

Natural Resources Wales Permitting Decisions

RWE Generation UK plc (Pembroke Power Station)

Decision Document

Application for a Substantial Variation to add an Electrolytic Hydrogen Production Facility to the Power Station installation.

Application for a Substantial Variation to an installation

The application number is: PAN-027129

The permit variation number is: EPR/DP3333TA/V006

The applicant / operator is: RWE Generation UK plc

The Installation is located at: Pembroke Power Station, West Pennar, Pembroke, Pembrokeshire SA71 5SS

Purpose of this document

This decision document:

- explains how the application has been determined
- provides a record of the decision-making process
- shows how all relevant factors have been taken into account
- justifies the specific conditions in the permit other than those in our generic permit template.

Unless the decision document specifies otherwise, we have accepted the applicant's proposals.

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Glossary of acronyms used in this document

(Please note that this glossary is standard for our decision documents and therefore not all these acronyms are necessarily used in this document.)

AQIA	Air Quality Impact Assessment
BAT	Best Available Technique(s)
BRef	Best Available Techniques Reference document
CCGT	Combined Cycle Gas Turbine
CO	Carbon monoxide
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalents
CROW	Countryside and Rights of Way Act 2000
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
EED	Energy Efficiency Directive (2012/27/EU)
ELV	Emission limit value
EN	European Standard
EPR	Environmental Permitting (England and Wales) Regulations 2016
EQS	Environmental quality standard
GWP	Global Warming Potential
HRA	Habitats Regulations Assessment
HRSG	Heat Recovery Steam Generators
IED	Industrial Emissions Directive (2010/75/EU)
LCP	Large Combustion Plant
MCERTs	Monitoring Certification Scheme
MCP	Medium Combustion Plant

MCPD	Medium Combustion Plant Directive
MW _{th}	Net rated thermal input (in megawatts)
NIA	Noise Impact Assessment
NO	Nitrogen monoxide
NO _x	Oxides of nitrogen (NO plus NO ₂ expressed as NO ₂)
OPRA	Operator Performance Risk Appraisal
PC	Process Contribution
PEC	Predicted Environmental Concentration
PHW	Public Health Wales
RGN	Regulatory guidance note
SAC	Special Area of Conservation
SMNR	Sustainable Management of Natural Resources
SPA(s)	Special Protection Area(s)
SSSI(s)	Site(s) of Special Scientific Interest
TGN	Technical guidance note
WFD	Waste Framework Directive

1. Executive summary

1.1. Application summary

RWE Generation UK plc (referred to as “the operator”) has applied to vary its existing Environmental Permit (EPR/DP3333TA) to include a new electrolytic hydrogen (H₂) production facility with an operating capacity of 110-120MWe, capable of producing up to 2 tonnes per hour of purified hydrogen gas using either Alkaline Electrolysis (AEL) or Proton Exchange Membrane (PEM) technology. This activity corresponds to a Section 4.2 Part A(1)(a)(i) activity under the Environmental Permitting (England and Wales) Regulations 2016 – producing inorganic chemicals such as hydrogen.

This variation brings the hydrogen production facility (HPF) into the operator’s installation permit, within an expanded installation boundary incorporating new operator-owned land to accommodate the facility. The operator is the sole permit holder and retains management control of the enlarged installation.

A 1.5km pipeline supplies a neighbouring industrial installation (Pembroke Refinery) with hydrogen produced at the HPF. Pembroke Refinery does not rely on the hydrogen pipeline connection, and this installation is functionally independent and physically separate from the operator’s permitted activities at Pembroke Power Station. The hydrogen pipeline does not form part of either installation, as it does not meet published regulatory criteria¹ for a Directly Associated Activity (DAA).

1.2. Our decision

We have decided to issue the permit variation for Pembroke Power Station operated by RWE Generation UK plc.

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

¹ [RGN 2: Understanding the meaning of regulated facility - GOV.UK](#) [RGN2 Appendix 2 – Defining the installation]

2. Receipt of the application

The application was received on 07/10/2024. In order for us to be able to consider the application duly made, we needed more information. We requested the following:

- Details of the HPF's emergency generator (Medium Combustion Plant)
- The correct application fee, calculated using NRW's charging tool
- Clarification of the expanded installation site boundary
- Verification of the installation's status under the Control of Major Accident Hazard (COMAH) Regulations 2015
- Confirmation of a certified Environmental Management System (EMS)
- Clarification of the HPF's maximum production capacity, intended mode of operation (continuous or intermittent) and electrolyser cooling technology type
- Clarification of the HPF's directly associated activities (DAAs)
- Clarification of HPF process water, surface water, and air emissions
- Verification of HPF raw materials use (throughput) and storage capacities
- Verification of Environmental Risk Assessment (ERA) information for designated habitats, surface water receptors, groundwater receptors, and the hydrogen flare pilot flame fuel source
- Air quality risk assessment (emissions screening) results for the HPF hydrogen flare and the emergency generator
- Verification of sound monitoring equipment calibration and a statement of competency for the applicant's Noise Impact Assessment (NIA)

Emails requesting this information were sent to the applicant on 08/05/2025, 27/05/2025 and 11/07/2025. Upon receipt of the final part of this information, on 25/07/2025, we were able to consider the application duly made. This means we considered it was in the correct form and contained sufficient information for us to begin our determination, but not that it necessarily contained all the information we would need to complete that determination.

3. Confidential information

The applicant made a claim for no claim for commercial confidentiality, and we have not received information in relation to the application that appears to be confidential in relation to any party.

4. Legislation

The variation will be issued, under Regulation 20 of the Environmental Permitting (England and Wales) Regulations 2016 (the EPR). The Environmental Permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* as described by the Industrial Emissions Directive 2010/75/EU (the IED);
- subject to aspects of the Well-Being of Future Generations (Wales) Act 2015 and the Environment (Wales) Act 2016 which also have to be addressed;
- *new medium combustion plant* as described in Schedule 25A of the EPR 2016.

We address the legal requirements directly where relevant in the body of this document. NRW is satisfied that the decision on this application is consistent with its general purpose of pursuing the sustainable management of natural resources (SMNR) in relation to Wales and applying the principles of SMNR. In particular, NRW acknowledges that it is a principle of sustainable management to take action to prevent significant damage to ecosystems. We consider that, in issuing the variation a high level of protection will be delivered for the environment and human health through the operation of the Installation in accordance with the permit conditions. NRW is satisfied that this decision is compatible with its general purpose of pursuing the sustainable management of natural resources in relation to Wales and applying the principles of sustainable management of natural resources.

As the EPR regulator for Part A1 installations in Wales, NRW are required to determine any duly made Part A1 permit applications. This means that we must decide either to

grant, or to refuse the variation based upon an objective assessment of the proposals against the detailed legal requirements of EPR. Our public participation statement² gives more information on what can, and cannot, be taken into account when making our permitting decision.

The application, and this decision document, only considers the permitting of the facility under EPR as described throughout the document. We only assess the installation and its impacts and cannot take into consideration indirect impacts which are not as a direct result of activity within the installation boundary.

Any proposed development and wider associated activities will be required to be compliant with all relevant and applicable law, for example, environmental law, health and safety law, planning law. This other legislation acts largely independently of EPR (although they may be inter-related). Such other matters are beyond both the scope of this document, and of our regulatory remit and expertise and are not relevant to our EPR permitting decision. Ensuring compliance with all other regulation and obtaining any required consents (such as planning permission) is the responsibility of those undertaking the development and is regulated by the relevant appropriate authority for each.

5. Consultation

5.1. Consultation on the Application

We have carried out consultation on the application in accordance with the Environment Permitting Regulations (EPR), our statutory Public Participation Statement (PPS), and our Regulatory Guidance.

A copy of the application is available on the public register ([PAN-027129](#)) for anyone to view. We advertised the application to the public by a notice placed on our website directing people to the public register, advising them of how they could arrange for copies to be made if required and how they can provide comments.

² [Natural Resources Wales / Public participation: how you can take part in our permit and licence consultations](#)

We also consulted with the following bodies, which includes those with whom we have “Working Together Agreements”:

- Public Health Wales
- Health and Safety Executive
- Pembrokeshire County Council – Planning Department
- Pembrokeshire County Council – Environmental Health Department
- Pembrokeshire Coast National Park Authority
- National Grid

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly.

The consultation started 22/08/2025 and ended on 19/09/2025.

A summary of consultation comments and our response to the representations we received can be found in Annex 1. We have taken all relevant representations into consideration in reaching our decision.

5.2. Draft Permit Consultation

We have carried out consultation on our draft decision. This consultation began on 03/08/2026 and ended on 28/08/2026. No consultation responses were received.

6. Requests for information

Further information was requested during determination by way of a Schedule 5 Notice requiring the applicant to provide further information relating to:

- Air emissions profiles for activities included in the application. Specifically, we requested air emissions screening results for the proposed hydrogen flare and the emergency (diesel) generator. See section 10.1 below.
- Hydrogen storage arrangements at the proposed HPF facility.
- The numbering and location of point source emissions to air within the installation, including the HPF facility.

The Schedule 5 Notice was sent on 17/10/2025 with a deadline for response of 21/11/2025.

Following clarification of our requirements by video conference on 07/11/2025, the applicant's response to the Schedule 5 Notice was provided on 18/11/2025. The additional information supplied satisfied the requirements of the Schedule 5 Notice.

