agency in response to improvement condition IC2	To be reported on annual basis

Schedule 4 – Reporting

Parameters, for which reports shall be made, in accordance with conditions of this permit, are listed below.

Table S4.1 Reporting of monitoring data			
Parameter	Emission or monitoring point/reference	Reporting period	Period begins
Emissions to water Parameters as required by condition 3.5.1	E1	Every 6 months	1 January, 1 July

Table S4.2: Annual production	
Parameter	Units
Hydrogen gas	Tonnes

Table S4.3 Performance parameters		
Parameter	Frequency of assessment	Units
Water usage	Annually	tonnes
Energy usage	Annually	MWe
Electrolysis energy efficiency	Annually	kWh/kg H ₂
Water efficiency	Annually	kg water /kgH ₂
Emissions of hydrogen from venting	Annually	kg H ₂
Fugitive emissions of hydrogen	Annually	kg H ₂

Table S4.4 Reporting forms		
Media/parameter	Reporting format	Date of form
Emissions to water	Form emissions to water 1 or other form as agreed in writing by the Environment Agency	08/03/2021
Water usage	Form water usage 1 or other form as agreed in writing by the Environment Agency	08/03/2021
Energy usage	Form energy 1 or other form as agreed in writing by the Environment Agency	08/03/2021
Other performance indicators	Form performance 1 or other form as agreed in writing by the Environment Agency	08/03/2021

Schedule 5 – Notification

These pages outline the information that the operator must provide.

Units of measurement used in information supplied under Part A and B requirements shall be appropriate to the circumstances of the emission. Where appropriate, a comparison should be made of actual emissions and authorised emission limits.

If any information is considered commercially confidential, it should be separated from non-confidential information, supplied on a separate sheet and accompanied by an application for commercial confidentiality under the provisions of the EP Regulations.

Part A

Permit Number	
Name of operator	
Location of Facility	
Time and date of the detection	

(a) Notification requirements for any malfunction, breakdown or failure of equipment or techniques, accident, or emission of a substance not controlled by an emission limit which has caused, is causing or may cause significant pollution	
To be notified within 24 hours of detection	
Date and time of the event	
Reference or description of the location of the event	
Description of where any release into the environment took place	
Substances(s) potentially released	
Best estimate of the quantity or rate of release of substances	
Measures taken, or intended to be taken, to stop any emission	
Description of the failure or accident.	

(b) Notification requirements for the breach of a limit	
To be notified within 24 hours of detection unless otherwise specified below	
Emission point reference/ source	
Parameter(s)	
Limit	
Measured value and uncertainty	
Date and time of monitoring	

(b) Notification requirements for the breach of a limit	
To be notified within 24 hours of detection unless otherwise specified below	
Measures taken, or intended to be taken, to stop the emission	

Time periods for notification following detection of a breach of a limit	
Parameter	Notification period

(c) Notification requirements for the breach of permit conditions not related to limits	
To be notified within 24 hours of detection	
Condition breached	
Date, time and duration of breach	
Details of the permit breach i.e. what happened including impacts observed.	
Measures taken, or intended to be taken, to restore permit compliance.	

(d) Notification requirements for the detection of any significant adverse environmental effect	
To be notified within 24 hours of detection	
Description of where the effect on the environment was detected	
Substances(s) detected	
Concentrations of substances detected	
Date of monitoring/sampling	

Part B – to be submitted as soon as practicable

Any more accurate information on the matters for notification under Part A.	
Measures taken, or intended to be taken, to prevent a recurrence of the incident	

Measures taken, or intended to be taken, to rectify, limit or prevent any pollution of the environment which has been or may be caused by the emission	
The dates of any unauthorised emissions from the facility in the preceding 24 months.	

Name*	
Post	
Signature	
Date	

* authorised to sign on behalf of the operator

Schedule 6 – Interpretation

“accident” means an accident that may result in pollution.

“application” means the application for this permit, together with any additional information supplied by the operator as part of the application and any response to a notice served under Schedule 5 to the EP Regulations.

