

The logo for PROTIUM, featuring the word in a white, sans-serif font with a blue dot above the letter 'O'.

PRŌTIUM

Environmental Management Plan

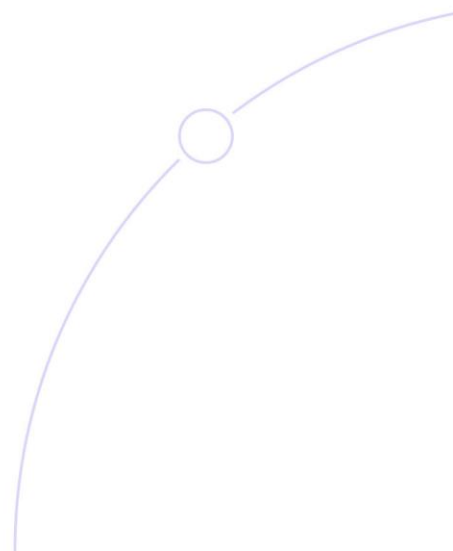
MINIMISING THE ENVIRONMENTAL IMPACT OF THE HPF





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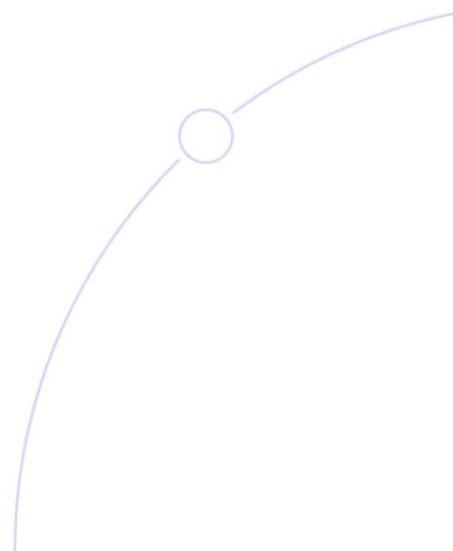
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Revision History

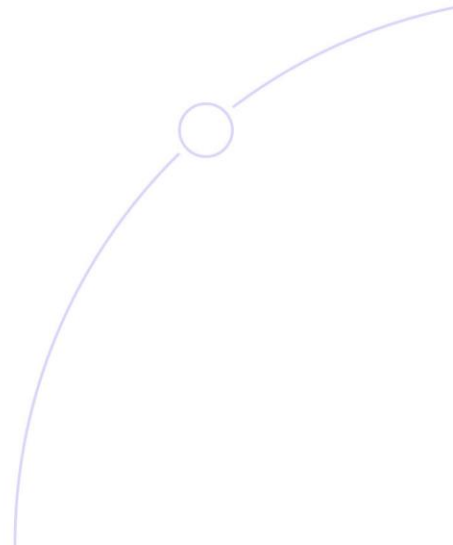
Date	Revision	Reason for Issue	Prepared by	Checked by	Approved by	QA by
07/07/22	A	Draft	Ed Brewer	Darren Thomas	Stephen Peng	Darren Thomas
			EB	DT	SP	DT





Abbreviations

ATEX	Explosive Atmosphere
EMP	Environmental Management Plan
FCSL	Fuel Cell Systems Limited
HGV	Heavy Goods Vehicle
HP	High Pressure
HPF	Hydrogen Production Facility
LFL	Lower Flammability Limit
LP	Low Pressure
MCP	Manifold Cylinder Pallet
NRW	Natural Resources Wales
SPL	Sound Pressure Levels



INTRODUCTION

Premise

The Protium 1 Hydrogen Production Facility (HPF), situated at the Baglan Energy Park in Port Talbort, will be Protium's first HPF. The Baglan Energy Park is home to the University of South Wales' Hydrogen Research and Demonstration Centre, and as such they are accustomed to the risks and legislation associated with hydrogen.

Purpose

The purpose of this Environmental Management Plan (EMP) is to:

- Identify specific environmental issues associated with the Protium 1 HPF.
- Address the issues and outline how they will be resolved or mitigated.
- Ensure compliance with legislation.
- Deliver best practical environmental performance.