An informal information request was also raised in a video conference on 07/11/2025 and confirmed via email. This related to a possible noise sensitive receptor located west of the installation within the applicant's noise monitoring survey area. See section 10.6 below.

A copy of the information notice and e-mails requesting further information were placed on our public register, as were the responses when received.

7. The Installation

7.1. The permitted activities

The regulated facility is an installation which comprises the following activities listed in Part 2 of Schedule 1 to the Environmental Permitting Regulations:

- S1.1 A(1)(a): Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts (*existing activity – combined cycle gas turbine power station*)
- S4.2 A(1)(a): Producing inorganic chemicals such as - (i) gases ...(hydrogen) (*new activity – production of hydrogen gas by electrolysis of water*)

The permitted activities are detailed in Table S1.1 of the Installation Permit. This variation adds the new electrolytic hydrogen production facility (HPF) to the previously permitted Combined Cycle Gas Turbine (CCGT) power station. These activities are co-located within the same installation, with some shared utilities e.g. water supply. The HPF is connected to National Grid's 400 kV Pembroke substation (co-located with the power station, but outside the permitted installation boundary) and supplied with electricity from grid-connected renewable sources.

Hydrogen from the HPF is supplied for third party use, unrelated to the power station. This variation does not permit use of hydrogen fuel by the power station's CCGTs.

The regulated facility also includes installation “directly associated activities” which have been amended where necessary. Together, these listed and directly associated activities comprise the Installation.

7.2. Changes to the installation

The existing installation activities will continue with only relatively minor changes as a result of this variation, as described in the application and this document.

The main change arising from the variation is to add a new electrolytic hydrogen production facility (HPF), which shares some infrastructure with the CCGT power station but is not an integral part of the primary permitted activity. The components of the HPF are described in section 9.1 (below) and shown in a proposed site layout plan included with the application.

The HPF is designed to operate alongside the CCGT within the same installation. In order to integrate the HPF into the installation, the following changes are required:

- Additional land to the southwest of the existing power station facility is added to the installation boundary. The HPF and an enlarged surface water drainage system serving the installation will be constructed on this additional area of land. Most of the additional land is not currently used for industrial activity. The revised installation permit boundary intentionally excludes an enclaved third-party natural gas above-ground installation (AGI) within the additional land. This third-party AGI has no technical connections to Pembroke Power Station.
- The listed activity and directly associated activity tables in the permit are updated to reflect the addition of the HPF and confirm its connections with existing power station utilities and infrastructure.
- The HPF requires two new permitted emission points to air, corresponding to controlled process venting of oxygen from the electrolyser.
- Two energy assets serving the HPF are added to the installation; a hydrogen flare stack and an emergency diesel generator, with new permitted emission points to air.
- Schedule 8 of the permit is updated to capture details of the HPF emergency generator, which is classified as new Medium Combustion Plant (MCP).

8. Operation of the installation

8.1. Operator competence

The applicant is the sole operator of the Installation. We are satisfied that the applicant is the person who will have control over the operation of the Installation after the variation is issued; and that they will be able to operate the Installation so as to comply with the conditions included in the permit. The decision was taken in accordance with EPR RGN 1 Understanding the meaning of operator³.

Relevant Convictions

The applicant has declared they have no relevant convictions. NRW's COLINS Database has been checked to confirm there are no relevant convictions. No relevant convictions were found.

8.2. Environmental Management System

The applicant has demonstrated in the application that an Environmental Management System (EMS) is already in place for the installation, which is independently certified to ISO 14001:2015 and meets the requirements for an EMS in our “How to comply with your environmental permit” guidance⁴.

We have reviewed the application and are satisfied that appropriate management systems and management structures will be in place for this Installation, and that sufficient resources are available to the operator to ensure compliance with all the Permit conditions. The applicant's EMS presently covers generation of electricity by combustion and small-scale generation of heat for local customers, including operational, technical and maintenance support functions. Following the proposed variation to include hydrogen production, the application states that the EMS will be reviewed to ensure it covers the new activities subject to this variation, principally the production of hydrogen gas.

The Environmental Risk Assessment (ERA) submitted with the application will inform updates to the Environmental Aspects and Impacts Register, a key component of an ISO 14001 EMS. Management system components relating to HPF site operation

³ [RGN 1 Understanding the meaning of 'operator' \(naturalresources.wales\)](#)

⁴ [Natural Resources Wales / Guidance to help you comply with your environmental permit](#)

(normal and abnormal conditions), maintenance, staff competence and training, record keeping, accident prevention and management, and complaint handling are summarised within the application, and these will be implemented and maintained to minimise the environmental risk from the activities covered by this permit variation.

We have included a pre-operational condition (PO6) that requires a summary report of the EMS components applicable to the HPF, including any necessary amendments. The applicable EMS components (including any amendments) must be implemented upon written approval by Natural Resources Wales, prior to HPF commissioning.

PO6 also requires the operator to make available for inspection all documents and procedures that form part of the EMS, including the site's Accident Management Plan (see below). These shall all form part of the written management system referenced in condition 1.1.1 (a) of the installation permit.

[Accident management](#)

The EMS is required to include an Accident Management Plan (AMP). The applicant has confirmed that its existing EMS includes an AMP for the installation, and this will be extended to include the HPF, and other new equipment authorised by this variation. As noted above, accident management and prevention measures for the HPF are summarised within the application.

We have reviewed the Environmental Risk Assessment (ERA) submitted with the application, noting that this includes accident/incident scenarios. We are satisfied that appropriate controls are in place to help reduce the occurrence and impact of any accidents that occur on the installation, and that provisions will be extended and amended for the new and altered activities authorised by this variation.

In order to ensure that the management system proposed by the applicant sufficiently manages the residual risk of accidents, permit condition 1.1.1 (a) requires the implementation of a written management system which addresses the pollution risks associated with, amongst other things, accidents. Pre-operational condition PO6 (see above) also provides Natural Resources Wales with a mechanism to review accident management provisions for operations authorised by the installation permit.

Fire Prevention and Mitigation

The HPF incorporates an underground cellular storage tank of 2,400m³ capacity designed to contain firewater run-off in the event of a fire incident. The HPF surface water drainage system – an extension of the power station's existing system – includes penstock valves upstream of the surface water attenuation basin, which can be closed in the event of a fire or spillage to prevent contamination of clean surface water and ensure contamination is retained within the installation boundary. The drainage system also includes Class 1 oil interceptors. Captured firewater will be contained and tested prior to disposal.

Fire incident scenarios, fire prevention, fire mitigation, and emergency response measures for the HPF are all considered in the Environmental Risk Assessment (ERA) submitted with the application. The applicant's AMP (see above) will be extended to include the HPF, and other new equipment authorised by this variation.

We have reviewed the application information, and we are satisfied that appropriate controls are in place to help reduce the occurrence of fires and minimise impact should one occur.

Site security

Having considered the information submitted in the application, we are satisfied that appropriate infrastructure and procedures will be in place prior to start up to ensure that the site remains secure.

The HPF will include security fencing around the perimeter of the facility and an active CCTV system, with cameras covering the perimeter fence line as well as the entrances and exits of critical buildings. This complements the operator's existing site security arrangements for Pembroke Power Station.

A battery system provides an uninterruptible power supply (UPS) to ensure that the HPF can be shut down safely in an emergency e.g. power failure. The UPS operates in combination with the emergency diesel generator to maintain electrical power for critical HPF systems, including lighting, alarms, locks, and security system circuits.

8.3. Operating techniques

Installation activities and assessment of Best Available Techniques

The applicant has considered appropriate operating techniques for the proposed hydrogen production activity, recognising it as an emerging technology not yet covered by established Best Available Techniques (BAT) Reference Documents (BREFs).

In the absence of formal BAT conclusions, the Environment Agency's published guidance on "Hydrogen production by electrolysis of water: emerging techniques" has been used to inform the design and operational proposals ([Hydrogen production by electrolysis of water: emerging techniques - GOV.UK](#)). Natural Resources Wales worked with the Environment Agency and other regulators and stakeholders to develop a [review of emerging techniques](#), which informs this published guidance.

These techniques align with the principles of Article 14(6) of the Industrial Emissions Directive (IED), which allows competent authorities to set permit conditions based on best available techniques determined through consideration of IED Annex III criteria.

Although a final decision for the HPF design has not been made, the applicant has considered Alkaline Electrolysis (AEL) and Proton Exchange Membrane (PEM) electrolyser technologies within its application. Specifically, the application describes selected BAT for the following key plant items:

- Electrolysis technology (AEL and PEM options)
- Cooling systems (wet, dry and hybrid cooling options)
- Emissions to air (controlled hydrogen flaring and oxygen venting)
- Hydrogen purification (deoxidisers, dehydration units, heat recovery systems, waste minimisation)
- Emissions to water (water minimisation, wastewater recycling, integration with existing power station water supply and water treatment systems)

The operator has concluded that AEL and PEM electrolyser technologies have similar environmental performance and either technology can be considered BAT. Solid Oxide Electrolysis (SOE) technology has been ruled out due to its lower technology readiness level and smaller scale of proven deployments, compared to AEL and PEM.

Similarly, an air-cooled option and a hybrid cooling option are both considered feasible for the HPF, offering similar environmental performance, and either would be considered BAT. The applicant has discounted wet cooling due to the excessive and disproportionate volume of make-up water required for the HPF, compared to the other techniques. The difficulty and uncertainty of securing a new, licenced cooling water supply from Milford Haven, due to existing environmental factors, is also recognised. Finally, integration with the existing power station (CCGT) cooling system has also been considered but ultimately ruled out due to increased operational complexity and restrictions on current cooling water discharge quality e.g. temperature and flow.