“authorised officer” means any person authorised by the Environment Agency under section 108(1) of The Environment Act 1995 to exercise, in accordance with the terms of any such authorisation, any power specified in section 108(4) of that Act.

“background concentration” means such concentration of that substance as is present in:

- for emissions to surface water, the surface water quality up-gradient of the site; or
- for emissions to sewer, the surface water quality up-gradient of the sewage treatment works discharge.

“emissions to land” includes emissions to groundwater.

“EP Regulations” means The Environmental Permitting (England and Wales) Regulations SI 2016 No.1154 and words and expressions used in this permit which are also used in the Regulations have the same meanings as in those Regulations.

“emissions of substances not controlled by emission limits” means emissions of substances to air, water or land from the activities, either from the emission points specified in schedule 3 or from other localised or diffuse sources, which are not controlled by an emission or background concentration limit.

“groundwater” means all water, which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

“Hazardous property” has the meaning in Annex III of the Waste Framework Directive as read in accordance with Schedule 1A to the Environmental Permitting (England and Wales) Regulations 2016.

“Hazardous waste” has the meaning given in the Hazardous Waste (England and Wales) Regulations 2005.

“Industrial Emissions Directive” means DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2010 on industrial emissions as read in accordance with Schedule 1A to the Environmental Permitting (England and Wales) Regulations 2016.

“List of Wastes” means the list of wastes established by Commission Decision 2000/532/EC replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste as read in accordance with Schedule 1A to the Environmental Permitting (England and Wales) Regulations 2016

“MCERTS” means the Environment Agency’s Monitoring Certification Scheme.

Pests” means Birds, Vermin and Insects.

“quarter” means a calendar year quarter commencing on 1 January, 1 April, 1 July or 1 October.

“recovery” means any of the operations provided for in Annex II to Directive 2008/98/EC of the European Parliament and of the Council on waste as read in accordance with Schedule 1A to the Environmental Permitting (England and Wales) Regulations 2016.

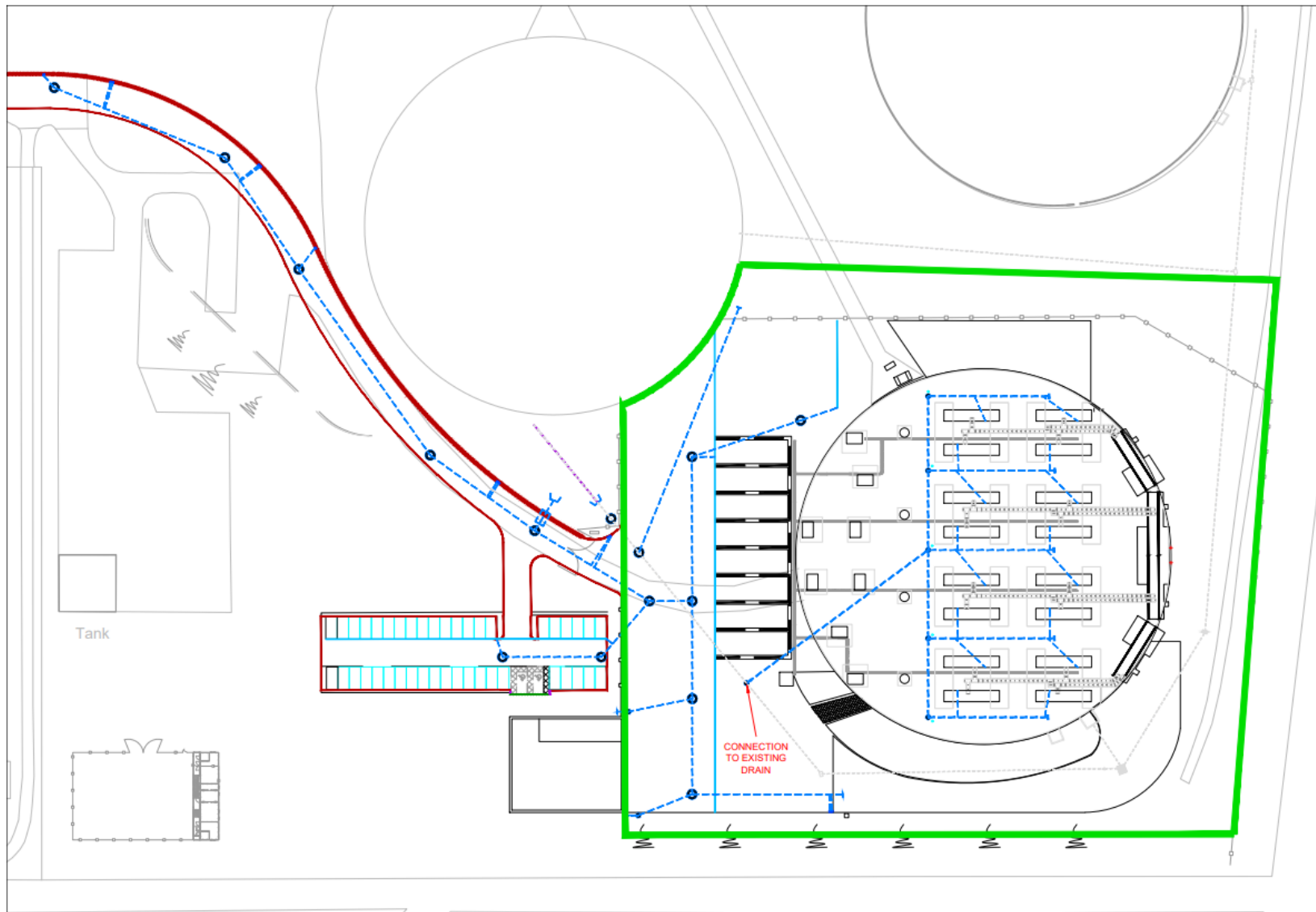
“Waste code” means the six digit code referable to a type of waste in accordance with the List of Wastes and in relation to hazardous waste, includes the asterisk.