Scope

This EMP applies to any individual operating the HPF, including:

- Production of hydrogen from the electrolyser unit.
- Storage of hydrogen in the Low Pressure (LP) buffer tank.
- Compression of hydrogen into the High Pressure (HP) storage tanks.
- Transport of hydrogen off site.

SITE PLAN

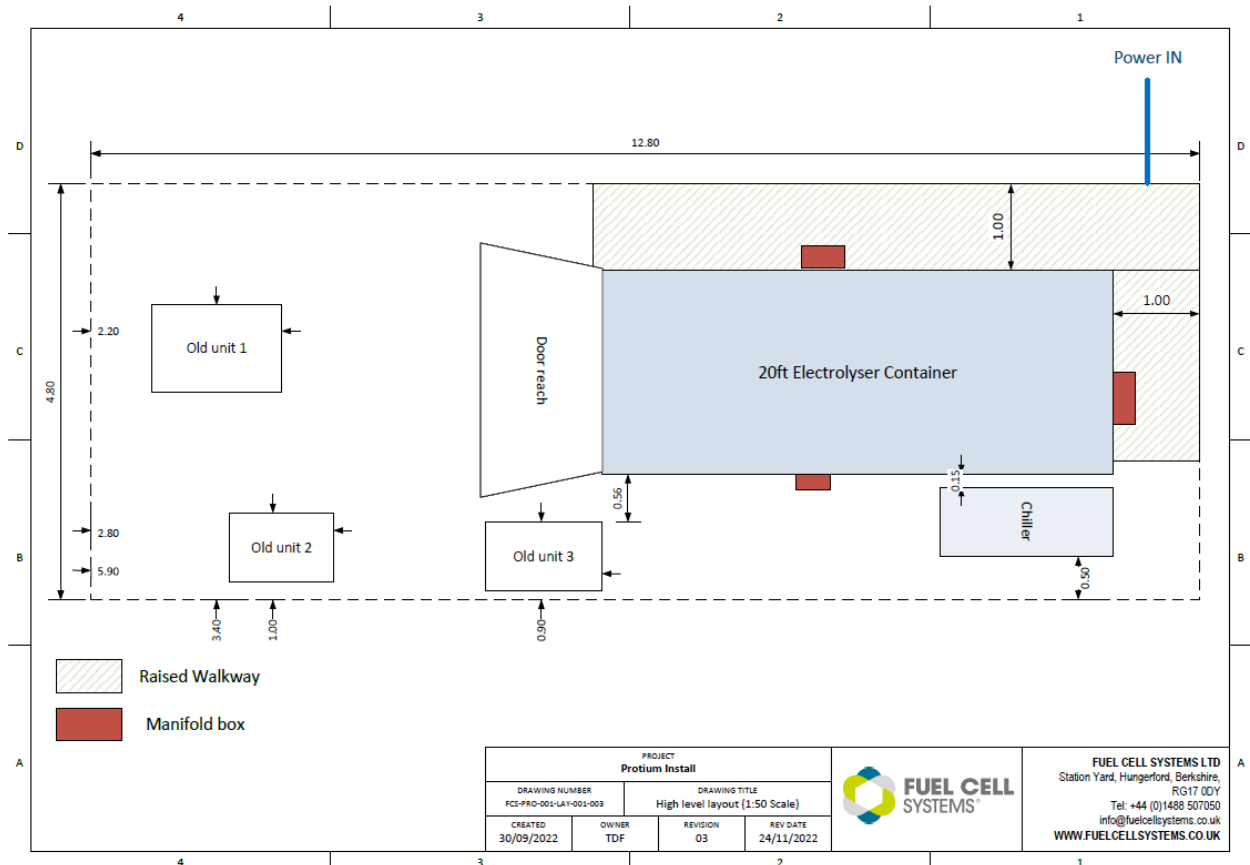