We have reviewed the techniques proposed and we agree that they are consistent with best practice for hydrogen production by electrolysis of water, as outlined in published guidance on GOV.UK (see above). To ensure the permit is robust, and the applicant's final technology selection and agreed operating techniques are clear, we have included a pre-operational condition (PO7) requiring the operator to submit a report confirming the selected electrolytic hydrogen production method, electrolyser stack configuration and modularisation, HPF site layout, cooling technique, hydrogen flare stack design and pilot light fuel source, prior to the commencement of HPF commissioning.

We have specified that the applicant must operate the permit in accordance with the application descriptions and the report required by pre-operational condition PO7. See section 12.2 of this document for more information on how we have incorporated the variation into the permit and section 12.3 for how emission limit values have been set.

[Efficient use of raw materials, water and energy](#)

Having considered the information submitted in the application, we are satisfied that the applicant will ensure that raw materials, water, and energy is used as efficiently as possible, which is also required by standard permit conditions 1.2 and 1.3.

The HPF will be powered by grid-supplied electricity from renewable sources, which is compatible with the applicant's technology selection (AEL or PEM electrolyser) and allows the hydrogen product to meet the [UK Low Carbon Hydrogen Standard](#).

Use of the diesel generator is restricted to emergency situations only e.g. plant shutdown in response to power failure, and routine testing for short periods. The HPF cooling system options offer either reduced energy consumption (hybrid cooling) or reduced water demand (air cooling).

The applicant's EMS will include an energy efficiency plan covering the HPF. The application states that basic energy saving measures and techniques will be employed when selecting plant and equipment and incorporated into the operating procedures.

The primary raw material is demineralised water for the electrolyzers. Water is unavoidably consumed in the process, as hydrogen is produced by breaking down water molecules into hydrogen and oxygen. HPF water supply is integrated with the power station water treatment system, with recycling of HPF wastewater occurring within a closed-loop system. If a hybrid HPF cooling system is selected, any cooling tower purge water will be recycled at the power station water treatment plant. Infrequently, wastewater from electrolyser stack regeneration (AEL or PEM) will be removed by tanker and treated elsewhere, but otherwise wastewater will be routinely recycled using existing power station systems and infrastructure.

The oxygen by-product from electrolysis will be released to atmosphere through two roof vents, which will be designed to ensure safe dispersal of oxygen. This practice does not conflict with published guidance for hydrogen production, although the regulator will review the situation periodically to identify if effective utilisation of oxygen byproduct is possible. The operator has acknowledged the potential for future oxygen offtake (for purification and use) and has recognised that such a change may require a variation to the installation permit.

The application indicates that on-site storage of raw materials is minimised where possible⁵ and raw material use controlled to minimise wastage (see below). Use of scarce rare metal catalysts e.g. iridium, platinum will be considered by the applicant

⁵ AEL electrolysis requires use of an alkaline solution, such as potassium hydroxide (KOH), as an electrolyte. The application indicates 483m³ of KOH is required for the proposed 120MW electrolyser, if AEL technology is selected (this is not incidental; the volume of electrolyte needed depends on plant configuration e.g. AEL stack size and working pressure). The electrolyte will be replaced periodically to maintain efficient electrolysis; please see avoidance, recovery, and disposal of wastes (see below).

when selecting its preferred electrolysis technology. Storage tanks and secondary containment systems will be designed to meet industry standards e.g. CIRIA 736F. Smaller containers containing potentially polluting liquids will be sited on impermeable surfaces and provided with secondary containment.

The proposed hydrogen flare includes a pilot light which burns a gaseous fuel – either hydrogen or propane – continuously during normal electrolyser operation. The pilot fuel will be confirmed once a final technology selection has been made. Energy consumption and performance (for both fuels) will inform the operator's final decision. If propane is selected, the application indicates secure and fully contained storage of approximately 0.4 tonnes of compressed and liquified gas fuel within the HPF.

The operator will be required to report water and energy usage under condition 4.2.2 and Schedule 4 table S4.3 of the permit. This will enable us to monitor water and energy recovery efficiency at the Installation.

Avoidance, recovery or disposal of wastes produced by the activities

Having considered the information submitted in the application, we are satisfied that the waste hierarchy referred to in Article 4 of the WFD will be applied to the generation of waste and that any waste generated will be treated in accordance with this Article.

Wastes arising from maintenance of the HPF are generated periodically but infrequently. This includes oils and chemicals needed for efficient plant operation, and spent catalysts, absorbents and resins requiring replenishment or replacement. The applicant proposes to periodically refurbish electrolyser stacks rather than replace them, minimising waste arising from HPF operation.

The applicant will consider the presence of PFAS compounds⁶ within PEM membranes and seals (and associated PFAS waste management considerations) when selecting its preferred technology. Our regulatory expectation is responsible disposal of PFAS waste e.g. from end-of-life electrolyser components, by incineration or recycling/reuse, preventing fluorinated material from entering the environment.

⁶ Fluoropolymers – a subtype of per- and poly-fluoroalkyl substances (PFAS) – are commonly used in PEM electrolyser membranes and seals and are currently an important part of the hydrogen value chain. Our understanding of PFAS impacts is evolving, and our regulatory expectations may change in future.

The HPF will not routinely generate aqueous waste, and process waters are reused, or recycled at the power station's water treatment plant (see above). Periodically, liquid electrolyte is replaced, and this waste is sent for disposal at suitably authorised facilities elsewhere; for AEL technology, this equates to an average of 97m³ per annum, based on the proposed plant configuration.

We are satisfied that waste from the Installation that cannot be recovered will be disposed of offsite using a method that minimises any impact on the environment. Permit condition 1.4.1 of the permit will ensure that this position is maintained.

9. The site

9.1. Site Plan

Pembroke Power Station is located at the southern edge of the Milford Haven Waterway near the mouth of the Pembroke River, approximately 2km west of Pembroke Dock and centred on national grid reference SM 9270 0260. Further west of the installation, approximately 1km distant, is Pembroke Refinery (Valero Energy Ltd). The power station installation occupies approximately 14 hectares which includes land added in this permit variation.

The new Hydrogen Production Facility (HPF) will be built at the southwest corner of the enlarged permitted installation. The main power station activities remain largely unaltered by this permit variation and the addition of the HPF. The surrounding land use is rural, with residential receptors located southeast (~1.5km) and northeast (~2km) of the HPF. Site access is provided by an existing road network.

The HPF comprises: the main electrolyser area (electrolysis stacks, cooling systems, compressors, purifiers, nitrogen purging system, control systems); hydrogen offtake pipeline (HPF entry point only); hydrogen flare stack; emergency power supply (diesel generator); process water polishing unit; chemical storage; transformer and electrical connection with Pembroke Substation (National Grid); firewater storage tank; HPF drainage system and links with power station water supply and drainage systems.

The applicant has provided an updated [installation boundary plan](#) and a proposed [site layout plan](#), which we consider are satisfactory. These show the extent of the site, the proposed composition of the HPF and its emission points, including additional land and four new emission points added by this permit variation. A small enclave owned by a third party is excluded from the installation (see section 7.2 of this document).

The updated boundary plan is included in Schedule 7 of the varied permit, and the operator will be required to carry on the permitted activities within the site boundary. We acknowledge that the HPF site layout plan is indicative and it may change following completion of the Front End Engineering & Design (FEED) project phase. We have added a pre-operational condition [PO7] requiring the operator to confirm the HPF site layout prior to the commencement of HPF commissioning.

9.2. Site Condition Report

The applicant has proposed to add land to the facility as part of this variation and has provided a description of the condition of that land in an Addendum to the installation's Site Condition and Baseline Report (Appendix C of this application). We have reviewed this and consider this description is broadly satisfactory. The decision was taken in accordance with our guidance on site condition reports – guidance and templates (H5)⁷, noting that key information appears to be present, but the Addendum does not appear to fully consider the footprint of the expanded surface water drainage system serving the HPF, which connects with existing power station infrastructure. This particular area requires attention to ensure the accuracy and clarity of baseline site conditions (from which permit surrender requirements will be determined).

We have therefore added an improvement condition (IC9) to the permit, requiring the operator to review and update the installation's site condition report, in accordance with our published H5 guidance, considering the newly added land that includes the proposed HPF and the expanded surface water drainage system. When responding in writing to IC9, the operator should either confirm that existing submissions fully describe the baseline condition of the newly permitted area; or provide any further relevant information, with reference to the H5 guidance and format. NRW will consider

⁷ [Environmental Permitting Regulations , Guidance for applicants H5, Site Condition Report, Guidance and Template \(naturalresources.wales\)](#)

there to be no existing contamination at the point of permit variation issue, unless demonstrated to us otherwise in writing before operation of the HPF commences.

9.3. Site protection: potentially polluting substances and prevention measures

The operator has a duty to ensure that soil and groundwater are protected in order to meet the requirements of Articles 14 (1)(b), 14(1)(e) and 16(2) of the IED.