“Waste Framework Directive” or “WFD” means Waste Framework Directive 2008/98/EC of the European Parliament and of the Council on waste as read in accordance with Schedule 1A to the Environmental Permitting (England and Wales) Regulations 2016

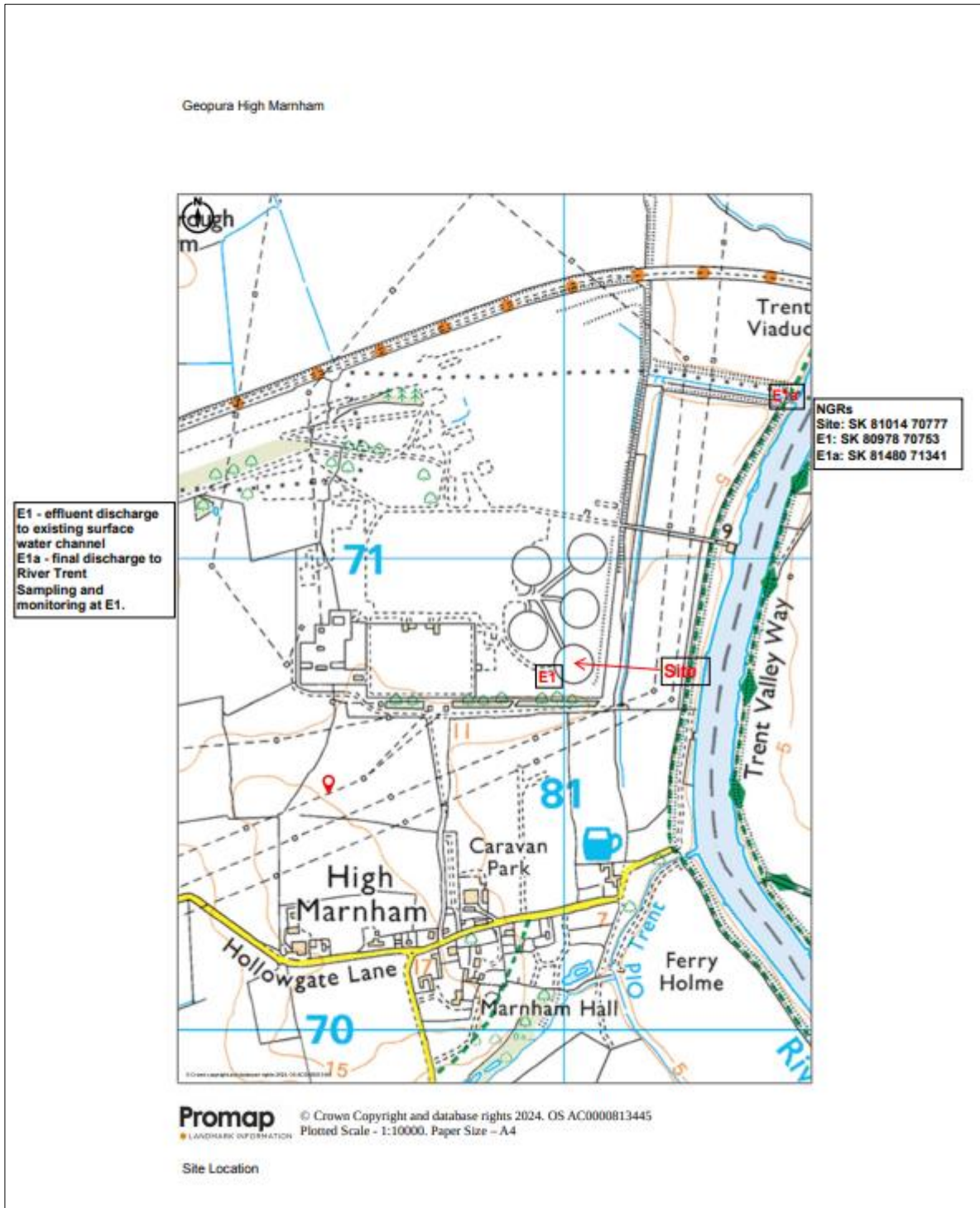
“year” means calendar year ending 31 December.