Figure 1 - Electrolyser Container Enclosure

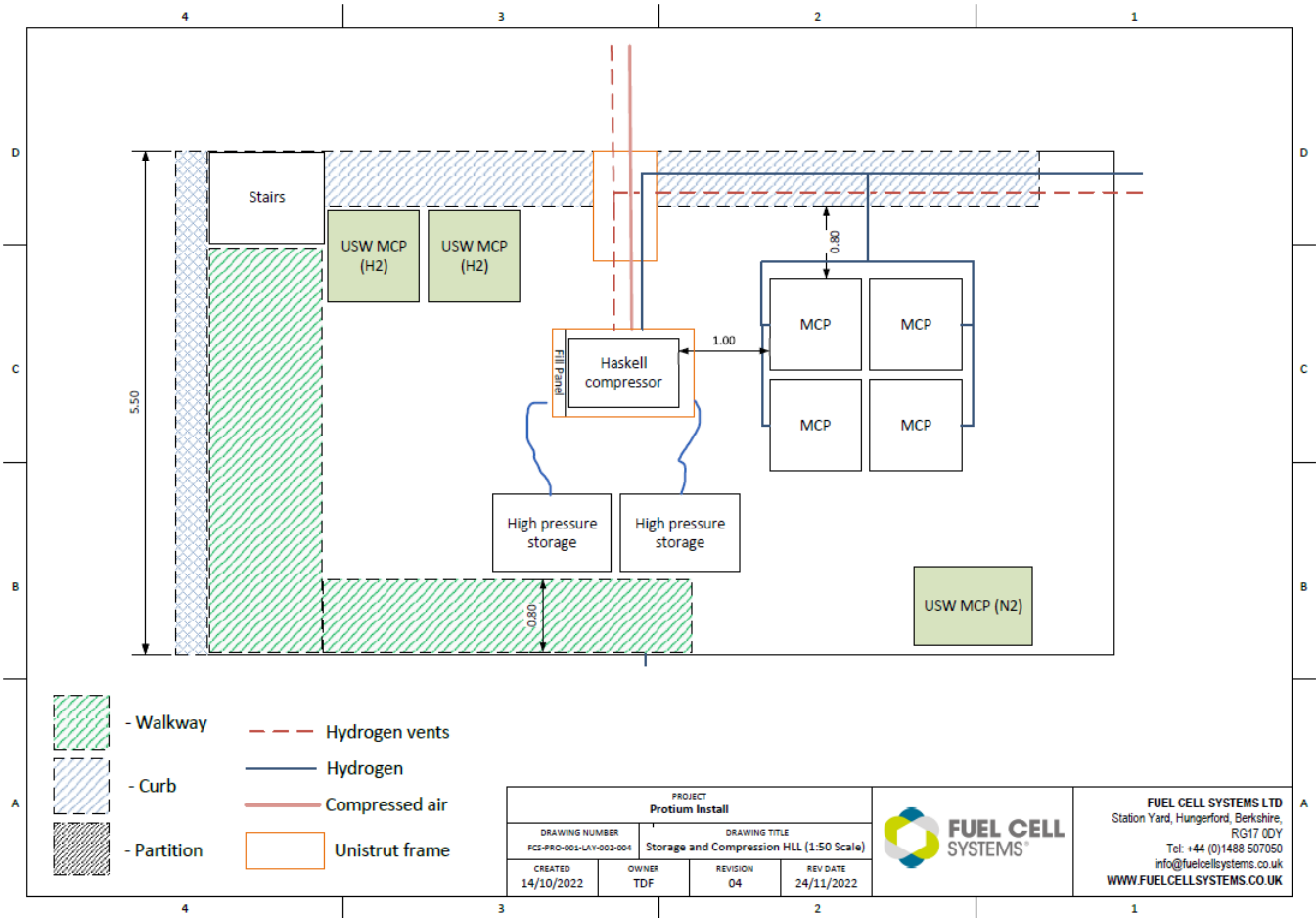


Figure 2 – Storage and Compression Enclosure

WASTE MANAGEMENT

The HPF will produce several waste products, the following outlines the possible consequences of each waste product and what Protium will do to mitigate them.