Within the application, the operator has described use of impermeable surfaces, bunds, and other secondary containment measures at the HPF for potentially polluting liquids, with confirmation that CIRIA 736F guidance will be followed for such systems. Additionally, the HPF drainage system incorporates firewater storage capacity, penstock valves, and oil interceptors to control the risk of soil and groundwater pollution. Uncontaminated surface water is directed through an expanded surface water drainage system linked to the existing installation. Periodically, liquid electrolyte may be removed by tanker and replaced with new solution. Process water can be recycled within the HPF or returned to the power station's water treatment plant.

These matters are also discussed in section 8.2, 8.3 and 10.2 of this document. Based upon the information in the application, we are satisfied appropriate measures will be in place to protect the site and its surroundings from polluting substances.

10. Environmental Risk Assessment

Regulated activities can present different types of risk to the environment, depending on their scale, complexity, process type(s), hazard profile, amenity impact potential, and environmental emissions e.g. air, land, water, and wastes. The relevant risks presented by electrolytic hydrogen production have been considered during our determination and are discussed in this and other sections of this document. Where relevant, we have outlined what measures we require to ensure a high level of environmental protection.

In line with our guidance, the applicant has provided an [Environmental Risk Assessment](#) (ERA) with the application which identifies and the sources of key risks

from the variation, possible pathways, and receptors. An [air quality screening impact assessment](#) and a [noise impact assessment](#) are also included with the application. The ERA and further assessments provided by the applicant and/or completed by NRW will be discussed in further detail below.

10.1. Assessment of impact on air quality

The applicant has assessed the installation's potential emissions to air against the relevant air quality standards, and the potential impact upon human health in line with relevant guidance⁸. These assessments predict the potential effects on local air quality from the installation.

The proposed Hydrogen Production Facility (HPF) is not expected to have a significant impact on local air quality. The electrolyser emits oxygen via two roof vents designed to ensure safe dispersal; oxygen is not considered a pollutant gas under current environmental guidance. Hydrogen systems will be designed to provide full containment; this is discussed in more detail in Section 10.4 (below).

The HPF's hydrogen flare stack and emergency generator both emit oxides of nitrogen (NO_x), a pollutant which can present human health and environmental concerns. Both activities are considered in the applicant's air quality screening impact assessment. Sulphur dioxide (SO₂) and airborne particulate matter with a diameter of 10 microns or less (PM₁₀) are also considered for the emergency diesel generator.

The emergency generator has a thermal input capacity of 2.61 MW and is classified as new Medium Combustion Plant (MCP). The generator is the HPF's backup power supply; for example, to enable safe shutdown of the HPF following a loss of electricity grid connection. It benefits from the limited hours exemption for new MCPs operating less than 500 hours per year as a 3-year rolling average. Although it generates electrical power, it is excluded from Specified Generator (SG) controls, as it is part of an IED Chapter III permitted installation (Pembroke Power Station). The generator will use diesel fuel and will be tested and run for short periods – the screening assessment confirms a maximum operating time of 72 hours per year for testing purposes. This is the key operational parameter informing the applicant's assessment, which has

⁸ [Air emissions risk assessment for your environmental permit - GOV.UK \(www.gov.uk\)](#)

followed NRW's expected screening method using the Simple Calculation of Atmospheric Impact Limits (SCAIL) tool [Medium Combustion Plant between 1 – 20 MW thermal input which is not a Specified Generator or an EPR Part B activity]⁹.

The hydrogen flare is not designed to run continuously, and its operation is limited to HPF startup, shutdown, and emergency conditions. Therefore, the applicant's air quality screening impact assessment has been based on two scenarios: predicted normal operating conditions (Scenario 1: 12.5hrs flaring per year) and a conservative, worst-case involving many startup and shutdown events (Scenario 2: 50hrs flaring per year). Scenario 2 is considered unlikely, as a high number of startup and shutdown cycles and flaring events would have negative economic implications for the HPF.

The SCAIL screening assessment considers the combined impact of both the emergency generator and the flare operating concurrently (for both flaring scenarios), as this is considered to be worst-case operating conditions. Human health receptors and designated habitats sites within the relevant screening distances for Medium Combustion Plant are included in the assessment; a conservative approach has been followed, considering more a polluting fuel – heavy fuel oil – for the MCP, the worst-case hydrogen flaring scenario described above and designated habitats sites within a 4km radius of the proposed activities. The assessment has also considered relevant annual and short-term process contributions relative to habitat critical levels and loads, as well as the nearest human health receptors.

It should be noted that use of the SCAIL tool to assess the combined air quality impact from a gas flare and a medium combustion plant at an installation is unusual in an environmental permitting context, but in this case, we believe it is reasonable and proportionate, noting the very low process contributions and the outcome of the assessment (below).

The screening assessment, noting the distances between the activities and nearby receptors, and very limited predicted annual operations, concludes that:

⁹ [Natural Resources Wales / What to do before you apply for a standalone Medium Combustion Plant \(MCP\) permit between 1 and less than 20 MW thermal input](#) – note expected use of the SCAIL combustion screening tool to identify if site-specific air quality emissions modelling is needed.

- Process ground level concentrations of NO_x, SO₂ and PM₁₀ are extremely low at nearby receptors.
- The long-term and short-term objectives for human health protection are met.
- The activities operating at ≤72 hours/year will have an insignificant impact on air quality at the nearest ecological and human health receptors.
- No further detailed air quality modelling or assessment is warranted.

We accept the applicant's conclusions and agree no further air quality modelling is necessary, noting the scenarios considered in the screening assessment. Emissions profiling and environmental assessment of hydrogen flaring is an emerging field, so to ensure the permit is environmentally protective, we have added an improvement condition (IC12) requiring a review of hydrogen flare and emergency generator operations during the first 12 months of hydrogen production following HPF commissioning. This review shall consider actual flaring data and generator use and compare this with the predictions in the application. IC12 also includes a requirement to re-run the SCAIL air emissions screening exercise for the hydrogen flare, if the reality is different to the predicted operating scenarios, with potential for increased emissions to air.

Emission limits

The predicted air quality impact of the hydrogen flare has been assessed and has screened out. There are no applicable Emission Limit Values (ELVs) for hydrogen flaring based on BAT or UK Guidance on Emerging Techniques (GET) at present.

There are no published BAT Conclusions that directly apply to the emergency diesel generator. It is a new MCP benefiting from the limited operating hours exemption from Medium Combustion Plant Directive (MCPD) ELVs, and it is excluded from Specified Generator (SG) provisions. In this case it falls to NRW to define BAT for the activity. The MCPD specifies appropriate controls for standalone MCPs, and we consider that it can indicate BAT for MCP located at IED Chapter II and III installations, including for low-usage, exempt units. We have considered this in our permitting decision, alongside the likely operating pattern and the predicted air quality impact of the generator (which has screened out as insignificant).

The generator fits the definition of a new MCP, and the installation permit already contains conditions, monitoring and reporting requirements related to MCPs operating less than 500 hours per year as a three-year rolling average. These provisions are extended to the emergency diesel generator serving the HPF, with a monitoring frequency corresponding to the generator's rated thermal input. Periodic monitoring for oxides of nitrogen (NOx) and carbon monoxide (CO) is required for the emergency generator and confirmed in Schedule 3 table S.3.1c of the permit. The monitoring requirements for this permit are also discussed in section 12.5 (below).

We consider that on a case-specific basis, MCP standards for exempt generators constitute BAT for this activity. This decision considers the definition of BAT and the criteria for determining BAT outlined within the IED, both indicating that the purpose of BAT is to prevent, or where not practicable, to reduce emissions and impact. In cases where projected operating hours for an emergency generator are well below the 500 hours annual threshold, the impact is negligible, so BAT need not be onerous.

Based upon the information in the application and the measures that will be imposed by the permit we are satisfied that the appropriate measures will be in place to protect air quality for the environment and human health.

10.2. Assessment of impact to surface and ground water

The application does not add any new direct discharges to surface water; however, the installation's surface water drainage system has been expanded within the additional area of land included in this variation application. The expanded system includes a hard surfaced HPF compound with new drains, penstock valves, and oil-water separators, connecting to the power station surface water drainage network via an attenuation pond and eventually discharging at emission point W2. It is expected that flows entering the attenuation pond will be uncontaminated and suitable for discharge as rainwater; the penstock valves can be closed if necessary, preventing the escape of polluting liquids and utilising the HPF's underground storage tank (see section 8.2 of this document). There are also unsurfaced areas within the additional permitted land, where contamination is unlikely and rainwater infiltration will occur.

Raw materials e.g. chemicals, diesel, and maintenance fluids have bunded storage with sufficient containment capacity within the hard surfaced HPF area. HPF process water is generally recycled; rejected flows and cooling water purges are directed to the power station water treatment plant (the application confirms the plant can manage the expected additional load without increasing risk to surface water or groundwater receptors). Sections 8.2, 8.3 and 9.3 of this document describe the proposed techniques and control measures to prevent surface water and groundwater pollution.

Based upon the environmental risk presented by the HPF and the information in the application, we are satisfied that the appropriate measures will be in place to prevent pollution of ground and surface water.

10.3. Emissions to sewer

Based on the application information, there are **no emissions to sewer** from the proposed HPF. Rejected HPF process water, and cooling water purge streams from hybrid cooling, will be returned to the power station's water treatment systems. Periodically, HPF electrolytes require regeneration; associated liquid wastes are removed by road tanker for treatment and disposal elsewhere. There are no new domestic sewage discharges e.g. from offices; HPF operation is automated and integrated with the main power station control room and site security systems.

No further assessment of sewer discharges is necessary for this permit variation application.