Where a minimum limit is set for any emission parameter, for example pH, reference to exceeding the limit shall mean that the parameter shall not be less than that limit.

Schedule 7 – Site plan



Emission to water



END OF PERMIT

Emissions to Water Reporting Form

Permit number: EPR/DP3329SM

Operator: Geopura Ltd

Facility name: High Marnham Hydrogen

Emissions to Water Reporting Form: version 1, 08/03/2021

Reporting of emissions to water (other than to sewer) for the period from *[DD/MM/YY]* to *[DD/MM/YY]*

Emission point	Substance / parameter	Emission Limit Value	Reference period	Test method ¹	Result ²	Sample dates and times ³	Uncertainty ⁴
<i>[e.g. W1]</i>	<i>[e.g. Total suspended solids]</i>	<i>[e.g. 30 mg/l]</i>	<i>[e.g. For 95% of all measured values of periodic samples taken over one month]</i>	<i>[e.g. BS EN 872:2005]</i>	<i>[State result]</i>	<i>[State relevant dates and time periods]</i>	<i>[State uncertainty if not 95% confidence interval]</i>

Signed: *[Name]*

Date: *[DD/MM/YY]*

(Authorised to sign as representative of the operator)

Guidance for use: Use this form to report your monitoring results.

Example text is shown in bracketed grey italics. Replace the example text by entering your own site specific information. Complete columns 1 to 5 using the information from schedule 3 of your permit. Complete columns 6 to 8 with your monitoring data. Add additional rows as necessary.

- ¹ Where an internationally recognised standard test method is used, give the reference number. Where another method that has been formally agreed with the Environment Agency, give the appropriate identifier. In other cases state the principal technique, for example gas chromatography.
- ² Give the result as the maximum value (or the minimum value in the case of a limit that is expressed as a minimum) obtained during the reporting period, expressed in the same terms as the emission limit value. Where the emission limit value is expressed as a range, give the result as the 'minimum to maximum' of the measured values.
- ³ For non-continuous measurements give the date and time of the sample that produced the result. For continuous measurements give the percentage of the process operating time covered by the result.
- ⁴ Complete if the uncertainty associated with the result is not a 95% confidence interval. Leave blank for 95% confidence intervals.