Item	Risk of	Control Measure
Water	<p>The generated effluent is effectively towns water with a slightly increased concentration of hardness salts (calcium and magnesium carbonates). Based on a rejection rate of 5 litres per litre of electrolyser input, this would mean an increase in hardness salt concentration of around 20% in the effluent.</p>	<p>Referring to the Drinking Water Inspectorate map ⁽⁸⁾, this would be well within the prevailing hardness range for potable water and would at most mean a “moderately soft” rather than “soft” classification. This would have a negligible effect on the water body ultimately handling any such effluent. Any other filtrate or residual chlorine will be retained (and degraded to chloride salts) by the filter and treatment media ⁽⁷⁾. As such the wastewater can simply be poured down the drain and allowed to re-enter the water system.</p>
Oxygen	<p>Vented oxygen could build up and form a bubble. High concentrations of oxygen can cause some items to self-combust. Mixed hydrogen and oxygen can also lead to an Explosive atmosphere (ATEX zone) forming.</p>	<p>Electrolytic oxygen will be vented to atmosphere outside the shipping container via a short flue so as not to cause build-up within the container. This will be rapidly diluted to ambient levels in the atmosphere and is not considered to have any material effect, environmental or otherwise ⁽⁷⁾. The hydrogen and oxygen vents will be separated to avoid mixing during a hydrogen discharge, meaning the atmosphere will be kept below the Lower Flammability Limit (LFL) of 4% ⁽⁴⁾</p>
Potassium Hydroxide	<p>1% potassium hydroxide solution is used as an electrolyte. At this concentration the solution is very low risk but can cause skin irritation and serious eye irritation. It also poses a risk to aquatic life if disposed of incorrectly.</p>	<p>The potassium hydroxide solution will be replaced on a biannual basis and the full inventory (<1 m³) removed by a specialist contractor ⁽⁷⁾. When handling the potassium hydroxide, gloves and goggles must be worn and spill kits will be available if required.</p>

<p>Hydrogen</p>	<p>There are a few different ways in which hydrogen could be released into the atmosphere, all of which are very small quantities. However, there is a risk that the concentration of hydrogen grows above the LFL of 4% ⁽⁴⁾.</p> <p>At high concentrations in air hydrogen can be toxic if inhaled.</p>	<p>All joints and fittings must be confirmed as leak-tight using a suitable hydrogen gas leak detector and leak detection spray. This operation must be repeated every 3 months as part of the service protocol.</p> <p>In the event of a leak, 3 ATEX rated fans provide high dilution to prevent high concentrations of hydrogen, and 3 hydrogen sensors set to 1000ppm shut off the electrolyzers when triggered ⁽³⁾.</p> <p>There will be approximately 2% ⁽²⁾ hydrogen in the oxygen outlet, which is below the LFL of 4.65% ⁽⁵⁾, furthermore the oxygen is vented at a high level, to ensure there is no build up and the gas is quickly diluted.</p> <p>During the electrolyser's operation, there are several scenarios in which the system must purge a small amount of hydrogen. The container has 2 vent lines which purge the hydrogen to a high level.</p>
<p>Nitrogen</p>	<p>Nitrogen is used to purge the electrolyzers of hydrogen. In above atmospheric concentrations, nitrogen can cause asphyxiation, leading to a possible loss of mobility/consciousness.</p>	<p>Due to the high concentration of nitrogen in the atmosphere there are no environmental issues associated with venting nitrogen. The health hazard however will be addressed by venting the nitrogen at a high level where it can quickly dissipate.</p>
<p>Glycol</p>	<p>There is 25% glycol in the cooling system, that can be harmful if ingested and polluting in the case of a spill.</p>	<p>The glycol will be replaced and maintained by a specialist contractor ⁽³⁾ and spill kits will be provided on the site.</p>
<p>Consumables</p>	<p>Periodically, carbon polishing filters, ion exchange resin cartridges, and RO membranes will require removal and transportation back to their suppliers for regeneration or occasionally disposal.</p>	<p>The quantity of consumables will be in the order of tens of kilograms per year ⁽⁷⁾, and all waste will be disposed in a sustainable manner and according to local legislation using a waste disposal specialist if required.</p>

INSTALLATION

Protium considers that the proposed installation meets Natural Resources Wales' (NRW) criteria for a Low Impact installation (as set out in Guidance for environmental permit applications: Part B1 – Standard facilities permit⁽¹⁾) and that a Standard Rules permit according to SR2009 No.02 would be appropriate for the site. ⁽⁹⁾



Protium has reviewed ⁽⁷⁾ the Standard Rules and the Risk Assessment SR2009 No.02 v4 and is satisfied that both are applicable to the proposed installation. ⁽⁹⁾

STORAGE OF CHEMICALS

A small amount (<100l) of dilute potassium hydroxide solution (1%) will be stored in the shipping container ⁽⁷⁾. The potassium hydroxide will be stored on top of a container bund to insure against leaks.