10.4. Fugitive emissions

The applicant has identified the following potential fugitive emissions within the ERA included with the application:

Emission type	Pathway	Overall risk
Dust	Air	Very low
Hydrogen leak	Air	Very low
Chemical leak	Land, Water	Very low
Oil / fuel leak	Land, Water	Low
Litter	Air	Very low
Pests	Air, Land	Very low

Correspondingly, the ERA and the supporting information within the application describe measures to prevent, control, or minimise fugitive emissions from the HPF, deployed in combination with the applicant's EMS, operating procedures, and accident management plan.

The hydrogen handling systems will be designed to provide full containment, and the applicant states they will be inspected and maintained to minimise fugitive emissions of hydrogen throughout the life of the proposed facility. An improvement condition (IC11) has been added to the permit to require a description of leak detection and repair provisions at the HPF within a written monitoring and management plan (see also section 10.7 of this document). Based on distances to the closest occupied residential premises, the HPF is not expected to release fugitive emissions which present significant risks to the environment or human health.

A section of the Pembrokeshire Coast Path borders the proposed facility at its southwest corner; however, any human presence here could reasonably be expected to be transient i.e. walkers using the path, and this would not present the same level of risk as an occupied residential premises. NRW has undertaken statutory consultation for this application with component authorities for human health (see Annex 1) and no specific concerns were raised in respect of impact at the Coast Path.

Containment measures for potentially polluting liquids are discussed in sections 8.2, 8.3, 9.3 and 10.2 of this document.

Based upon the information in the application we are satisfied that the appropriate measures will be in place to prevent or where that is not practicable to minimise fugitive emissions and to prevent pollution from fugitive emissions.

Permit condition 3.2.1 requires that emissions of substances not controlled by emission limits (i.e., fugitive emissions) shall not cause pollution. Condition 3.2.2 requires that a management plan shall be developed if pollution is subsequently identified.

10.5. Assessment of odour impact

The applicant has identified the following potential sources of odour within the ERA included with the application:

Odour source at HPF	Pathway	Overall risk
Hydrochloric acid (HCl)	Air	Very low
Diesel fuel	Air	Very low

These substances are associated with the operation of the HPF and will be stored in tanks designed to meet industry standards, with appropriate secondary containment. Projected use of these substances is intermittent: HCl is used during electrolyser regeneration, and diesel fuel powers the emergency generator system which is tested periodically for short periods. Correspondingly, the overall odour risk is assessed as very low and the application confirms measures which will be in place for preventing and minimising pollution, including a complaints / incident investigation procedure.

The hydrogen production process will generate oxygen and hydrogen, which are not odorous substances. The risk of odour nuisance at nearby receptors, attributable to HPF operations, is considered very low. No further mitigation measures are proposed.

The requirement for a specific Odour Management Plan (OMP) for the HPF is considered disproportionate in this instance. However, permit condition 3.3.2 applies to the whole installation and it allows the regulator to require an OMP to be written, approved and implemented if we notify the operator that odour pollution is occurring.

Condition 3.3.1 in the permit will also require that emissions from the activities are free from odour at levels likely to cause pollution outside the site. We are satisfied that standard conditions 3.3.1 and 3.3.2 will be sufficiently protective in conjunction with the measures described by the applicant for minimising odour at the installation.

10.6. Noise and vibration assessment

Pembroke Power Station is located on the south bank of the Milford Haven Waterway, a natural harbour and one of the UK's most important ports. Local industry includes oil refining, energy storage, power generation and shipping activities.

Aside from the Waterway and its concentration of industry, the land use around the power station is mainly rural/agricultural; this produces a varied local soundscape, with a mixture of sources contributing to environmental noise during the day and at night. The applicant's [noise impact assessment](#) (NIA), combined with our checks during this determination, identifies the nearest sensitive receptors to the proposed HPF:

Receptor reference & name	OS Grid reference	Description
RP1 Pwllcrochan ¹⁰	SM 92052 02655	Former hamlet. ~480m west-northwest of centre of proposed HPF.
RP2A Greenhill Farm	SM 92551 02149	Residential, not occupied. ~370m south of centre of proposed HPF
RP3 Lambeeth Farm	SM 93834 01659	Residential, occupied. ~1.5km south-east of centre of proposed HPF
RP4 Power Station boundary ¹¹	SM 92052 02655	Noise monitoring position at power station installation (east) boundary
RP4A Pennar Point	SM 94468 02956	Residential, occupied. ~2.0km east-northeast of centre of proposed HPF
RPe1 Pennar Gut ¹²	SM 93802 02361	Noise monitoring position. ~1.3km east of centre of proposed HPF

For completeness, the table above includes the location of specific noise monitoring points which are referenced in the applicant's NIA.

Operational noise impact on human receptors

St Mary's Church at Pwllcrochan is owned by Valero Energy Ltd. Valero has restored and converted the church into Pwllcrochan Environment Centre, a place of learning for primary schoolchildren. During this determination we have obtained feedback from Valero, via the applicant, confirming that the centre is used between April and June each year, during daytime hours (typically 10.00 – 14.00hrs). It is not occupied every day during this seasonal period of use; in 2024, 26 visits took place, which corresponds to a relatively small percentage of the year (~7%).

¹⁰ Pwllcrochan is an abandoned hamlet with no residential receptors. A grid reference for RP1 was not supplied with the application; the grid reference included here corresponds to St Mary's Church (14th century, deconsecrated) at Pwllcrochan. The status of the church is discussed in this document.

¹¹ RP4 is a noise monitoring position used to obtain operational sound data for the CCGT power station.

¹² RPe1 is a noise monitoring position used to assess impact on ecology and nearby designated sites.

Pwllcrochan Environment Centre could be considered a noise sensitive receptor in accordance with published guidance¹³ for permitted sites on GOV.UK. The applicant's NIA has not considered noise impact at Pwllcrochan (based on the absence of occupied residential receptors). Additionally, the meaning of 'schools' is not clarified within the published noise and vibration management guidance, so the status of the Environment Centre in this noise impact assessment context is open to interpretation.

There is case law¹⁴ that has considered the definition of a school in a planning context, noting that provision of education alone does not make an institution a school, and attendance (for education) by young human beings at a specified place for a number of hours on a considerable number of days per year is typical of a school. This offers an indication of the Environment Centre's status for our permitting purposes, but it does not allow us to definitively exclude or include it as a noise sensitive receptor in this case. However, we have followed the precautionary principle and considered potential operational noise impact at this location (RP1), discussed on pages 35 – 36.

Greenhill Farm is the closest receptor to the proposed HPF and is owned by the applicant. The submitted NIA confirms that farmland is still used for agriculture, but the farmhouse is not occupied, and the applicant does not intend to return it to residential use. The NIA has considered this receptor but also emphasises its current status, and this is accepted for the purpose of this particular permit determination. The applicant is advised that a future change in use (for the farmhouse) may trigger a re-assessment of noise impact, with implications for regulated activities at Pembroke Power Station.

The applicant has identified the following sources of operational noise in the ERA (Table 3-3), and the NIA (Appendix A) submitted in support of this application:

Noise source at HPF	Operating mode	Overall risk
HPF – electrolyser stacks and pumps	Continuous	Very low
HPF – hydrogen compressors	Continuous	Very low
HPF – hydrogen flare stack	Intermittent	Low

¹³ [Noise and vibration management: environmental permits - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/noise-and-vibration-management-environmental-permits)

¹⁴ [Bright Horizons Family Solutions Ltd v Secretary of State for Communities And Local Government \[2019\] EWHC 14 \(Admin\) \(16 January 2019\)](https://www.bright-horizons.co.uk/news/bright-horizons-family-solutions-ltd-v-secretary-of-state-for-communities-and-local-government-2019-ewhc-14-admin-16-january-2019)

The applicant has assessed noise and vibration impact from the proposed HPF in accordance with *BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound*. Based on the core application submissions received on 07/10/2024, and additional information received on 06/06/2025 in response to our queries, we are satisfied that the standard has been followed, the applicant's NIA is comprehensive and considers expected sound sources and noise sensitive receptors. Readers requiring further detail should refer to the submitted NIA and ERA reports.

Readers should also note that this permitting decision considers *operational* noise from the HPF and its contribution to the cumulative operational sound profile of the installation. Construction noise is not considered here, as it is normally regulated and controlled through the planning regime with reference to relevant codes of practice.

We note that the applicant has drawn attention to operational noise limits for Pembroke Power Station included as a condition in a planning consent issued by Pembrokeshire County Council for the installation. Operational noise impact from permitted installations is assessed and regulated separately from planning, and standard conditions are used to control operational noise impact from permitted installations. Relevant operational noise limits from the planning consent are referenced later in this document. Although these are not critical to our permitting decision for this application, they do inform it and help us understand the sensitivity of key residential receptors.

Tables 13 and 14 from the applicant's NIA are reproduced below, summarising the predictions and results of the BS 4142 assessment of HPF operational sound at three sensitive noise receptors:

Receptor Position		$L_{Aeq,T}$ dB	A-weighted octave band sound pressure Levels (dB)							
			63	125	250	500	1k	2k	4k	8k
RP2A:	Greenhill Farm	44	31	31	30	37	40	36	23	-
RP3:	Lambeeth Farm	29	19	15	16	22	26	18	-	-
RP4A:	Pennar Point	28	19	14	16	20	26	16	-	-

Table 13: Predicted specific $L_{Aeq,T}$ sound level from operation of GHP, at noted receptor positions.