Water Usage Reporting Form

Permit number: EPR/DP3329SM

Operator: Geopura Ltd

Facility name: High Marnham Hydrogen

Water Usage Reporting Form: version 1, 08/03/2021

Reporting of water usage for the year [YYYY]

Water source	Water usage (m³)	Specific water usage (m³/unit) ²
Mains water	<i>[insert annual usage in m³ where mains water is used]</i>	<i>[insert annual usage in m³/unit where mains water is used]</i>
Site borehole	<i>[insert annual usage in m³ where water is used from a site borehole]</i>	<i>[insert annual usage in m³/unit where water is used from a site borehole]</i>
River abstraction	<i>[insert annual usage in m³ where abstracted river water is used]</i>	<i>[insert annual usage in m³/unit where abstracted river water is used]</i>
Other – <i>[specify other water source where applicable. Add extra rows where needed]</i>	<i>[insert annual usage in m³ where applicable]</i>	<i>[insert annual usage in m³/unit where applicable]</i>
Total water usage	<i>[insert total annual water usage in m³]</i>	<i>[insert total annual water usage in m³/unit]</i>

Operator's comments

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Signed: *[Name]*

Date: *[DD/MM/YY]*

(Authorised to sign as representative of the operator)

Guidance for use: Use this form to report your annual water usage.

Example text is shown in bracketed grey italics. Replace the example text by entering your own site specific information. Add additional rows as necessary.

Energy Usage Reporting Form

Permit number: EPR/DP3329SM

Operator: Geopura Ltd

Facility name: High Marnham Hydrogen

Energy Usage Reporting Form: version 1, 08/03/2021

Reporting of energy usage for the year [YYYY]

Energy source	Energy consumption / production (MWh)	Specific energy consumption (MWh/unit) ²
Electricity imported as delivered - source [specify source, e.g. supplied from the national grid]	<i>[insert annual consumption in MWh where electricity is imported]</i>	<i>[insert annual consumption in MWh/unit where electricity is imported]</i>
Electricity imported as primary energy 1 – conversion factor of [specify conversion factor used to convert electricity delivered to primary energy]	<i>[insert annual consumption in MWh where electricity is imported]</i>	<i>[insert annual consumption in MWh/unit where electricity is imported]</i>
Natural gas	<i>[insert annual consumption in MWh where natural gas is used]</i>	<i>[insert annual consumption in MWh/unit where natural gas is used]</i>
Gas oil – conversion factor of [specify conversion factor used to convert tonnes to MWh]	<i>[insert annual consumption in MWh where gas oil is used]</i>	<i>[insert annual consumption in MWh/unit where gas oil is used]</i>
Imported heat	<i>[insert annual consumption in MWh where heat is imported]</i>	<i>[insert annual consumption in MWh/unit where heat is imported]</i>
Other – <i>[specify other energy source and conversion factors where applicable, e.g. renewable fuel. Add extra rows where needed]</i>	<i>[insert annual consumption in MWh where applicable]</i>	<i>[insert annual consumption in MWh/unit where applicable]</i>
Electricity exported	<i>[insert annual production in MWh where electricity is exported]</i>	Not applicable
Heat exported	<i>[insert annual production in MWh where heat is exported]</i>	Not applicable

Other Performance Parameters Reporting Form

Permit number: EPR/DP3329SM

Operator: Geopura Ltd

Facility name: High Marnham Hydrogen

Other Performance Parameters Reporting Form: version 1, 08/03/2021

Reporting of other performance parameters for the period from *[DD/MM/YY]* to *[DD/MM/YY]*

Parameter	Units
<i>[e.g. Total raw material usage]</i>	<i>[e.g. tonnes per production unit]</i>

Operator's comments

Signed: *[Name]*

Date: *[DD/MM/YY]*

(Authorised to sign as representative of the operator)

Guidance for use: Use this form to report the performance parameters (other than water and energy) required by your permit. Example text is shown in bracketed grey italics. Replace the example text by entering your own site specific information. The parameters to report and units to be used can be found in the 'Performance parameters' table in schedule 4 of your permit. Add additional rows as necessary.