NOISE

If the HPF is adequately loud it could affect residents in the local area, either by interrupting their sleep or as a general irritant.

Calculations of noise level at the nearest receptor were undertaken based on sound pressure levels of the equipment as follows:

Compressor – 85 dB at 1 m distance (93 dB effective sound power level)

Electrolyser – 60 dB at 1 m distance (68 dB effective sound power level)

All noise sources were assumed as point sources and ground effects were not considered. It was assumed that the compressor would be enclosed to the sides behind a barrier (of height 2 m, with a mass per unit area >12 kgm⁻² and without gaps either between elements or between the barrier and the ground)

Calculations show that the predicted noise level at the nearest receptor due to the compressor and electrolyser is 24.2 dB. Background noise levels within a typical urban area affected by commercial and transport noise sources are generally above 30 dB. Where predicted levels are below background levels it is unlikely that any acoustic characteristics (such as tonality) would be perceptible at the receptor. This would indicate a low impact ⁽⁷⁾.

The final noise level occurring in the work area will depend on the final installation but may be above 85 dB and therefore sufficiently loud to cause hearing damage ⁽³⁾. During commissioning a noise survey of the plant will be undertaken and areas where Sound Pressure Levels (SPL) exceed 85 dB a sign will be erected to ensure that no-one enters the zone without hearing protection.

Noise surveys will be done in all areas where there is potential for the noise level to exceed safe limits.

VEHICLES

Due to the HPF, there will be an increase in traffic on the site from both operational staff, and Heavy Goods Vehicles (HGV) transporting hydrogen Manifold Cylinder Pallets (MCP) on and off the site. This will come with an additional environmental impact. To minimise this, HGV's should not be left idle during unloading and loading of goods.

Due to the increase in traffic, there will be a larger risk of vehicle accidents. This could mean vehicle damage, injury to personnel, and potential downtime for the electrolyser. Therefore, all vehicles' movements will be planned out carefully and simultaneous operations will be avoided.

TRAINING

Ensure all staff are properly trained prior to commencing operation. Fuel Cell Systems Limited (FCSL) offer training during the commissioning process, together with their user manual ^(3Error! Reference source not found.). The user manual for the compressor will also be supplied.

SERVICING

Protium will service the HPF in line with the Operational Procedures document ⁽⁶⁾ to minimise the degradation of the equipment and ensure the best possible environmental performance. This will reduce the risk of pollution, minimise adverse environmental impacts and secure the benefits associated with higher standards of environmental performance.



EMERGENCY AND INCIDENT PREPAREDNESS

Environmental response plan:

- After being alerted to an environmental incident the operative should not enter the container until the problem has been identified.
- Once the problem has been identified the operative should follow the appropriate procedures outlined in the Operational Procedures document ⁽⁶⁾.
- There are spill kits, first aid equipment, and an eyewash station, on hand to aid in the resolution of any potential incidents.
- If the incident is beyond the scope of the operative, they should alert Protium Head Office to the problem and the appropriate actions will be taken.

MONITORING, AUDITING AND REPORTING

Protium will review this EMP every 6 months and do a full audit annually.

Regular system checks will be carried out by Protium Personnel. The Procedures for carrying out a system check are outlined in the Operational Procedures document ⁽⁶⁾.

The Enapter app and other electronic systems will be reviewed periodically to confirm normal working order.



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The image features a background of wind turbines silhouetted against a vibrant sunset sky with orange, pink, and purple clouds. A large, thin white arc curves across the sky, with a small white circle at its peak. The word "PROTIUM" is written in white, uppercase letters in the upper left corner, with a small blue circle above the letter 'O'.

PROTIUM

For further information, please contact:

Chris Jackson,
Chief Executive

Protium Green Solutions Limited
+44(0)7884 496 451
chris@protium.co.uk