Receptor Position	Rating level $L_{Ar,Tr}$ (dB)	Background Sound Level $L_{A90,T}$ (dB)	BS 4142 Assessment Level (dB)
RP2A: Greenhill Farm	44	35	+9
RP3: Lambeeth Farm	29	35	-6
RP4A: Pennar Point	28	42	-14

Table 14 BS 4142 assessment of GHP operational sound at defined sensitive receptor positions.

The applicant has acknowledged that some elements of HPF operation would exhibit tonality at source, but other industrial sounds are present (see below), and the distances involved reduce the prominence of any tonal aspects specifically emanating from the HPF. The applicant has therefore not applied any character correction to the HPF sound rating levels in the table, and the predicted specific sound levels ($L_{Aeq,T}$) at nearby receptors are the same as the sound rating levels ($L_{ar,Tr}$). Section 6.4 of the applicant's NIA indicates that operation of the HPF would not be expected to produce sound emissions with an impulsive character or intermittent/irregular pattern.

The assessment results show a low adverse impact from operational sound at RP3 (Lambeeth Farm) and RP4A (Pennar Point), which are both occupied residential receptors. Notably, the background sound level is higher than the rating level of the HPF operational sound at RP3 and RP4A i.e. a negative assessment level.

The assessments results also show an adverse impact of +9dB at RP2A (Greenhill Farm), however as explained earlier in this document, the applicant owns this property and there is no residential receptor at this location.

The applicant has also assessed the cumulative impact of operational sound from the HPF combined with the existing CCGT power station i.e. the proposed configuration of permitted installation EPR/DP3333TA. Table 15 from the applicant's NIA is reproduced below, summarising the specific sound levels ($L_{Aeq,T}$) for the power station installation following addition of the HPF. Operational sound limits from the applicant's planning consent are shown in the sixth column of the table. Readers should note that sound levels have been expressed as dB(A) i.e. A-weighted decibels for this cumulative assessment within the NIA, as the CCGT power station may generate operational sound with a wider range of characteristics compared to the HPF.

Receptor Position	Specific Sound Level $L_{Aeq,T}$ dB				Operational sound Limit $L_{Aeq,T}$
	CCGT	+GHP	Total	Change	
RP2A: Greenhill Farm	35	44	45	+10	42
RP4A: Pennar Point	35	28	36	+1	40

Table 15: Predicted $L_{Aeq,T}$ specific sound level for Pembroke Power Station, including GHP operation.

Note: The specific CCGT sound level of $L_{Aeq,T}$ 35dB at RP4A: Pennar Point has been determined from measurements at the RP4* reference position.

These results show an adverse impact of +10dB(A) at RP2A (Greenhill Farm) and a low adverse impact of +1dB(A) at RP4A (Pennar Point), considering the combination of CCGT and HPF operating concurrently. Our previous comments apply in respect of Greenhill Farm, which we accept is not occupied for residential use. A slight increase is noted at Pennar Point; however, this corresponds to a low adverse impact using BS 4142 assessment thresholds, and it is also well within the operational sound limit set by the planning authority at this location.

Finally, the applicant has undertaken targeted, cumulative assessment of HPF operational sound combined with the primary installation (CCGT power station), other consented or proposed RWE projects, and other non-RWE projects. The receptors considered for this phase of the assessment are RP3 (Lambeeth Farm) and RP4A (Pennar Point), both of which are occupied for residential use. The results of this assessment are not discussed in detail here, as the projects considered by the NIA appear to be at various stages in construction and/or consenting phases, and several fall outside the scope of the applicant's installation permit for Pembroke Power Station. In summary, the results of this assessment indicate low adverse impact at Lambeeth Farm [+3dB(A)] and Pennar Point [+1dB(A)] following the BS 4142 methodology, should all the listed projects become operational. This corresponds to a minor level when grading the significance of effects from operational sound.

Returning to receptor RP1 (Pwllcrochan). Although the applicant has not assessed noise impact at this position, and it is no longer used for noise monitoring, Table 1 of the applicant's NIA confirms that an operational sound limit of 42dB(A) was previously provided at this location for planning purposes, as in the case of Greenhill Farm. As noted on page 29 of this document, there is no occupied residential presence at RP1. The applicant's noise contour mapping (Figure 6 of the NIA) indicates the predicted

operational sound at RP1 is 41dB(A). Assuming a background sound level of 35dB – as in the case of Greenhill Farm – and considering existing operational sound from the CCGT power station in combination with the HPF, this suggests the predicted specific sound level ($L_{Aeq,T}$) at Pwllcrochan would exceed the background by 6 – 7dB(A). This exceeds the ‘adverse impact’ assessment threshold as outlined in BS 4142, but it matches the previous operational sound limit [42dB(A)] used at this receptor position.

Considering the predicted impact, noise sensitivity potential at RP1, and feedback from the Environment Centre owner regarding patterns of use and frequency of occupation, NRW is satisfied that significant noise pollution corresponding to adverse effect or significant adverse effect is qualitatively unlikely at this location. The permit contains standard conditions allowing the regulator to intervene, if we perceive that noise pollution attributable to the permitted activities is occurring outside the site.

Operational noise impact at ecological receptors

Section 10.3 of the applicant’s NIA confirms that sound has been measured at the western edge of Pennar Gut (RPe1), with ambient noise levels in the range of 35 – 45 dB(A) routinely recorded and intermittent noise generating peaks of 60 – 70dB(A). The RPe1 receptor point is accepted as representative of the closest parts of nearby designated habitats e.g. Pembrokeshire Marine Special Area of Conservation (SAC) and Milford Haven Waterway Site of Special Scientific Interest (SSSI).

The applicant’s noise contour mapping (Figure 6 of the NIA) shows a predicted sound level ($L_{Aeq,T}$) from HPF operation of between 30 – 35dB(A) in the Milford Haven Waterway and between 35 – 40dB(A) in Pennar Gut. Therefore, we accept that operational noise impact from the HPF is not expected to have any likely significant effect on the closest sensitive ecological receptors.

Noise management – prevention and minimisation

Table 3-3 of the ERA included with the application details measures which will be in place for preventing and minimising noise and/or vibration from the HPF. Notably, the hydrogen production and compression activities will operate within a building with additional sound insulation fitted to minimise sound emissions and noise nuisance.

The hydrogen flare may operate during electrolyser start up and shut down, and in emergency situations. Flaring is not expected during normal production and only the pilot light would be in continuous operation, with low gas flows and sound emissions. Intermittent operation of the flare is not expected to generate significant noise pollution, and the applicant has categorised the overall environmental risk as low.

We have compared the measures proposed to minimise noise at for the site with published GET for hydrogen production by electrolysis of water¹⁵ and we are satisfied that the applicant has considered relevant sources with noise potential. We have also compared the application with general guidance for noise and vibration management at permitted sites¹⁶ and we are satisfied that the appropriate measures will be in place to prevent or where not practicable to minimise the effects of noise, in particular the use of techniques such as buildings with sound insulation to minimise noise at source.

The operator will be expected to update its existing Noise Management Plan (NMP), for the power station installation, required by permit condition 3.4.2, to consider HPF noise emissions within the whole installation context. As noted in section 8.2 of this document, we have included a pre-operational condition (PO6) requiring the operator to share a summary of the updated EMS components applicable to the HPF, before commissioning begins. An NMP is a key component of an EMS for installations and therefore falls within the scope of PO6.

We are satisfied that vibration is unlikely to be an issue at the HPF. The nature of the activity means that there are no significant sources of vibration on site. Therefore, vibration (for the HPF) does not need to be included in the installation's NMP.

Condition 3.4.1 of the permit requires noise from the activities to be below that which could cause pollution outside the site. We are satisfied that this will be sufficiently protective in conjunction with the measures described by the applicant for minimising noise at the installation.

¹⁵ [Hydrogen production by electrolysis of water: emerging techniques - GOV.UK](#)

¹⁶ [Noise and vibration management: environmental permits - GOV.UK \(www.gov.uk\)](#)

10.7. Global warming potential

Emissions of carbon dioxide (CO₂) and other greenhouse gases differ from those of other pollutants in that, except at gross levels, they have no localised environmental impact. Their impact is at a global level and in terms of climate change.

Hydrogen is not considered a direct greenhouse gas, however hydrogen leakage from anthropogenic sources has an indirect global warming potential which is greater than CO₂ over 100 years (GWP100). Hydrogen may react with other atmospheric molecules, which would otherwise react with and break down greenhouse gases such as methane (CH₄), indirectly contributing to global warming.

Published [Guidance on Emerging Techniques \(GET\)](#) for hydrogen production by electrolysis of water states that emissions of hydrogen should be eliminated or minimised due to their global warming potential. The HPF will be designed to provide full containment (see sections 10.1 & 10.4), and hydrogen flaring has been selected instead of venting, to reduce the global warming potential of the proposed facility.

To ensure the permit is environmentally protective, we have included an improvement condition (IC11) which requires the operator to submit a written monitoring and management plan for hydrogen emissions as a result of 'slip' from production and flaring activities. The plan shall be periodically reviewed, based on monitoring outputs, at a frequency no greater than three years, and shall be incorporated into the operator's EMS. This measure should further minimise the potential for indirect global warming contributions as a result of hydrogen emissions from the facility.

11. Impact on National Site Network Sites, SSSIs and non-statutory sites

The applicant has used Simple Calculation of Atmospheric Impact Limits (SCAIL) to derive screening distance criteria allowing identification of relevant protected conservation sites which could be at risk from the proposal. 'Hybrid' run mode was selected for the SCAIL tool in this case, aligning with our expectations for MCP bespoke permit screening in support of permit applications (see also section 10.1 of

this document). The applicant has followed a conservative approach and set the minimum screening distance at 4.0km from the emergency diesel generator (a new MCP of 2.61 MWth capacity) and the hydrogen flare stack, to designated SSSI and European sites. This screening distance corresponds to an MCP burning liquid heavy fuel oil between 2 - 5 MWth (see table included with NRW's SCAIL user guidance¹⁷). We are in agreement with the screening distances used for these protected sites.

The applicant has not included local nature sites e.g. Local Nature Reserves, Local Wildlife Sites, Ancient Woodland in its SCAIL assessment, however there are no such sites within 200m of the HPF, and this has screened out of further assessment. Noting the applicant's screening approach for protected sites, this permitting decision has considered worst-case impact of these intermittent combustion sources at the HPF.

Due to the distance between the HPF and designated priority species for the Milford Haven Waterway SSSI (fauna: greater horseshoe bat, lesser horseshoe bat), it is not expected that operational noise emissions will cause damage to these protected species and SSSI features, and the structural coherence of the woodland, scrub, grassland and estuarine habitats used by these bat species is unlikely to be weakened by construction and operation of the HPF. Impact on bats has been surveyed and assessed during the planning process for this development, and it is understood that the planning permission issued by the Local Authority has been conditioned accordingly. Regardless, the environmental permit EPR/DP3333TA includes monitoring requirements, air emission limits and noise management conditions which will all apply to the HPF and allow NRW to regulate the activity effectively.

A full assessment of the variation application and its potential to affect the identified sites has been carried out as part of the permit determination process, with consideration of relevant permitting guidance including the AQTAG21 advice note (habitats screening thresholds for EPR installations). We have considered the potential for in-combination effects, noting the low Process Contribution (PC) of HPF emissions (<1%) and existing industrial activity around Milford Haven.

¹⁷ [Natural Resources Wales / What to do before you apply for a standalone Medium Combustion Plant \(MCP\) permit between 1 and less than 20 MW thermal input](#)

In this case, we believe the 1% screening threshold is comprehensive and sufficiently precautionary, noting the conservative approach followed for distances and fuel type.

National Site Network sites, Sites of Special Scientific Interest (SSSI) and non-statutory conservation sites will be discussed separately below this overview.

Other than air and noise emissions, other mechanisms of impact can be disregarded (no credible impact pathway). As noted above, there are no process emissions to water and the risk from accidents / incidents, including loss of containment, is controlled (see section 8.2 of this document) so as to remove any credible impact pathway. Other impact pathways e.g. disturbance, direct physical habitat damage can be dismissed, noting that the installation is not within a protected site and the closest protected ecological receptor site is >400m from the proposed HPF (SAC and SSSI), meaning that direct impact pathways can be ruled out.

11.1. The National Site Network

The following National Site Network sites are located within 4.0km of the installation:

Site Type	Site Name	Distance	JNCC code
SAC	Pembrokeshire Marine SAC	0.432km	UK0013116
SAC	Limestone Coast of South West Wales SAC	2.967km	UK0014787
SPA	Castlemartin Coast SPA	3.096km	UK9014061

Note: the distances quoted have been supplied by the applicant and are measured from the proposed hydrogen production facility to these protected sites.

A Habitat Regulations Assessment (HRA) was completed to assess the potential to affect any of the sites identified. The project was screened for likelihood of significant effects and is considered not likely to have a significant effect on any National Site Network site (as documented in section 3.2 of OGN 200 Form 1, or section 5 if applicable). The full assessment is available to view on our public register, see [here](#).

11.2. Sites of Special Scientific Interest (SSSI)

The following SSSIs are located within 4.0km of the installation:

Site Type	Site Name	Distance	SSSI code
SSSI	Milford Haven Waterway	0.432km	0282
SSSI	Gweunydd Somerton Meadows	1.823km	4215
SSSI	Broomhill Burrows	2.967km	1136
SSSI	Castlemartin Corse	3.567km	0242

Note: the distances quoted have been supplied by the applicant and are measured from the proposed hydrogen production facility to these protected sites.

As a Section 28G Authority as defined in the Countryside Rights of Way Act 2000 permitting teams within NRW has a legal duty, under Section 28I of the Wildlife and Countryside Act 1981, to consult with NRW for formal advice when permitting an activity which has been determined to be likely to damage the features of a SSSI.

To determine if consultation is required, a SSSI Assessment was completed. The assessment concluded that the proposed permission is not likely to damage any of the flora, fauna or geological or physiological features which are of special interest. Therefore, no consultation with NRW's protected sites advisors is required. A copy of the assessment is available to view on our public register, see [here](#).

11.3. Non-statutory conservation sites

The following relevant non-statutory sites are located within 2.0km of the installation:

Site Type	Description	Distance	AW code
AW	Ancient Semi Natural Woodland	0.71km (W)	084
AW	Restored Ancient Woodland	0.71km (NNE)	117
AW	Ancient Semi Natural Woodland	0.79km (N)	074
AW	Restored Ancient Woodland	1.02km (NNE)	105
AW	Restored Ancient Woodland	1.27km (NE)	106
AW	Ancient Semi Natural Woodland	1.57km (SSE)	099
AW	Ancient Semi Natural Woodland	1.77km (WSW)	082

AW = Ancient Woodland

Note: the distances quoted are derived from NRW digital map databases and are measured from the proposed hydrogen production facility to these protected sites. Compass direction to the conservation site (from the facility) is indicated in brackets.

As noted earlier in this section, the applicant has not included non-statutory conservation sites in its air emissions screening assessment; however, we have assessed potential impact on sites within 2.0km of the proposed facility, with consideration of relevant permitting guidance and screening distances in the AQTAG14 advice note (identifying relevance for habitats assessment of EPR combustion installations). In this case, the selected AQTAG14 screening distance criterion for local nature sites is 200m / 0.2km for combustion processes with a combined rated thermal input of 1 – 5 MWth. We have followed the same conservative approach as the applicant's SCAIL assessment and considered combustion processes burning fuels other than natural gas and gas oil, e.g. heavy fuel oil.

As noted above, there are no non-statutory conservation sites within 200m of the proposed HPF and based upon the information in the application we are satisfied that there will be no adverse impact to the non-statutory conservation sites identified.

12. The Permit Conditions

The permit has been updated to include a new listed activity [Table S1.1, S4.2 A(1)(a) inorganic chemicals production], as described in section 7 of this document, with associated periodic monitoring and reporting requirements. Some outdated emissions and monitoring tables are removed from Schedule 3, which is now a single consolidated schedule. Schedule 1 table S1.3 has been updated to confirm the status of an existing improvement condition (IC8). To ensure clarity and coherence we have also made minor changes to the permit structure, referencing, and formatting.

12.1. Updating permit conditions during consolidation

We have updated previous permit conditions to those in the new generic permit template as part of permit consolidation. The new conditions have the same meaning as those in the previous permit(s).

The operator has agreed that the new conditions are acceptable.

12.2. Incorporating the variation

We have specified that the applicant must operate the permit in accordance with descriptions in the application, including additional information received as part of the determination process. These descriptions are specified in the Operating Techniques table in the permit.

A pre-operational condition has been used (PO6, see section 12.6 below) to require confirmation of specific environmental management system (EMS) components prior to the commencement of HPF commissioning, to ensure compliance with the general management requirements outlined in section 1.1 of the permit.

12.3. Emission Limits

There are no changes to existing permitted emission limits. No new emission limits are added to the permit in this variation.

12.4. Monitoring

We have decided that monitoring should be carried out for the parameters listed in Schedule 3 of the permit using the methods and to the frequencies specified in those tables. These monitoring requirements have been imposed in order to demonstrate compliance with the emissions limits in the permit, meet indicative BAT standards for certain activities (see section 10.1 of this document) or meet other statutory requirements e.g. EPR Schedule 25A [Medium Combustion Plant Directive (MCPD)].

For emissions to air, the methods for continuous and/or periodic monitoring are in accordance with general regulatory guidance for stack emissions monitoring¹⁸. Monitoring frequencies have also been considered in line with MCPD requirements¹⁹. No emissions monitoring requirements are imposed for the new electrolyser; however, new process monitoring requirements are added to Schedule 3 table S3.3 to capture the environmental performance of the electrolyser, build operational knowledge of this relatively new technology, and ensure the permit remains environmentally protective. Schedule 3 table S3.3 also confirms a new process monitoring requirement for the

¹⁸ [Monitoring stack emissions: environmental permits - GOV.UK](#) – see techniques and standards for periodic monitoring, which are applicable to activity AR18 (HPF emergency diesel generator)

¹⁹ [EU Directive 2015/2193 \(MCPD\)](#) – monitoring requirements are confirmed in MCPD Annex III

hydrogen gas flare, ensuring that the quantity of hydrogen gas flared is measured, and an event-based flaring data is gathered to inform the applicant's response to improvement condition IC12 (see section 12.7 below).

An improvement condition has been used (IC11, see section 12.7 below) to require a written monitoring and management plan for the HPF, to be submitted within three months of completion of HPF commissioning. This plan shall also include proposals for its periodic review, at a frequency no greater than three years, and shall be incorporated into the EMS required by section 1.1 of the permit.

Based on the information in the application and the requirements set in the conditions of the permit we are satisfied that the monitoring techniques, personnel, and equipment employed by the operator will have either MCERTS certification or MCERTS accreditation as appropriate.

12.5. Reporting

We have specified the reporting requirements in Schedule 4 of the Permit to ensure data is reported to enable timely review by Natural Resources Wales to ensure compliance with permit conditions and to monitor the efficiency of material use and waste recovery at the installation. Schedule 4 has been refreshed to ensure units of measurement are expressed clearly and consistently throughout this part of the permit.

Schedule 4 table S4.1 (reporting of monitoring data) has been updated to capture the HPF emergency diesel generator, in accordance with MCPD requirements and exemption criteria for this type of combustion plant²⁰.

Schedule 4 table S4.2 (annual production/treatment) has been updated to confirm an annual reporting requirement for hydrogen gas production, a key performance indicator for the HPF.

²⁰ [Medium combustion plant \(MCP\): comply with emission limit values - GOV.UK](#) – ELV exemptions

Schedule 4 table S4.3 (performance parameters) has been divided into two sections, to confirm the requirement to report new performance parameters²¹ for the HPF:

- Water usage (tonnes)
- Water efficiency (kg water per kg H₂)
- Energy usage (MWe)
- Energy efficiency (KWh per kg H₂)
- Fugitive emissions of hydrogen (kg H₂)
- Quantity of hydrogen flared (kg H₂)

The existing performance reporting requirements for Chapter III Large Combustion Plant (LCP) within Table S4.3 remain unchanged.

12.6. Pre-operational conditions

Based on the information in the application, we consider that we need to impose a pre-operational condition. Details of the pre-operational conditions used (PO6 & PO7) can be found in Schedule 1 table S1.4 of the permit.

The requirements for PO6 and PO7 are discussed elsewhere in this decision document – please refer to sections 8.2, 8.3 & 10.6.

12.7. Improvement conditions

An existing improvement condition (IC8) has been marked ‘completed’ in Schedule 1 table S1.3, following an earlier submission received from the operator in October 2020 and confirmation from NRW’s regulators that compliance with IC8 has been achieved.

Based on the information on the application, we consider that we need to impose improvement conditions. Details of the improvement conditions used (IC9, IC10, IC11 & IC12) can be found in Schedule 1 table S1.3 of the permit.

IC9: The requirements for this improvement condition are discussed in section 9.2 of this document.

²¹ Annual reporting of water efficiency, energy efficiency, fugitive emissions of hydrogen and quantity of hydrogen flared is in alignment with the HPF process monitoring confirmed in Schedule 3 table S3.3.

IC10: This is a standard requirement to submit a report on the commissioning of a new facility at a permitted industrial installation. In this case, a new hydrogen production facility (HPF) with a requirement to submit a report to the regulator within three months of completion of HPF commissioning.

IC11: The requirements for this improvement condition are discussed in sections 10.4 & 10.7 of this document.

IC12: The requirements for this improvement condition are discussed in section 10.1 of this document.

13. OPRA

The OPRA score has changed as a result of this variation. The new agreed score is now **361** (old score was 316). This will form the basis for ongoing subsistence fees.

ANNEX 1: Consultation Responses

1. Advertising and consultation on the Application

The application has been advertised and consulted upon in accordance with Natural Resources Wales Public Participation Statement. Responses to this consultation and how we have taken consultation responses into account in reaching our draft decision is summarised in this Annex.

Consultation Responses from Statutory and Non-Statutory Bodies

Response Received from Public Health Wales (Environmental Public Health Service)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
High-level response received in an emailed letter. No adverse risks to public health foreseen, if the operations are undertaken in line with industry practice and best available techniques, and the regulator is <i>“completely satisfied with the proposals.”</i> Consultee recommends the regulator <i>“satisfies themselves that cumulative impacts have been appropriately considered and will not have adverse site impacts.”</i> Response includes a short ‘public health risk assessment’ noting the applicant’s existing environmental management system for the whole installation and the inclusion of environmental risk assessments and amenity impact assessments for the HPF. Fire risk associated with storage of diesel, oil and hydrogen is highlighted for further consideration.	NRW has considered the consultee’s response, and we believe most topics are addressed within our decision, e.g. applicant has agreed to follow published Guidance on Emerging Techniques (GET) for hydrogen production; air emissions impact assessment; effluent management; surface water management; noise and vibration impact assessment; secondary containment for potentially polluting liquids. Subject to the comments above in relevant sections of our Decision Document (DD), we are satisfied with the applicant’s proposals and agree with the consultee’s comments. We have clarified that there will be no bulk storage of hydrogen at the proposed HPF facility, reducing the fire risk associated with this substance. The hydrogen offtake pipeline falls outside the scope of this permitting decision and will be subject to safety regulations enforced by other statutory bodies e.g. Gas Safety (Management) Regulations 1996, Pipeline Safety Regulations

	1996 which are both enforced by the Health and Safety Executive (HSE). The applicant has demonstrated it has an Environmental Management System (EMS) that identifies and minimises risks of pollution, including those arising from accidents or incidents e.g. fires. We have included a pre-operational condition (PO6) requiring the applicant to submit a summary of its EMS components that are applicable to the HPF, including the site's Accident Management Plan, six months prior to the commencement of commissioning work. The applicant must implement these applicable EMS components upon written approval by NRW. A standard permit condition (3.2.3) addresses the environmental risk presented by potentially polluting liquids such as oils and diesel fuel.
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Response Received from Pembrokeshire County Council (Public Protection)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
Emailed response evaluating the environmental impact of the proposal and confirming “<i>no objection</i>” is raised to the proposed permit variation for the HPF facility. The consultee suggests that NRW “<i>should satisfy itself that any secondary containment design complies with CIRIA C736 and that maintenance regimes are robust</i>”. The consultee highlights that the applicant’s environmental risk assessment does not explicitly consider air emissions of oxides of nitrogen (NO_x) from hydrogen flaring or the emergency diesel generator. Standard pro-forma response in respect of noise. No specific noise	NRW has considered the consultee’s response and we believe the topics raised are mostly addressed within our decision, with the exception of hydrogen fire/explosion risk which is either reduced to very low levels (no hydrogen bulk storage at the HPF) or addressed by other, separately enforced legislation e.g. GSMR 1996, PSR 1996 enforced by the HSE. A standard permit condition (3.2.3) addresses the environmental risk presented by potentially polluting liquids such as oils and diesel fuel. For new installations, our regulatory expectation is that an applicant follows the published CIRIA 736F guidance when risk assessing and designing containment systems.

issues raised by the consultee; supporting narrative highlights identified adverse noise impact at a nearby unoccupied property owned by the applicant, and the likelihood of future reassessment (for planning and permitting) if the status of this property changes e.g. reoccupation, change of ownership.	See DD section 10.1 (assessment of impact on air quality) which considers NO_x emissions from the hydrogen flare and emergency generator. We have also included improvement conditions (IC11 and IC12) in respect of hydrogen flaring and emergency generator emissions. Consultee's input and other factors considered in deciding our approach. See DD section 10.6 (noise and vibration assessment). NRW is not aware of any noise complaints for this installation. Consultee's input and other factors have been considered in deciding our approach.
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Consultation Responses from Members of the Public and Community Organisations

No other comments were received during our consultation on the duly made application, including from members of the public and community organisations, or representatives such as Local MP, Member of the Senedd (MS), Councillors and Parish / Town / Community Councils.

2. Advertising and consultation on the draft decision

Our draft decision has been advertised and consulted on in accordance with requirements under the Industry Emissions Directive and in accordance with Natural Resources Wales's Public Participation Statement²².

Public consultation opened on 03/08/2026 and closed on 28/08/2026. No responses were received. Following consultation, minor changes were made to the permit draft documents to improve formatting and update the permitting chronology for this variation.

²² [Natural Resources Wales / Public participation: how you can take part in our permit and licence consultations](#)

ANNEX 2: BAT Assessment

This annex should be read in conjunction with the permit.

At present, Best Available Techniques (BAT) for hydrogen production via electrolysis are not formally established within existing EU BREF or BAT Conclusions (BATc) documentation, nor are they included in any UK BATc²³ which are under development.

As such, site-specific BAT is proposed and implemented in line with published Guidance on Emerging Techniques (GET) for hydrogen production by electrolysis of water²⁴. In line with pre-application advice received from Natural Resources Wales (NRW), the GET has been followed to inform the design and operational approach of the proposed hydrogen production facility (HPF) at the permitted installation. This ensures that the proposal aligns with current expectations for emerging techniques and demonstrates a commitment to environmental best practice. The operator has appraised its proposed HPF against the GET requirements and NRW is satisfied that the operator has met those requirements.

Site-specific BAT has also been considered for the HPF's emergency diesel generator, considering its projected pattern of use, the environmental risk presented by this activity and the indicative BAT outlined within the MCPD. This is discussed in more detail within sections 10.1 and 12.4 of this document.

Throughout the life of the permit, the operator must employ applicable BAT for the permitted activities. The permitted activities are also reviewed periodically against the latest techniques and published standards.

²³ [UK BAT - GOV.UK](#) – describing the future development of UK Best Available Techniques (BAT)

²⁴ [Hydrogen production by electrolysis of water: emerging techniques - GOV.UK](#) – published March 2024